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APPLIED

CROP

MANAGEMENT

FOR

IDAHO

SECONDARY AGRICULTURE INSTRUCTORS

Developed and written by:
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Idaho State Division of Vocational Education
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Administered through the
Department of Agricultural and Extension Education
University of Idaho
By
Douglas A. Pals, Project Director

FOREWORD

The Agricultural Science and Technology Curriculum Guides are the product of many years of careful planning and development. In 1987, an Agricultural Education Technical Committee was assembled to determine the competencies necessary to prepare students for careers in agriculture. In 1989, a committee of secondary agriculture instructors, state supervisory staff and University of Idaho Agricultural and Extension Education faculty arranged the competencies into an outline of courses appropriate for secondary agriculture programs in Idaho. These curriculum guides have been written to provide the secondary agriculture instructor with up-to-date instructional materials to be used in developing lessons for the student interested in pursuing a career in agriculture.

The arrangement of the guide follows the courses outlined in the Agricultural Science and Technology Curriculum Outline - The Guide to the 90's (Vo. Ed. #240) published in 1989. The format used in this guide was adapted from the curriculum guides developed for Idaho secondary agriculture instructors during the period of 1981-1985.

The original Idaho Agricultural Curriculum Guides used in the development of these materials were:

1981 - Livestock Production
1981 - Agricultural Mechanics
1982 - Farm Business Management
1985 - Crop and Soil Science

Many individuals made the original guides possible. The format used was adapted from curriculum developed by the Curriculum and Instructional Materials Center of the Oklahoma State Department of Vocational and Technical Education. Selected information and many of the transparency masters used in the guides were provided by the Vocational Instructional Services, Texas A & M University. Additional information and transparency masters were provided by the Department of Agricultural Communications and Education, College of Agriculture, University of Illinois and the Agricultural Education Program, Department of Applied Behavioral Sciences, University of California, Davis.

Laboratory exercises incorporated into the units of instruction were used from the Holt, Rinehart and Winston, Inc. book, Modern Biology, Biology Investigations and the Scott, Foresman, and Company Lab Manual for Biology. Credit appears on the first page of the materials used from these two sources.

Without the following individuals' dedication and commitment, this project would not have been completed.

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USE OF THIS PUBLICATION

Introduction

This material must be taught. It does not replace the teacher, nor the teacher's expertise. The teacher needs to adapt the material to the local area and individual students. The teacher must also provide the necessary motivating techniques to help the students learn the material.

The pages in the guide are color coded to assist in identifying and locating the desired pages. The colors used are:

Table of Contents	Ivory
Semester Course Title Page	Green
Foreword	Yellow
Use of Publication	Salmon
Divider Page Between Units	Tan
Refer to Another Unit Page	Grey
Unit Objectives/Specific Competencies	White
Suggested Activities	Blue
Information Sheets	White
Transparency Masters	White
Assignment Sheets	White
Answers to Assignment Sheets	Gold
Instructors Notes for Laboratory Exercises	Blue
Laboratory Exercises	White
Answers to Laboratory Exercises	Gold
Unit Test	White
Answers to Test	Gold

Instructional Units

These units are not geared to a particular age level and must be adapted for the students with whom they are used. Units include objectives and competencies, suggested activities for the instructor and students, information sheet, transparency masters, assignment sheets, laboratory exercises, instructor notes for laboratory exercises, answers to assignment sheets and laboratory exercises, test and answers to test. Units are planned for more than one lesson or class period.

The teacher should carefully study each instructional unit to determine:

A. The appropriateness of the material for the age level

B. The amount of material that can be covered during a class period

C. Additional objectives and/or assignments, which could be developed

D. The skills that must be demonstrated

1. Supplies needed
2. Equipment needed
3. Amount of practice needed
4. Amount of class time needed for demonstrations

E. Supplementary materials, such as pamphlets, filmstrips and slides that must be ordered

F. Resource people who must be contacted

<u>Objectives and Competencies</u>

Each unit of instruction is based on stated objectives. These objectives state the goals of the unit, thus providing a sense of direction and accomplishment for the student.

The objectives are stated in two forms: unit objectives, stating the subject matter to be covered in a unit of instruction; and specific objectives, stating the student performances necessary to reach the unit objective.

Since the objectives of the unit provide direction for the teaching-learning process, it is important for the teacher and students to have a common understanding of the intent of the objectives. A limited number of performance terms have been used in the objectives for this curriculum to assist in promoting the effectiveness of the communication among all individuals using the materials.

Following is a list of performance terms and their synonyms that may have been used in this material:

<u>Name</u>	<u>Identify</u>	<u>State a Rule</u>	<u>Apply a Rule</u>
Label	Select	Calculate	
List in writing	Mak		
List orally	Point out		
Letter	Pick out		
Record	Choose		
Repeat	Locate		
Give	Match		

<u>Describe</u>	<u>Order</u>	<u>Distinguish</u>
Define	Arrange	Discriminate
Discuss in writing	Sequence	
Discuss orally	List in order	
Interpret	Classify	
Tell how	Divide	
Tell what	Isolate	
Explain	Sort	

Construct		Demonstrate	
Draw	Transcribe	Show your work	Replace
Make	Reduce	Show procedure	Turn on/off
Build	Increase	Perform an experiment	(Dis) assemble
Design	Figure	Perform the steps	(Dis) connect
Formulate	Conduct	Operate	
Reproduce	Compare	Remove	

Reading of the objectives by the student should be followed by a class discussion to answer any questions concerning performance requirements for each instructional unit.

Teachers should feel free to add objectives, which will fit the material to the needs of the students and community. When a teacher adds objectives, he/she should remember to supply the needed information, assignment sheets and/or laboratory exercises and criterion tests.

Suggested Activities

Each unit of instruction has a suggested activities sheet outlining steps to follow in accomplishing specific objectives. Duties of the instructor will vary according to the particular unit. However, for best use of the material they should include the following: provide students with objective sheet, information sheet, assignment sheets, and laboratory exercises; preview filmstrips, make transparencies, and arrange for resource materials and people; discuss unit and specific objectives and information sheet; give test. Teachers are encouraged to use any additional instructional activities and teaching methods to aid students in accomplishing the objectives.

Information Sheet

The information sheet provides content essential for meeting the cognitive (knowledge) requirements of the unit. The teacher will find that the information sheet serves as an excellent guide for presenting the background knowledge necessary to develop the skills specified in the unit objective.

Students should read the information sheet before the information is discussed in class. Students may take additional notes on the information sheet.

Transparency Masters

Transparency masters provide information in a special way. The students may see as well as hear the material being presented, thus reinforcing the learning process. Transparencies may present new information or they may reinforce information presented in the information sheet. They are particularly effective when identification is necessary.

Transparencies should be made and placed in the notebook where they will be immediately available for use. Transparencies direct the class's attention to the topic of discussion. They should be left on the screen only when topics shown are under discussion. (NOTE: Stand away from the overhead projector when discussing transparency material. The noise of the projector may cause the teacher to speak too loudly.)

Assignment Sheets

Assignment sheets give direction to study and furnish practice for paper and pencil activities to develop the knowledge which is a necessary prerequisite to skill development. These may be given to the student for completion in class or used for homework assignments. Answer sheets are provided which may be used by the student and/or teacher for checking student progress.

Laboratory Exercises

Laboratory exercises are found in selected units. The laboratory exercises include both science and agricultural mechanics activities. The science laboratory exercises often have instructions to the instructor prior to the actual laboratory. Procedures outlined in the laboratory exercise for agricultural mechanics give direction to the skill being taught and allow both student and teacher to check student program toward the accomplishment of the skill.

Test and Evaluation

Paper-pencil and performance tests have been constructed to measure student achievement of each objective listed in the unit of instruction. Individual test items may be pulled out and used as a short test to determine student achievement of a particular objective. This kind of testing may be used as a daily quiz and can help the teacher spot difficulties being encountered by students in their efforts to accomplish the unit objective. Test items for objectives added by the teachers should be constructed and added to the test.

Test Answers

Test answers are provided for each unit. These may be used by the teacher and/or student for checking student achievement of the objectives.

Care of Materials

The cost of reproduction of this guide prohibits the replacement of these materials. Therefore, please be extremely careful in handling originals. Make the necessary copies of the information sheets, transparencies, assignments and tests and replace originals in the curriculum guide notebook. Take extra care in keeping originals clear for future reproduction.

PLANTING

AG 320 - A

UNIT OBJECTIVE

After completion of this unit, students should be able to list the five functions of planters and grain drills, name the parts of a row-crop planter and grain drill and select from a list factors to consider in planting to maximize yields. This knowledge will be demonstrated by completion of the unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with planting to the correct definitions.
2. List three environmental conditions necessary for germination.
3. Name the two plant growth zones.
4. List five functions of planters and grain drills.
5. Identify types of planters.
6. Match types of row-crop planting to the correct situation.
7. Identify the parts of a row-crop planter.
8. Discuss planter preparation before going to the field.
9. List the three planter field adjustments.
10. Name two types of grain drills.
11. Identify the parts of a grain drill.
12. Discuss grain drill operation.
13. List three factors that affect grain drill seed rate variation.
14. Select factors to consider in planting to maximize yields.
15. Discuss the importance of proper row spacing.
16. Match common crops with the correct per bushel weight.
17. Match common crops with the correct average planting depth.
18. Match common crops to the correct method of seeding.

19. Calibrate planter seeding rate in the field.

20. Calibrate grain drills.

PLANTING

AG 320 - A

SUGGESTED ACTIVITIES

I. Suggested activities for instructor

A. Order materials to supplement unit

1. Literature

a. *Planting*, an FMO publication by John Deere, 5 chapters on seeds and planting equipment; order from John Deere Distribution Service Center, Service Publications, Dept 150 1400-13th Street, East Moline, Illinois 61244 (1-800-544-2122); textbook cost $21.06.

b. *Planting and Seeding Equipment*, class activity packet; available from Agri-Farm Publications, Inc., 1019 Market St., Gowrie, Iowa 50543; approximate cost $14.40; order no. 1118.

c. *Planting & Seeding Equipment*, instructional packet; available from IAVIM, 208 Davidson Hall, Iowa State University, Ames, Iowa 50011; approximate cost $3.00; order no. 207.

2. Filmstrips, slideshows, etc.

a. *Chisel Planter*, Program #23; 5 minutes; explains operation and features of an experimental chisel planter; available from Chuck Peterson, Ag Engineering, College of Agriculture, Moscow, Idaho 83843.

b. *Planting*, slide set; available from John Deere Distribution Service Center, Service Publications, Dept. 150, 1400-13th Street, East Moline, Illinois 61244; approximate cost $99.73.

c. *STEEP Review No. 3*, Program #244; 21 minutes; describes and demonstrates various farm machines being modified or specifically designed for conservation tillage; available from Ag Communications Center, University of Idaho, Moscow, Idaho 83843-4196, (208-885-6436).

B. Make transparencies and necessary copies of materials.

C. Provide students with objective sheet.

D. Provide students with information sheet.

E. Discuss unit and specific objectives.

F. Discuss information sheet.

G. Invite local machinery dealer to address class on advances in modern planting equipment. Organize a field trip to look at several seeded fields to compare no-till and conventional seeding.

H. Calibrate a grain drill during class.

I. Review and give test.

J. Reteach and retest if necessary.

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Environmental Conditions Necessary For Germination

2. TM 2--Plant Growth Zones

3. TM 3--Why Is the Seedbed So Important?

4. TM 4--Functions of Planters

5. TM 5--Depth of Planting Seed

6. TM 6--The Size of Seed Determines Planting Depth

7. TM 7--Row-Crop Planters

8. TM 8--Drilling Grain

9. TM 9--Broadcast Seeder

10. TM 10--Specialized Planters

11. TM 11--Types of Row-Crop Planting

12. TM 12--Parts of a Row-Crop Planter

13. TM 13--Parts of a Press-Wheel Grain Drill

E. Assignment sheets

1. AS 1--Calibrate Planter Seeding Rate in the Field

2. AS 2--Calibrate Grain Drills--Pounds Per Acre (Method 1)

3. AS 3--Calibrate Grain Drills--Pounds Per Acre (Method 2)

F. Test

G. Answers to test

III. Unit references

A. Aldrich, S.R., et al., *Modern Corn Production*, 2nd edition, A & L Publications, Champaign, Illinois, 1982.

B. Breece, H.E., *Planting*, John Deere Service Publication, Moline, Illinois, 1981.

C. Delorit, R.J., et al., *Crop Production*, 4th edition, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

D. Hudson, H.T., et al., *Plant Science - Growth, Development, and Utilization of Cultivated Plants*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1981.

E. Janick, J., et al., *Plant Science*, 2nd edition, W.H. Freeman and Company, San Francisco, California, 1974.

F. Murray, G., *"Plant Science 407: Crop Production"*, Class notes, Spring 1983, University of Idaho, Moscow, Idaho.

G. *Planting*, Vo-Ag I, Unit IV-F, Teaching Materials Center, Agriculture Education Department, Texas A & M University, College Station, Texas.

H. *Vegetable Grower's Seed Guide*, Asgrow Company, Kalamazoo, Michigan, 1982.

PLANTING

AG 320 - A

INFORMATION SHEET

I. Terms and definitions

A. Broadcast--A method of sowing seeds by randomly scattering them on the ground

B. Drill planting--Seeds are dropped on an individual basis at a pre-determined spacing between seeds in the row

C. Seedbed--Area directly beneath the planting unit prepared for the seed

D. Rootbed--Area to either side and below seed to rooting depth of crop; more loosely prepared allowing for air and moisture to move into the soil to support root growth

E. Furrow--Narrow groove made in the soil by the furrow openers into which the seeds are dropped

F. Furrow opener--A single or double disc device that opens a furrow in the soil for the seed

G. Germination--The point at which a seed having adequate moisture, temperature and oxygen begins to grow

H. Emergence--The point in plant growth when the plant actually breaks through the soil surface

II. Environmental conditions necessary for germination (Transparency 1)

A. Moisture

B. Oxygen

C. Heat

III. Plant growth zones (Transparency 2)

A. Seedbed (Transparency 3)

(Note: The furrow opener makes a furrow at the selected depth. The seed is dropped into the furrow and then covered. The seedbed area over and to each side of the seed is usually firmed and packed by a press wheel. This should provide a firm, but not too compact, seedbed. This firm seedbed will better provide moisture for germination than a loose, open one. However, the soil must not be packed so tightly that the supply of oxygen to the seed or seedling is restricted.)

B. Rootbed

(Note: The rootbed should be loose and less compacted than the seedbed. The loose soil allows the roots to grow and develop, working their way through the soil, increasing the area from which it will collect moisture and nutrients. The more open rootbed area will allow for better moisture and oxygen movement down into the root zone providing moisture and oxygen for the young seedling.)

IV. Functions of planters and grain drills (Transparency 4)

A. Open a furrow in the soil

(Note: The furrow opener must maintain the seed furrow at the proper depth in a variety of soil conditions. If the seed is planted too shallow or too deep, it may not germinate because the environmental conditions may be poor. Shallow planting is okay if adequate moisture is available to the seed. Planting too deep causes problems with emergence and not germination.)

B. Meter the seed

(Note: A controlled seeding rate, such as seeds per acre, bushels per acre or pounds per acre is desired when planting most crops to obtain the optimum yield. Metering of seed is considered one of the major functions of any seeding or planting machine.)

C. Place the seed (Transparencies 5, 6)

(Note: Depth and space between seeds greatly affect the yield of a crop. When seeds are properly placed in a well-prepared seedbed, a high percentage will germinate; and more plants can be expected to emerge under normal conditions.)

D. Cover the seed

(Note: If seed is broadcast seeded and it is necessary to cover it, it will be necessary to use other implements.)

E. Firm the seedbed

(Note: A firm seedbed provides excellent soil and moisture contact with the seed and thus improves conditions for germination.)

V. Types of planters

A. Row-crop planters (Transparency 7)

B. Grain drills (Transparency 8)

C. Broadcast seeders (Transparency 9)

D. Specialized planters (Transparency 10)

VI. Types of row-crop planting (Transparency 11)

A. Flat-land planting--Used in areas where rainfall is sufficient to grow a crop from planting to harvest without irrigation; also used for crops requiring flat surface for harvest, such as peas

B. Bed planting--Used in areas where there is too much moisture prior to planting or where it is desirable to apply irrigation water in furrows between beds

C. Furrow planting--Used in areas where there is a limited amount of rainfall during the growing season

VII. Parts of a row-crop planter (Transparency 12)

A. Frame

B. Drive wheel

C. Seed hopper

D. Furrow openers

E. Seed metering device

F. Seeding depth adjustment

G. Seed covering device

H. Press wheel

I. Materials attachments

(Note: Modern cultural practices include application of fertilizer, herbicide or insecticide individually or in any combination at the time of planting.)

VIII. Planter preparation before going to the field

A. Inspect for worn or broken parts

B. Attach planter to tractor

C. Level planter

D. Adjust row spacing

E. Adjust marker length

F. Adjust seeding rate

IX. Planter field adjustments

A. Adjust planting depth--One of the most common methods is to change position of the press wheel

B. Field calibration--The operator's manual serves as a guide to adjusting the planter, but it is important to remember that the recommended settings are based on average soil conditions, average grading of seed, etc. The actual rates of seeding and material application can be determined only by field checking. Field calibration is the process of actually checking and making final adjustments

C. Fertilizer, herbicide and insecticide calibration

(Note: Use protective gear when handling any chemicals.)

X. Types of grain drills

A. End-wheel drill--Has wheels that support and drive the drill

B. Press-wheel--Drill has press-wheel gangs mounted on the rear of the drill; press wheels firm the soil over the seed, drive the metering mechanism and support the rear of the drill

XI. Parts of a press-wheel grain drill (Transparency 13)

A. Frame

B. Grass seed hopper

C. Seed hopper

D. Fertilizer hopper

E. Furrow openers

F. Seed metering device

G. Seeding depth adjustment

H. Seed press wheel

I. Materials attachments

(Note: Attachments such as a grass seed hopper, fertilizer hopper, etc. may be added to the plain drill if desired.)

XII. Grain drill operation

A. Inspect hitch for worn or broken parts

B. Lubricate

(Note: Moving parts and bearings in the grain drill require frequent lubrication -- usually every 10 hours of use.)

C. Hitch to tractor

(Note: Adjust the hitch so that the drill is level with the ground when attached to the tractor.)

D. Inflate tires

(Note: Proper tire inflation is important to obtain accurate seeding rate with a grain drill since the seed and fertilizer metering devices are ground-wheel driven.)

E. Calibrate drills

(Note: There are two types of seeding rates--pounds per acre and plant population--and there is a different method of calibration for each.)

F. Check seeding depth

(Note: This must be done in the field to be planted--seeding depth varies among crops and is influenced by soil moisture.)

XIII. Factors that affect grain drill seed rate variation

A. Seed weight

B. Seed size

C. Soil preparation and its effect on wheel slippage

D. Tire pressure

E. Overlapping or skipping

XIV. Factors to consider in planting to maximize yield

A. Time of planting

(Note: The best time of planting varies with the crop and the geographic location. Some factors to consider when determining time of planting include: soil temperature for germination; prominence of disease; heat during seed set; and frost before maturity. Consult with county extension agent or other local expert to determine the proper time to plant your crop under your existing conditions.)

B. Seeding depth

(Note: Soil condition is one of the major factors in determining the depth to plant. The factors that determine depth to plant are: (1) Soil texture--seed can be planted deeper in sandy soil than clay soil; (2) Soil temperature--seed can be planted deeper in warm soil than cold soil; (3) Soil moisture--seed is planted deeper in dry soil than wet soil; (4) Plant structure--some seeds can be planted deeper because of their emergence structure and food reserve. Large seed will emerge from a greater depth than small seed.)

C. Seeding rate

(Note: The seeding rate is as variable between different crops as it is between climates and soil conditions. Some of the major factors affecting optimum seeding rates are: available moisture; soil fertility; germination; row spacing; planter operation; and end use; for example: a higher seeding rate is used for alfalfa when raised as forage rather than seed. Seeding rates are lower for dry land farming areas and higher for irrigated farming areas for the same crops.)

D. Soil preparation

(Note: Obtaining best results and profits depends a lot on how the land is prepared for planting. The previous crop and the presence or absence of residue will influence necessary operations, soil temperature, moisture and fertility.)

E. Soil fertility

(Note: The productivity of the soil plus the stored reserves of plant nutrients must be evaluated before the crop is planted. A soil test should be made far enough in advance of planting so that nutrient levels found to be too low to produce optimum yields can be corrected before the plants need the nutrients. Do not soil test too early as nutrients may be lost in areas of high winter precipitation.)

F. Tillage

(Note: The purpose of tillage is to prepare the soil so that seeds will germinate, to ensure optimum yields will be produced, for pest control, for moisture control, for fertilizer application, for residue management, etc.)

G. Weed control

(Note: Weeds rob crops of moisture, nutrients and sunlight; and cause large losses at harvesting time through plugging of harvesting machines.)

H. Insect control

(Note: Insects can reduce crop yields and profits if not properly controlled. Most crops are susceptible to damage by insects at nearly every stage of growth.)

XV. Row spacing--If plants are planted too close together, there will be too much competition for nutrients and sunlight, resulting in stunted crops which won't reach full maturity; weak, susceptible to lodging, diseases and insect damage

XVI. Seeds in a pound and pounds in a bushel for common crops

Crop	Number of seeds/lb	Number of lbs/bushel
Alfalfa	220,000	60
Barley	13,000	48
Beans	1,600	--
Corn	1,500	56
Kentucky Bluegrass	2,156,000	--
Oats	13,000	37
Peas	2,120	--
Red Clover	272,000	--
Rye	18,000	56
Sorghum	15,000	50
Soybeans	3,000	60
Wheat	12,000	60

XVII. Planting depth and germination period

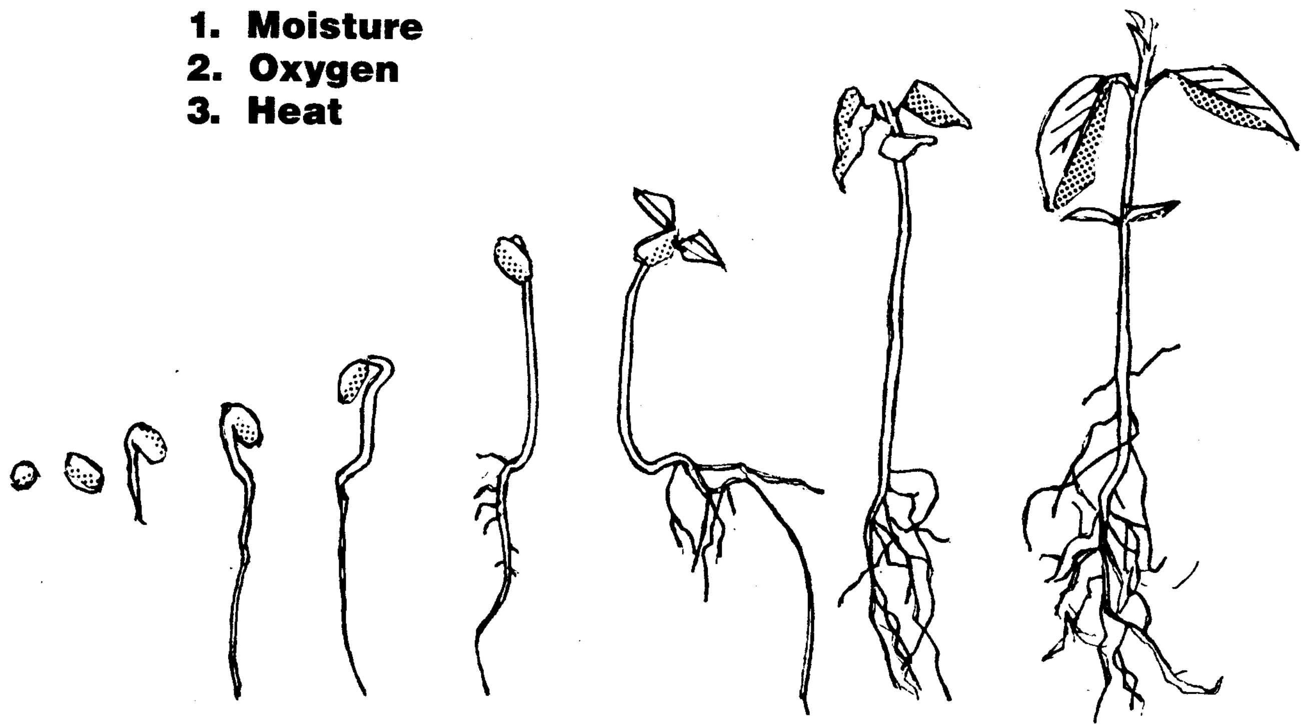
Crop	Average planting depth (in.)	Days required for germination
Alfalfa	1/4 to 3/4	4 - 7
Barley	1 to 2	3 - 7
Beans	1 1/2	6 - 7
Corn	1 to 3	4 - 7
Kentucky Bluegrass	1/4 to 1/2	-----
Oats	1 to 2	5 - 10
Peas	2 to 3	8
Red Clover	1/4 to 3/4	-----
Wheat	1 to 2	3 - 7
Potatoes	3 to 5	

XVIII. Rates, spaces and methods of seeding crops

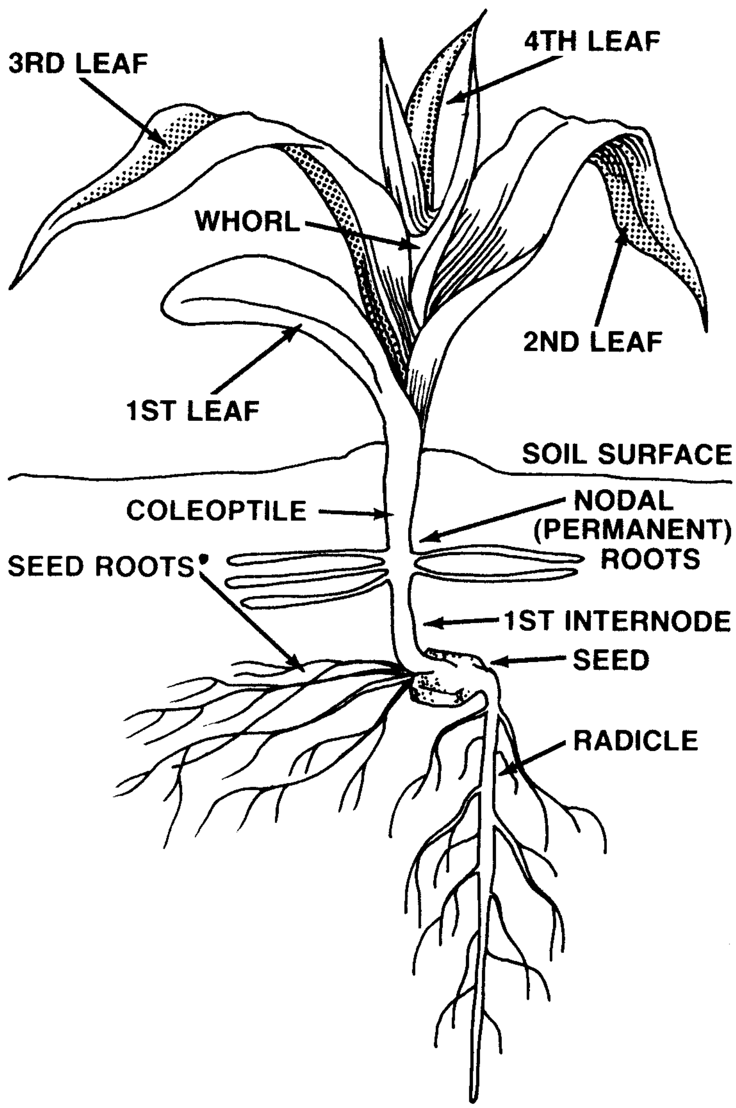
Crop	Rate of Planting Per Acre	Seeding Space	Method of Seeding
Alfalfa	6-12 lbs	15-30 seeds/ft	drill-grass seeder
Barley	80-130 lbs	8-10 seeds/ft	drill
Beans	70 lbs	5 seeds/ft	rows--22" to 24"
Corn	20,000 plants	8 inches	rows--30" to 36"
Kentucky Bluegrass	4 lbs	100 seeds/ft	drill or broadcast
Lentils	50-60 lbs	4-5 seeds/ft	drill
Oats	80-100 lbs	8-10 seeds/ft	drill or broadcast
Peas	125-175 lbs	6-8 seeds/ft	drill
Potatoes	250-300 lbs	2 seeds/ft	rows--34" to 36"
Red Clover	4 lbs	13 seeds/ft	drill-grass seeder
Wheat	60-150 lbs	8-10 seeds/ft	drill

Environmental Conditions Necessary for Germination

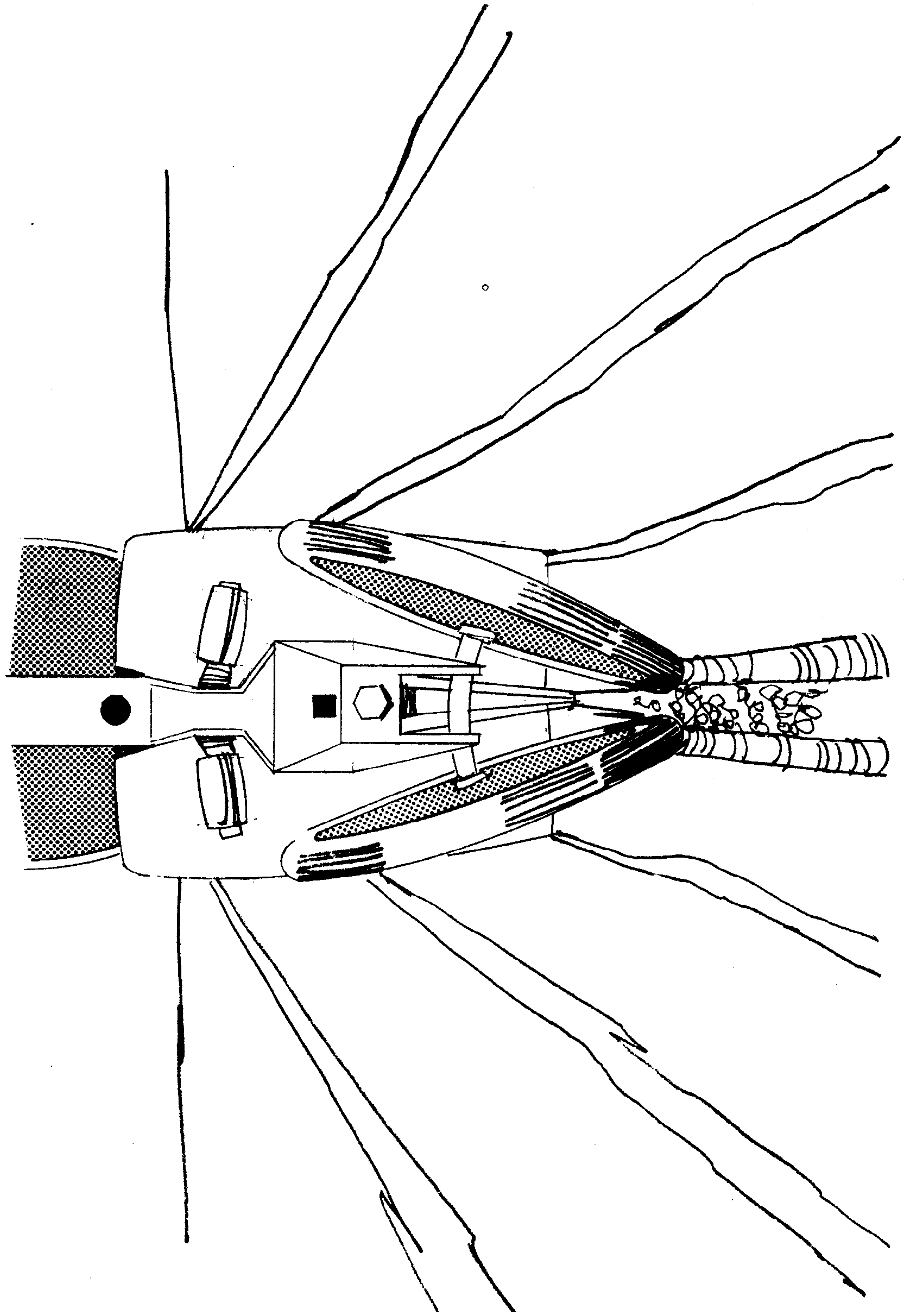
1. Moisture
2. Oxygen
3. Heat



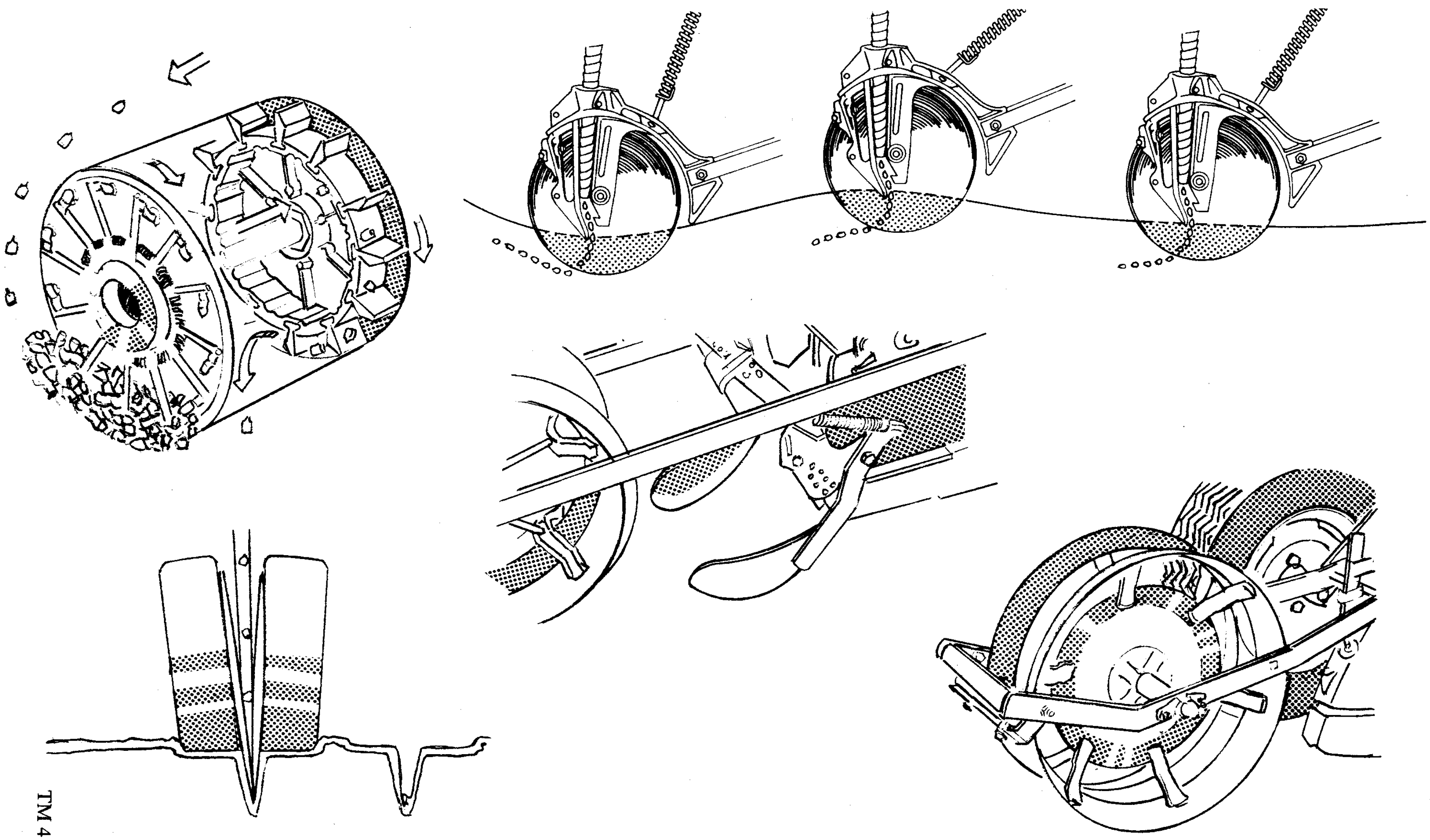
PLANT GROWTH ZONES



WHY IS THE SEEDBED SO IMPORTANT?

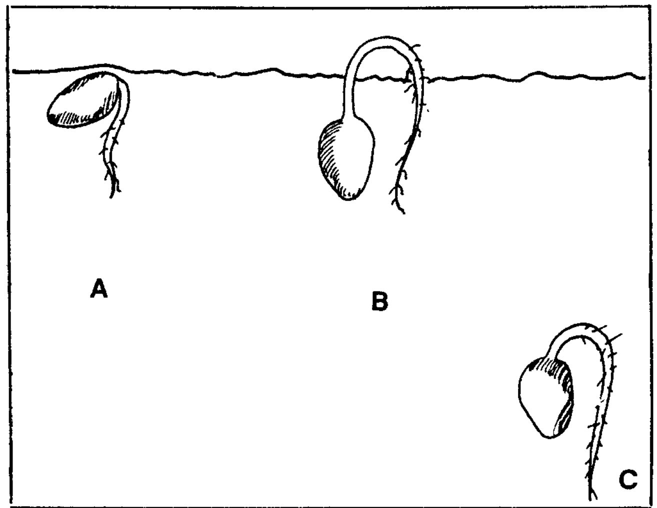


FUNCTIONS OF PLANTERS



TM 4

Depth of Planting Seed

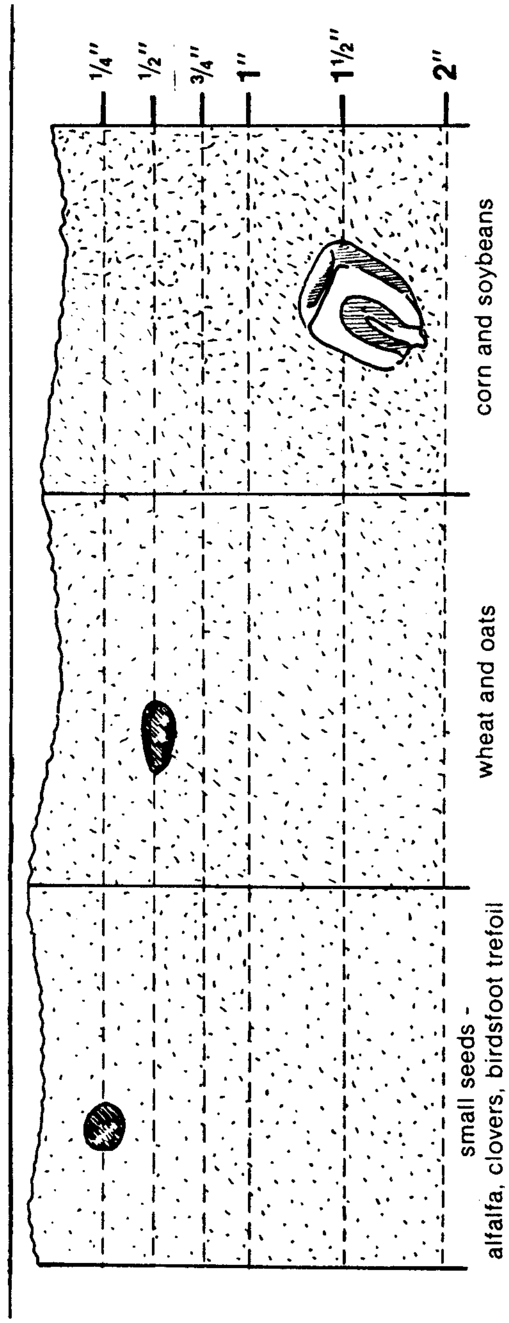


A. Too shallow-seed may die for lack of moisture

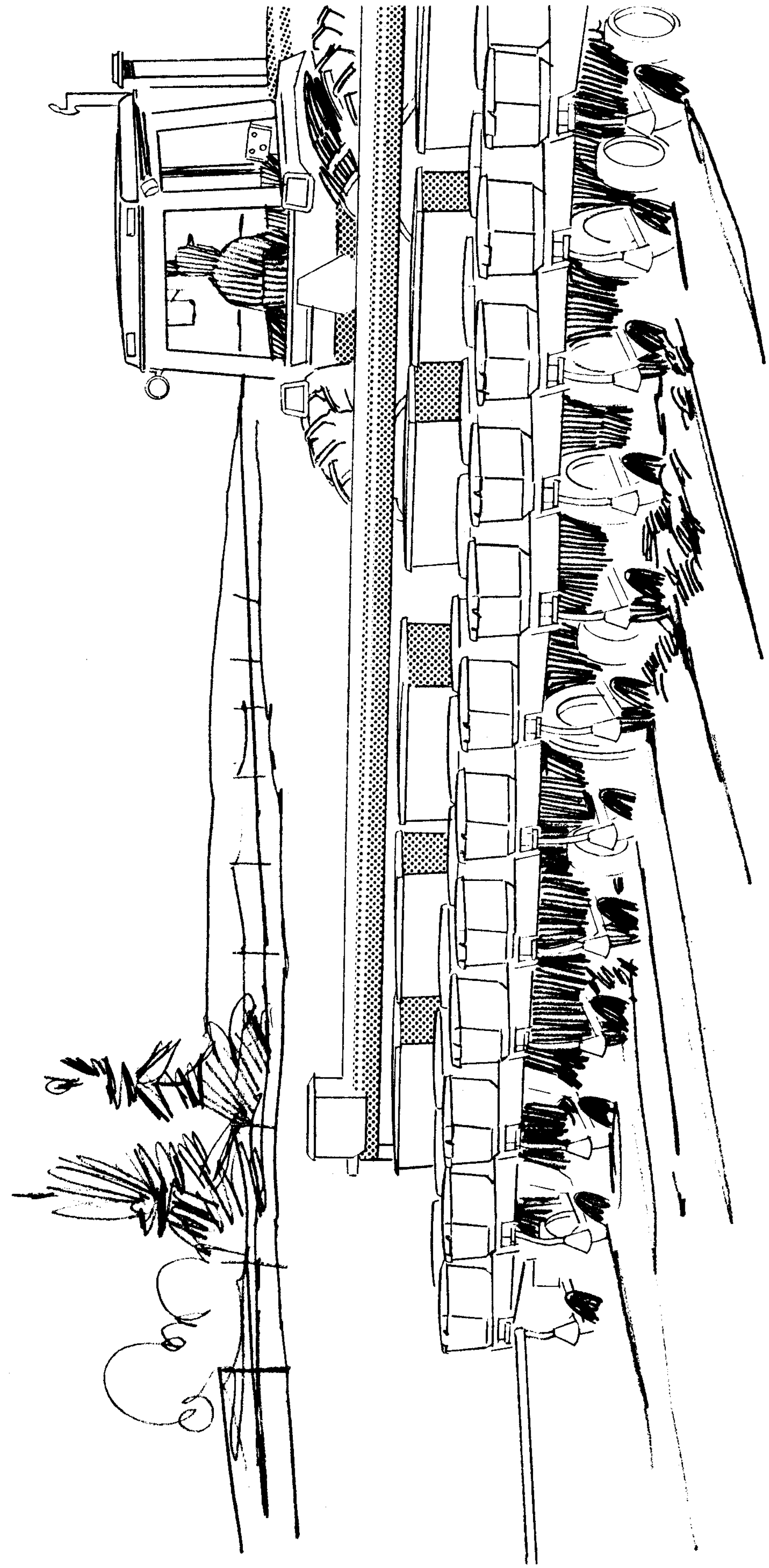
B. Correct depth

C. Too deep hypocotyl does not elongate enough to reach soil surface; seed uses up stored food and rots

The Size of Seed Determines Planting Depth

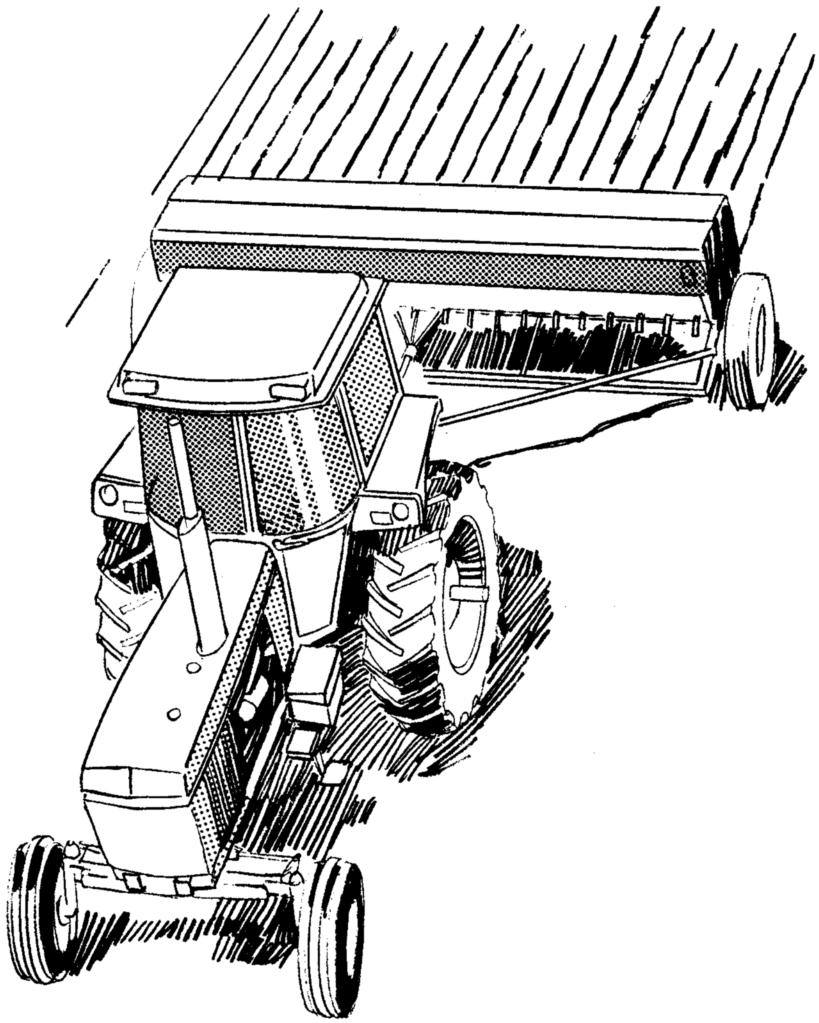


ROW-CROP PLANTERS

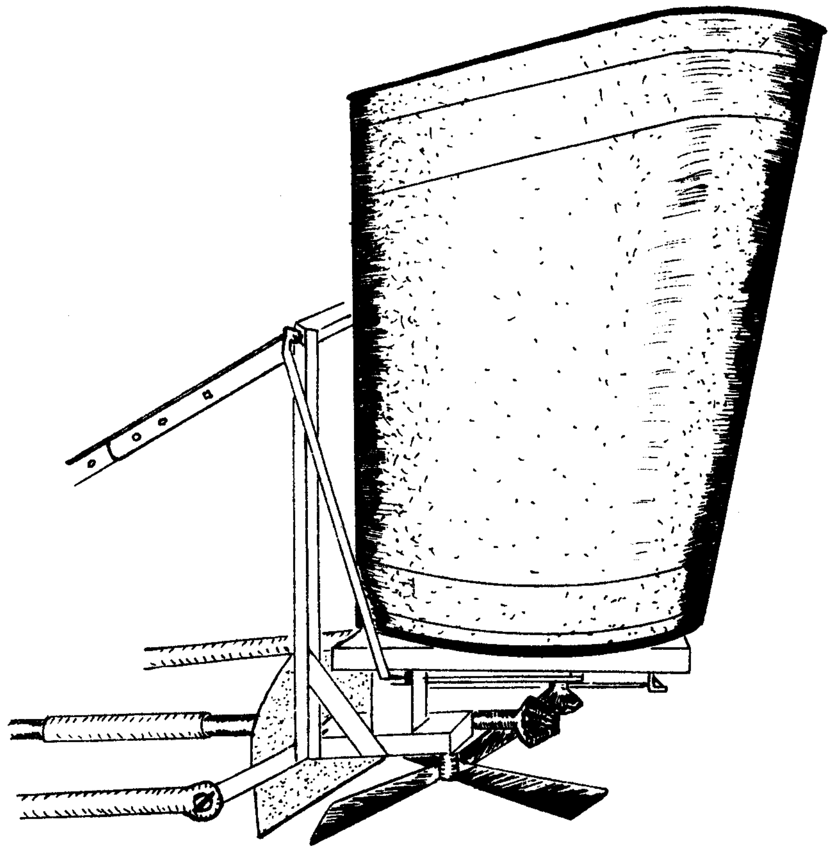


TM 7

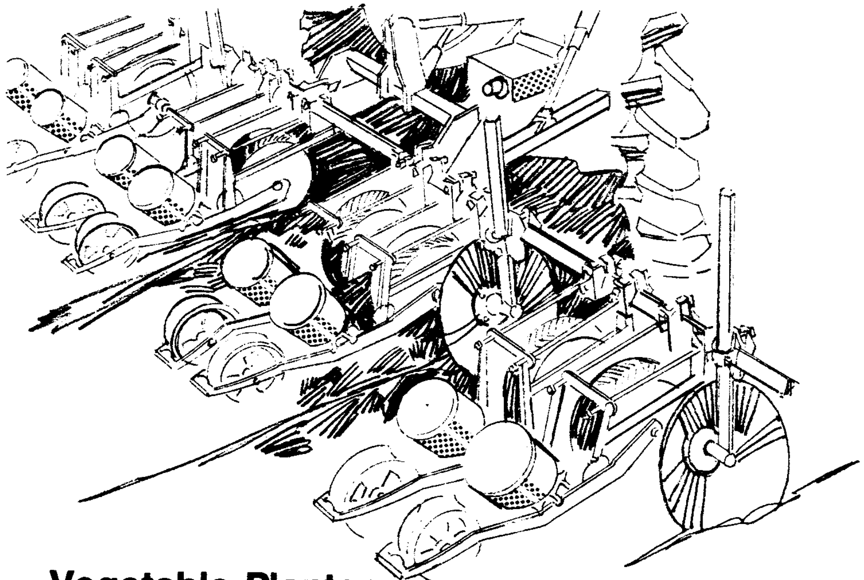
DRILLING GRAIN



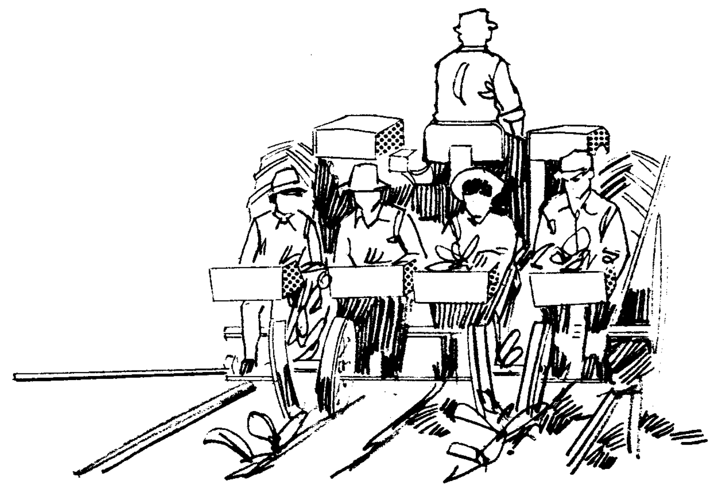
Broadcast Seeder



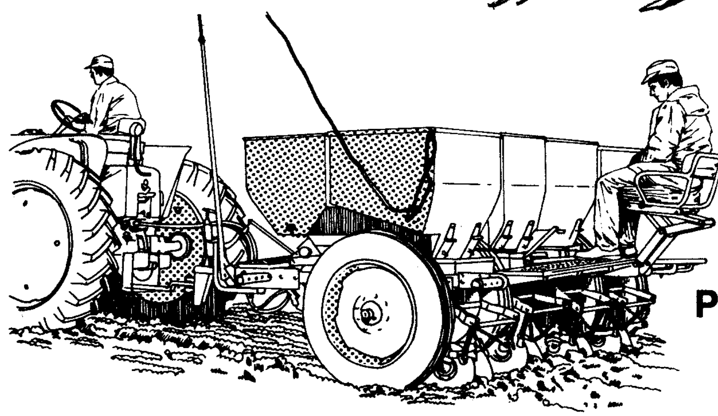
SPECIALIZED PLANTERS



Vegetable Planter



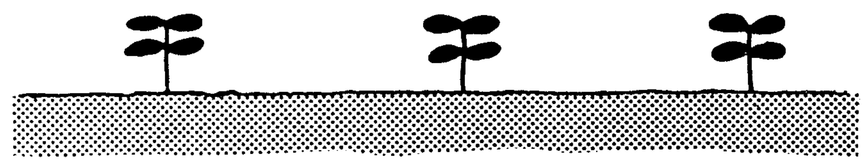
Transplanter



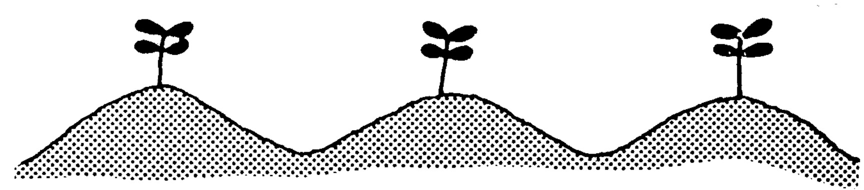
Potato Planter

Types of Row-Crop Planting

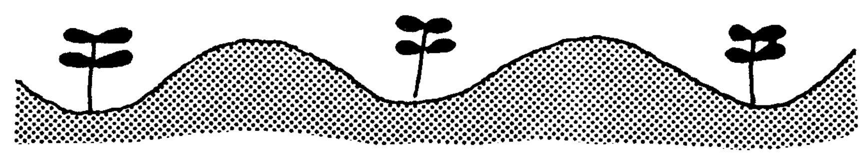
1. Flat Land Planting



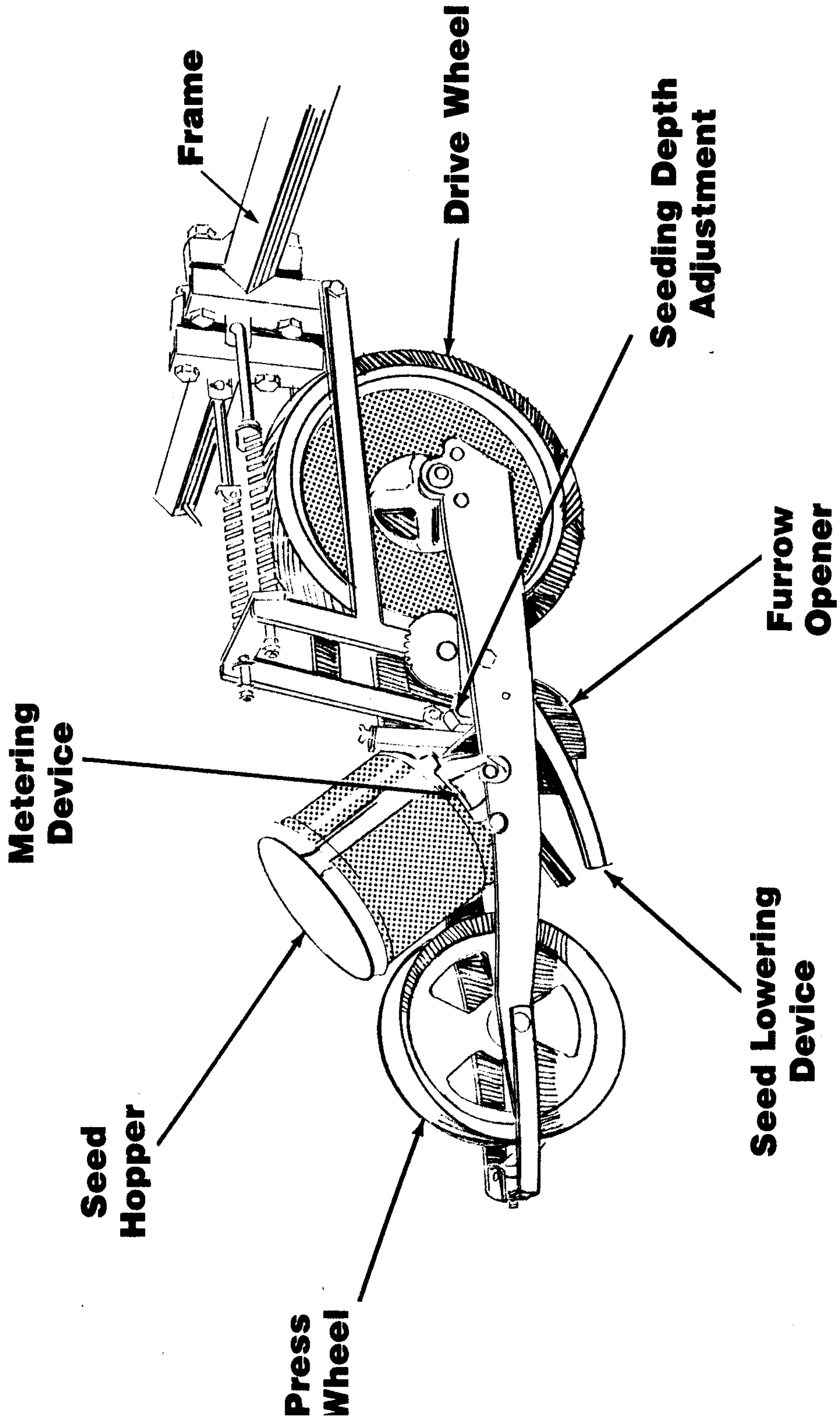
2. Bed Planting



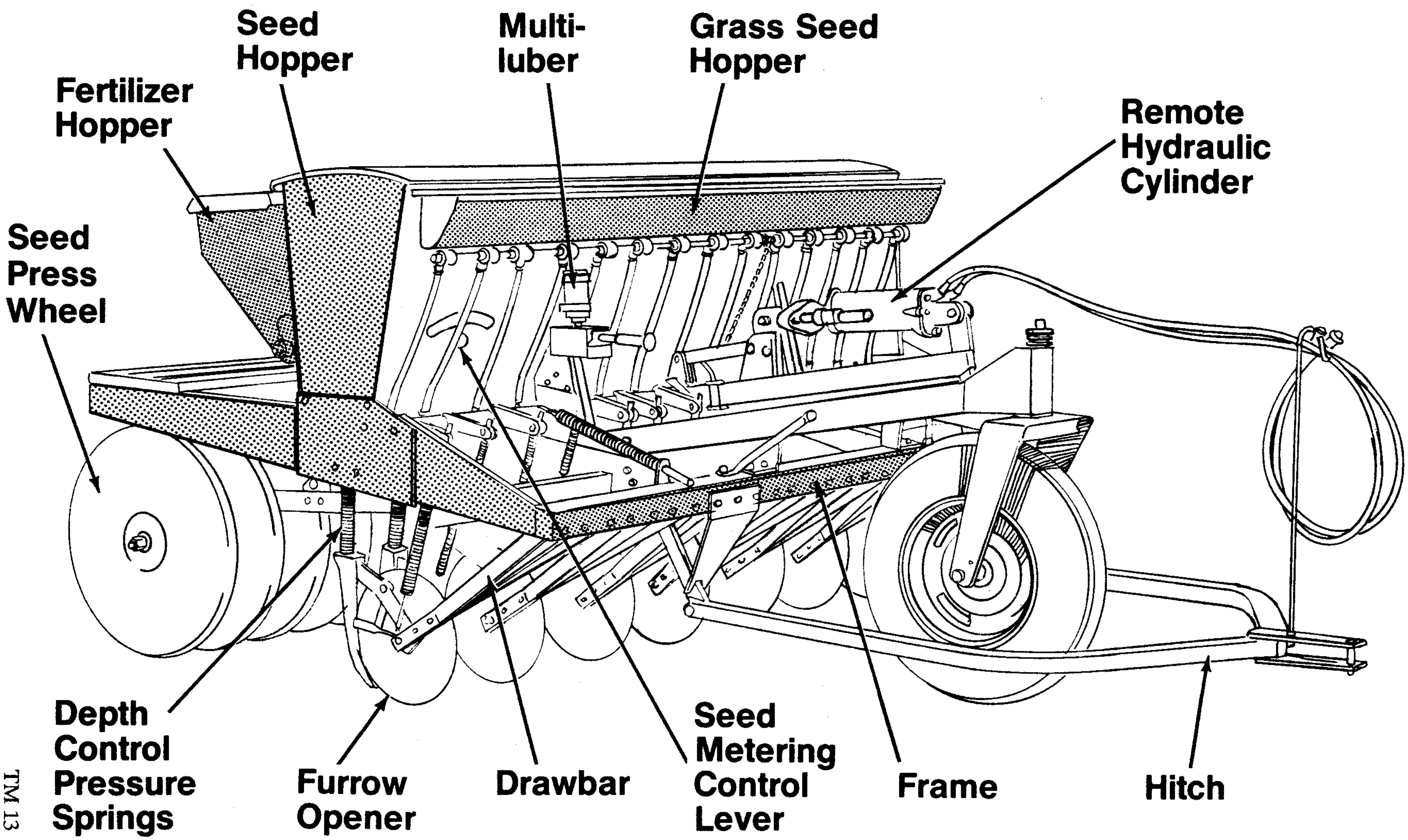
3. Furrow Planting



Parts of a Row-Crop Planter



Parts of a Press-Wheel Grain Drill



TM 13

PLANTING

AG 320 - A

ASSIGNMENT SHEET #1--CALIBRATE PLANTER SEEDING RATE IN THE FIELD

Name ___________________________________ Score ___________________________________

1. Fill the hoppers at least half full with seed

2. Plant several feet

3. Measure three feet along each row

   (Note: To simulate accurate field conditions, use three feet in the middle of the practice run--do not measure at the start or the end of the planting run.)

4. Count the number of seeds uncovered in the three feet that you have marked, and determine the average number of seeds found per row

5. Multiply the <u>average</u> number of seeds by the appropriate factor found in Table I below and multiply by 1000

Table 1

Factors for seeding calibration

Row spacing (inches)	Multiplying factor
30"	4.36
36"	4.59
38"	4.84
40"	5.81

$$\text{Planting population} = \frac{\text{Seeds}}{\text{Row}} \times \text{Factor} \times 1000$$

6. Measure planting depth and make adjustments if necessary

7. Check average distance between seeds to determine accurate seed placement and make adjustments if necessary

8. Recheck by repeating the calibration

PLANTING

AG 320 - A

ASSIGNMENT SHEET #2--CALIBRATE GRAIN DRILLS--POUNDS PER ACRE (METHOD 1)

Name ________________________________ Score ________________________________

1. Make all feed adjustments as shown on the grain drill seed chart

2. Fill the seed hopper full in the field and pull the drill a short distance to settle the seed. Refill the hopper so that it is level-full

3. Drill a calculated 1/10 acre (for low seeding rates use a full acre or larger fraction of an acre). See Table I below for drilling distance.

Table I -- Drilling Distance for 1/10 acre

Drilling width (feet)	Distance from 1/10 acre (feet)
7	311
8	272
9	242
10	218
11	198
12	182
13	168
14	156

4. Weigh the seed required to refill the hopper level-full. Multiply by 10 for one acre

5. Compare the weight of seed required to fill the box with that shown on the grain drill seed chart

6. Adjust the feed-cup setting accordingly to compensate for any variation between the chart and the amount actually drilled

PLANTING

AG 320 - A

ASSIGNMENT SHEET #3--CALIBRATE GRAIN DRILL--POUNDS PER ACRE (METHOD 2)

Name ________________________________ Score ________________________________

(Note: This method is a more accurate check on the seeding rate than Method 1.)

1. Jack up the drive wheel

2. Place seed in the hopper and a tarp under all feeds. (Seed may be collected in sacks attached to each seed tube instead)

3. Make feed-cup settings on drill for desired quantity per acre as shown on seed chart

4. Turn the drill wheels the required number of turns (some operator's manuals give this information) for 1/10 acre as calculated using the following formula:

$$\text{Rotations to equal 1/10 acre} = \frac{8319.3}{W' \times D''}$$

W' = Drilling width in feet

D" = Wheel diameter in inches (rolling diameter)

5. Weigh the seed collected and compare that to the weight shown on the seed chart. Divide weight in seed chart by 10 (because calibration was on 1/10 acre)

6. Adjust the feed-cup setting to compensate for any variation and repeat the test until the desired quantity is obtained

PLANTING

AG 320 - A

UNIT TEST

Name ______________________________________ Score________________________________

1. Match terms associated with planting to the correct definitions. Write the correct numbers in the blanks provided.

_____a.	The point in plant growth when the plant actually breaks through the soil surface	1.	Broadcast
_____b.	Area to either side and below seed to rooting depth of crop	2.	Drill planting
_____c.	Narrow groove made in the soil by the furrow openers into which the seeds are dropped	3.	Seedbed
_____d.	A method of sowing seeds by randomly scattering them on the ground	4.	Rootbed
_____e.	Area directly beneath the planting unit prepared for the seed	5.	Furrow
_____f.	The point at which a seed having adequate moisture, temperature and oxygen begins to grow	6.	Furrow opener
_____g.	A single or double disc device that opens a narrow groove in the soil for the seed	7.	Germination
_____h.	Seeds are dropped on an individual basis at a pre-determined spacing between seeds in the row	8.	Emergence

2. List three environmental conditions necessary for germination.

   a.____

   b. ____

   c.____

3. Name the two plant growth zones.

   a.____

   b. ____

4. List five functions of planters and grain drills.

   a.____

   b. ____

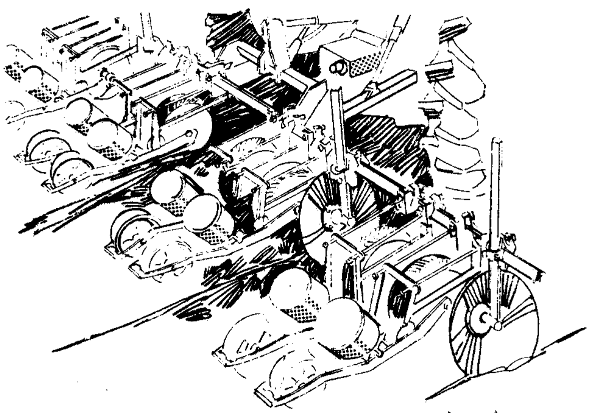
   c.____

   d. ____

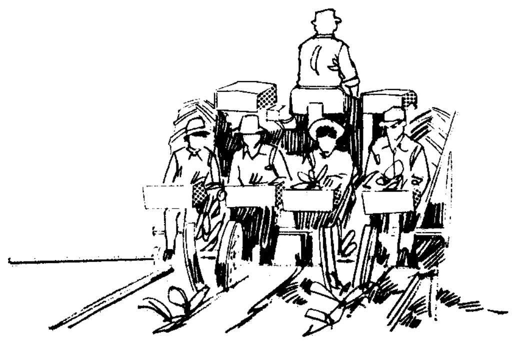
   e.____

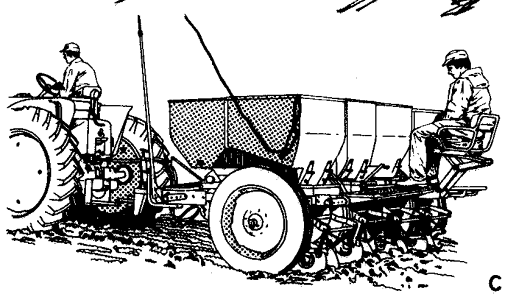
5. Identify the types of planters. Write the correct names in the blanks.

a.____________________



b.____________________



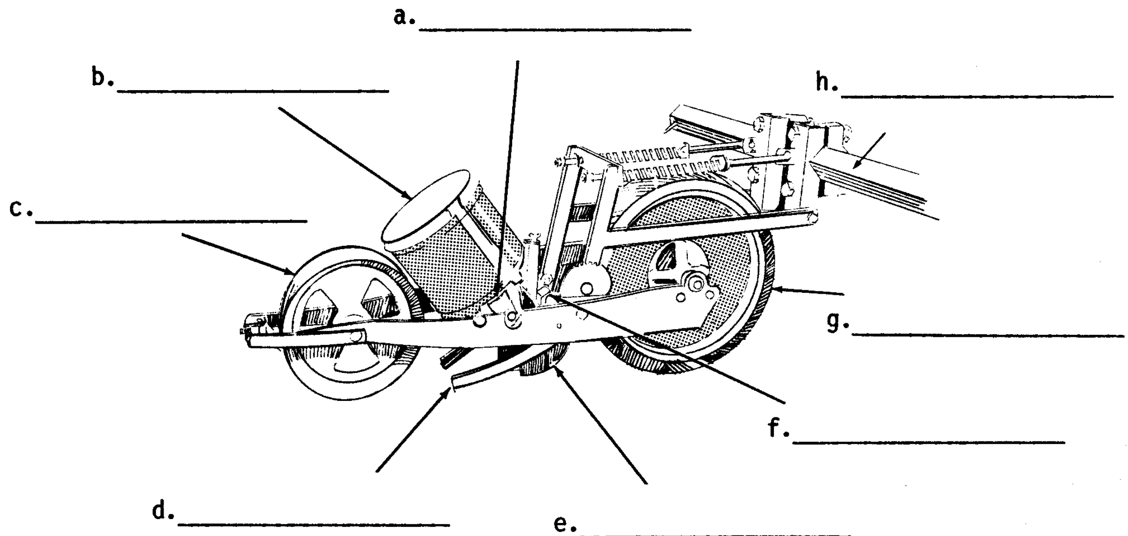


c.____________________

6. Match types of row-crop planting to the correct situation. Write the correct numbers in the blanks provided.

_____a.	Used in areas where there is too much moisture prior to planting or where it is desirable to apply irrigation water in furrows between beds	1.	Flat-land planting
_____b.	Used in areas where rainfall is sufficient to grow a crop from planting to harvest without irrigation	2.	Bed planting
_____c.	Used in areas where there is a limited amount of rainfall during the growing season	3.	Furrow planting

7. Identify the parts of a row-crop planter. Write the correct names in the blanks.

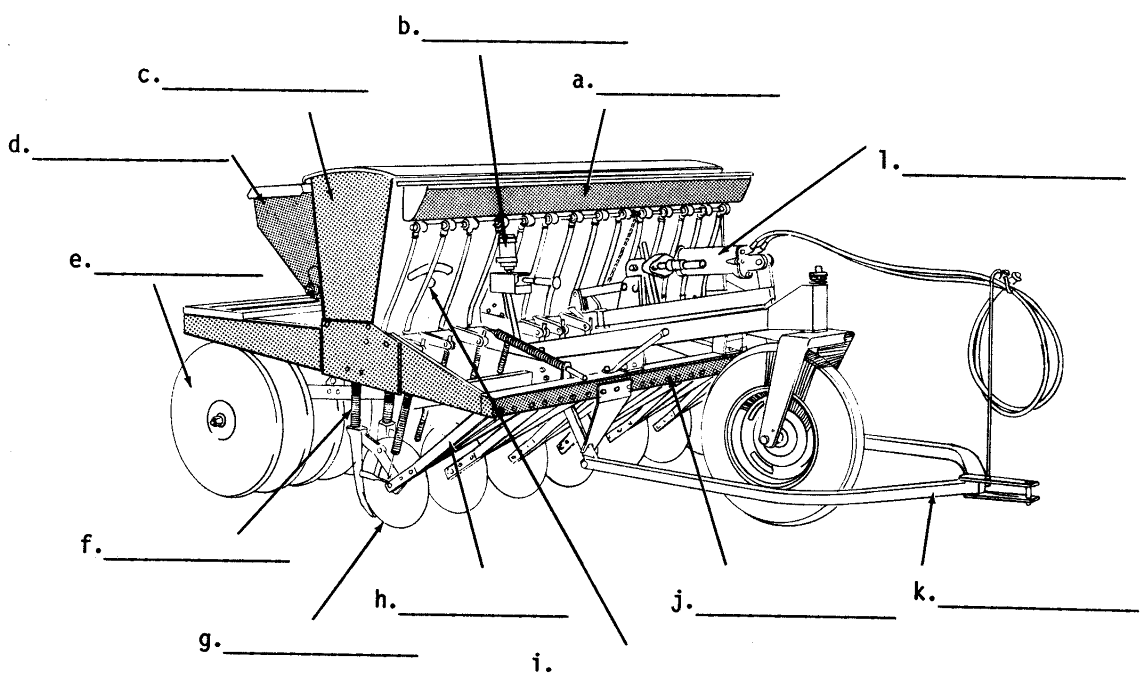


8. Name two types of grain drills.

a.____________________

b.____________________

9. Identify the parts of a grain drill. Write the correct name in the blank.



10. Select from the following list factors to consider in planting to maximize yields. Write an "X" in the blank before each correct answer.

_____a. Weed control

_____b. Insect control

_____c. Tillage

_____d. Soil fertility

_____e. Soil preparation

_____f. Seeding rate

_____g. Seeding depth

_____h. Time of planting

11. Match common crops with the correct per bushel weight. Write the correct number in the blank. (Note: Weights can be used more than once.)

_____a.	Alfalfa	1.	37 pounds
_____b.	Barley	2.	48 pounds
_____c.	Corn	3.	50 pounds
_____d.	Oats	4.	56 pounds
_____e.	Rye	5.	60 pounds
_____f.	Sorghum		
_____g.	Soybeans		
_____h.	Wheat		

12. Match common crops with the correct average planting depth. Write the correct number in the blank. (Note: Depths can be used more than once.)

_____a.	Potatoes	1.	1/4 to 3/4 inch
_____b.	Wheat	2.	1 to 2 inches
_____c.	Alfalfa	3.	1 1/2 inches
_____d.	Barley	4.	1 to 3 inches
_____e.	Red Clover	5.	2 to 3 inches
_____f.	Peas	6.	3 to 5 inches
_____g.	Beans		
_____h.	Corn		
_____i.	Oats		

13. Match common crops to the correct method of seeding. Write the correct number in the blank. (Note: Methods can be used more than once.)

_____a. Red Clover

_____b. Peas

_____c. Barley

_____d. Beans

_____e. Potatoes

_____f. Wheat

_____g. Corn

_____h. Kentucky Bluegrass

_____i. Alfalfa

1. Row planter
2. Drill
3. Drill with grass seeder
4. Drill or broadcast

PLANTING

AG 320 - A

ANSWERS TO TEST

1.
   a. 8
   b. 4
   c. 5
   d. 1
   e. 3
   f. 7
   g. 6
   h. 2

2. Moisture; Oxygen; Heat

3. Seedbed; Rootbed

4. Open a furrow in the soil; Meter the seed; Place the seed; Cover the seed; Firm the seedbed

5.
   a. Vegetable Planter
   b. Transplanter
   c. Potato Planter

6.
   a. 2
   b. 1
   c. 3

7.
   a. Seed metering device
   b. Seed hopper
   c. Press wheel
   d. Seed lowering device
   e. Furrow opener
   f. Seeding depth adjustment
   g. Drive wheel
   h. Frame

8. End-wheel drill; Press-wheel drill

9.
   a. Grass seed hopper
   b. Multiluber
   c. Seed hopper
   d. Fertilizer hopper
   e. Seed press wheel
   f. Depth control pressure springs
   g. Furrow opener
   h. Drawbar
   i. Seed metering contol lever
   j. Frame
   k. Hitch
   l. Remote hydraulic cylinder

10. a, b, c, d, e, f, g, h

11.
   a. 5
   b. 2
   c. 4
   d. 1
   e. 4
   f. 3
   g. 5
   h. 5

12.
   a. 6
   b. 2
   c. 1
   d. 2
   e. 1
   f. 5
   g. 3
   h. 4
   i. 2

13.	a.	3	f.	2
	b.	2	g.	1
	c.	2	h.	4
	d.	1	i.	3
	e.	1		

POTATO PRODUCTION

AG 320 - B

UNIT OBJECTIVE

After completion of this unit, students should be able to describe potato production techniques involved in seedbed preparation, fertilizer requirements, seed preparation, planting, cultivation, disease and insect control, weed control, harvest, storage and marketing. This knowledge will be demonstrated by completion of the unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with potato production to the correct definitions.
2. Select leading potato-producing states.
3. Discuss the economic importance of potato production to Idaho.
4. Identify the parts of a potato plant.
5. Identify the parts of a potato tuber.
6. Select characteristics of a desirable seedbed.
7. List three tillage operations involved in seedbed preparation.
8. Name three common varieties of seed.
9. Discuss the major points in selecting and preparing seed.
10. Name two types of planters.
11. Select factors to consider in planting potatoes.
12. Select factors that influence final plant populations.
13. Calculate fertilizer requirements for potatoes.
14. Name two potato diseases.
15. Name two harmful insects of potatoes.
16. Discuss three ways weeds compete with potatoes.
17. List three ways weeds cause losses in potato production.
18. Match the general categories of weeds to the correct description.
19. Name three methods of weed control.

20. List two types of cultivation.

21. Select reasons for killing vines prior to harvest.

22. Name two ways to kill potato vines.

23. Select methods of handling potatoes to reduce bruising.

24. Tell what a proper potato storage environment consists of and how it is provided.

25. List four uses of potatoes.

26. Name three grades of potatoes for fresh pack.

27. Discuss the sizing of potatoes for fresh pack.

28. List ten factors that affect the profitability of potato production.

29. Make fertilizer recommendation for potatoes.

POTATO PRODUCTION

AG 320 - B

SUGGESTED ACTIVITIES

I. Suggested activities for instructor

A. Order materials to supplement unit.

1. Literature

a. *Potato Handbook*, 3-ring binder containing all University of Idaho CIS publications related to potatoes; order from Agricultural Communications Center, University of Idaho, Moscow, Idaho 83843, (208-885-7982); approximate cost $40.00.

b. *Cooperative Extension Publications*, order catalog from Bulletin Department, Cooperative Extension, Cooper Publications Bldg., Washington State University, Pullman, Washington 99164.

c. *Estimated Costs and Returns For a 100 acre Seed Potato Enterprise*, Idaho Farm Business Management Series #10; order from Agricultural Communications Center, University of Idaho, Moscow, Idaho 83843, (208-885-7982).

d. The following Current Information Series publications are available from Agricultural Communications Center, Ag Publications Building, University of Idaho, Moscow, Idaho 83843-4196, (208-885-7982).

CIS	136	Thumbnail Cracks in Potatoes $.25
CIS	239	Control of Early Blight of Potato in Eastern and Southeastern Idaho $.35
CIS	261	Idaho Fertilizer Guide: Potatoes $.35
CIS	262	Potato Ring Rot $.25
CIS	291	Metribuzin for Potato Weed Control $.35
CIS	381	Rhizoctonia Disease of Potato and Its Control $.25
CIS	386	Common Scab of Potato $.25
CIS	454	Potato Varieties for Idaho $.45
CIS	488	Translucent - End of Potatoes $.35
CIS	534	An Automatic Boom Control for Potato Harvesters $.25

CIS	564	Verticillium Wilt of Potato in Southeastern Idaho $.35
CIS	637	Scheduling of Nitrogen Applications for Russet Burbank Potatoes $.35
CIS	669	The Blackleg - Soft Rot Disease Complex in Potatoes $.40
CIS	759	Potato Vine Killing $.50
CIS	835	Potato Harvesting and Handling Operations For Quality, Efficiency and Safety $.35
CIS	859	Cultural Management of Frontier Russet Potatoes $.35
CIS	860	Cultural Management of Gemchip Potatoes $.35
CIS	864	Herbicide Carryover in Potatoes $.25
CIS	868	The Potato Root Nematode $.25
PNW	257	Potatoes--Storage and Quality Maintenance in the Pacific Northwest $.75
EXP	619	Northwest Export Shipping of Potato Products--Hinterland Delineation and Growth Potential $1.00
EXT	691	Brown Center and Hollow Heart in Potatoes $1.00
EXT	695	Cultural and Chemical Practices for Commercial Potato Weed Control $1.00
EXP	700	Guidelines for Russet Burbank Nuclear Seed Potato Production in Idaho $1.00
EXP	709	Herbicides for Weed Control in Commercial Potatoes $.50
EXP	710	The Potato Export Market $.50
WRRP	11	Integrated Pest Management for Potatoes in the Western United States $17.00
WREP	64	Management of Potato Insects in the Western States $1.75
EB	717	Sugar Development in Potatoes $.50

2. Films

a. *Adjustment of Equipment to Reduce Bruising*, Program #19; 8 minutes, VHS or Beta format; explains how to adjust potato harvesting equipment to minimize bruising during harvest; available from each University of Idaho Extension Potato Specialist.

b. *Blackleg of Potatoes*, Program #162; 4 minutes, VHS or Beta format; describes history, symptomology and treatment of Blackleg; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196 (208-885-6436); purchase price $25; rental price $10 for 14 days.

c. *Bruise Prevention*, Program #18; 9 minutes, VHS or Beta format; discusses the techniques necessary during potato harvesting, handling and storage to prevent bruising of potatoes; available from each University of Idaho Extension Potato Specialist.

d. *Dodder on Potatoes*, Program #17; 12 1/2 minutes, VHS or Beta format; describes history, symptomology and treatment; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196 (208-885-6436); purchase price $25; rental price $10 for 14 days.

e. *Early Blight and Vine Tubers on Potatoes*, Program #175; 3 1/2 minutes, VHS or Beta format; describes history, symptomology and treatment; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196 (208-885-6436); purchase price $25; rental price $10 for 14 days.

f. *Early Dying of Potatoes*, Program #164; 5 minutes, VHS or Beta format; describes history, symptomology and treatment; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196 (208-885-6436); purchase price $25; rental price $10 for 14 days.

g. *Potato Bruise Prevention: #1--The Harvester*, Program #275; 24 minutes, VHS or Beta format; copies available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196 (208-885-6436); purchase price $60; rental price $10 for 14 days.

h. *Potato Bruise Prevention: #2--Harvester Chain Adjustment*, Program #471; 27 1/2 minutes, VHS or Beta format; copies available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196 (208-885-6436); purchase price $60; rental price $10 for 14 days.

i. *Rhizoctonia on Potatoes*, Program #185; 11 minutes, VHS or Beta format; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196 (208-885-6436); purchase price $25; rental price $10 for 14 days.

j. *Root Knot and Lesion Nematodes of Potatoes*; Program #176; 11 1/2 minutes, VHS or Beta format; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196 (208-885-6436); purchase price $25; rental price $10 for 14 days.

k. *White Mold on Potatoes*, Program #172, 8 minutes, VHS or Beta format; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196 (208-885-6436); purchase price $25; rental price $10 for 14 days.

B. Make transparencies and necessary copies of materials.

C. Provide students with objective sheet and discuss.

D. Provide students with information and assignment sheets and discuss.

E. Arrange a field trip to potato processing and fresh pack company.

F. Arrange for potato inspector to be a guest speaker on grading and sizing potatoes.

G. Review and give test.

H. Reteach and retest if necessary.

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Principal Potato Producing Areas

2. TM 2--Leading Potato Producing States

3. TM 3--Parts of a Potato Plant

4. TM 4--Cross Section of a Potato Tuber

E. Assignment sheet

1. AS 1--Make Fertilizer Recommendation for Potatoes

F. Answers to assignment sheet

G. Test

H. Answers to test

III. Unit references

A. *Commercial Potato Production in North America*, Potato Association of America Handbook, Potato Association of America, Orono, Maine.

B. Delorit, R.J., et al., *Crop Production*, 4th edition, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

C. *Potato Handbook*, University of Idaho, Moscow, Idaho, 1983.

POTATO PRODUCTION

AG 320 - B

INFORMATION SHEET

I. Terms and definitions

A. Rhizomes--A subterranean (underground) stem

B. Tubers--Enlarged tips of rhizome

C. Suberization--The healing over of the cut part of the seed

D. Feathered--Skin rubbed off at harvest

E. Eyes--Bud areas on tuber that give rise to new stems and roots

II. Leading potato producing states (Transparency 1, 2)

A. Idaho

B. Washington

C. Maine

D. Oregon

E. Colorado

F. Wisconsin

III. Economic importance of potato production to Idaho

A. 347,000 acres harvested

B. 286 cwt. yield per harvested acre

C. 99,320,000 cwt. total production

D. Economic value to the state is $348,985,000

IV. Parts of a potato plant (Transparency 3)

A. Flower

B. Leaflets

C. Stipules

D. Stem

E. Roots

F. Tuber

V. Parts of a potato tuber (Transparency 4)

A. Corky epidermis

B. Cortex

C. Vascular ring

D. Inner medulla

E. Outer medulla

F. Eyes or buds

VI. Characteristics of a desirable seedbed

A. Loose and mellow

B. Fairly level

C. Free of large clods

(Note: Large clods may cause injury to potatoes at harvest.)

D. Adequate available moisture

E. Free of weeds

VII. Tillage operations involved in seedbed preparation

A. Primary tillage

1. Moldboard plow

a. Time--Fall

b. Depth--6 to 8 inches

c. Moisture needed

2. Ripper (chisel plow)

a. Time--Fall

b. Depth--12 to 14 inches

c. Dry conditions needed

B. Secondary tillage

1. Disk

a. Time--Spring or fall

b. Depth--3 to 4 inches or deeper

2. Chisel

a. Time--Spring, before planting

b. Depth--3 to 4 inches or deeper

3. Harrow

a. Time--Spring, following chisel

b. Depth--Surface to 1 inch

VIII. Common varieties

A. Russett Burbank

(Note: Russett Burbank accounts for 98% of the state's production. It is a multipurpose variety suitable for fresh market and processing.)

B. Butte

C. Norgold

D. Lemhi

E. Nooksack

IX. Major points in selecting and preparing seed

A. Use only certified seed

(Note: Certified seed is inspected and held to requirements of disease control. Good cultural practices cannot be used to overcome the effects of poor quality seed.)

B. Avoid seed that has been

1. Chilled

2. Frosted

3. Heated

4. Sprouted

C. Cutting seed

1. Warm to 50^{o}F to 55^{o}F before cutting

2. Cut seed into pieces from 1 3/4 oz to 3 oz

   (Note: Seed pieces should average 2 oz.)

3. Screen out slivers and rotted seed

   (Note: Slivers interfere with planting and produce a weak plant.)

D. Handling cut seed

1. Cut in a draft-free area

2. Wet down floors for high humidity

   (Note: Most storages have humidification systems, which would eliminate this step. High humidity encourages rapid healing or suberization of the cut surfaces.)

3. Treat seed pieces to help heal and protect against disease

4. Plant immediately after cutting when possible

5. If stored, store at 50^{o}F to 55^{o}F with ventilation and humidity for two weeks

6. Protect from sun and wind

X. Types of planters

A. Picker-type--Arms attached to a revolving wheel with two prongs at the end of each arm. The prong picks up a seed piece and deposits it in the dropping tube, and it falls into a trench made by furrow opener; requires one person for operation

B. Cup-type--Commonly used by growers who use whole tubers for seed. Cups on a chain carry seed pieces to dropping tube; requires one person for operation

XI. Factors to consider in planting potatoes

A. Time of planting

   (Note: Planting dates range from March 1 to June 18. The later the planting date, the lower the yield and percentage of #1 potatoes. Planting dates are later in seed-producing areas.)

B. Seeding depth--4 to 5 inches

C. Seeding rates--2000 to 2500 lbs/acre

(Note: Seeding rate depends on row-spacing, plants per foot, seed size and how the potatoes will be marketed, for example: commercial or seed.)

D. Row spacing--34 to 36 inches

XII. Factors that influence final plant yields

A. Planting rate

B. Planting depth

C. Germination percentage

D. Vigor of seedling

E. Availability of plant nutrients

F. Moisture availability

G. Competition from weeds

H. Damage from disease and insects

XIII. Fertilizer requirements

A. Soil testing

(Note: Use soil test results in conjunction with CIS #261--Idaho Fertilizer Guide for Potatoes. Nutrients of concern for soil test include nitrogen, phosphorus, potassium and zinc. Applications of other nutrients have not been shown to be responsive or economical and are not suggested.)

B. Tissue analysis

(Note: Laboratory analysis of potato petioles to determine level of nitrogen and phosphorus in the plant. This test will detect a shortage of nutrients before visual symptoms appear and before yield has been reduced. If required, additional nutrients may be added during growing season through the irrigation system.)

XIV. Potato diseases

A. Early blight of potato

1. Symptoms--Dark brown to black colored, target shaped lesions on leaves and stems, older leaves infected first

2. Causal agent--A fungal disease that survives the winter on dead potato refuse in the field; spread by air-borne spores

3. Methods of control--Fungicides

B. Early dying (verticillium wilt)

1. Symptoms--Slight downward growth of petioles and yellowing of lower leaves. Leaf yellowing proceeds up the stem, with upper leaves last to show symptoms. Leaf yellowing is followed by wilt, browning, necrosis, flagging and eventual death of the stem

2. Causal agent--Soil-borne fungus that lives on a broad range of hosts; infects by direct penetration into the roots; also through wounds, for example: nematodes

3. Methods of control

a. Sanitation

b. Use resistant varieties, such as Russett Burbank

c. Chemical control--Fungicides

C. Potato ring rot

1. Symptoms--Infected plant may produce completely or partially decayed tubers; foliage will yellow and the stem will eventually wilt and die; a milky ooze in the underground stem can be used to diagnose

2. Causal agent--Bacteria; survives in tubers; spreads mainly by contaminated machinery, cutting knives, bins

3. Methods of control

a. Plant certified seed

b. Sanitation--Disinfect storage facilities, equipment and machinery. Destroy all old sacks and volunteer plants from infected lot

c. Rotate crop out of potatoes if field had ring rot the previous year

D. Blackleg (soft rot disease complex)

1. Symptoms--Sunken, dark, moist rot develops on tuber giving a dark mush appearance to the tuber's core; mush lesions found anywhere on the stem below, as well as above, the soil line

2. Causal agent--Bacteria; survives in seed tubers; spreads by tuber-to-tuber contact, seed cutting, plant-to-plant by insects and contact with contaminated surfaces

3. Methods of control

a. Plant seed known to be free of blackleg in the previous growing season and storage period

b. Sanitation--Carefully clean and disinfect handling and planting equipment between each seed lot

c. Plant single drop seed

d. Irrigate with well water

E. Common scab of potato

1. Symptoms--Severely blemished tuber that reduces visual attractiveness and value

2. Causal agent--Soil borne fungi occur early in growing season following tuber initiation; occurs only during plant growth

3. Methods of control

a. High soil moisture suppresses common scab

b. Chemical control--PCNB (Terraclor) treatment

c. Plant resistant varieties, such as Norgold and Targhee

F. Rhizoctonia disease of potato

1. Symptoms--Lesions that are reddish-brown in appearance occur on underground stems and stolons; infection of underground stems restricts movement of carbohydrates downward

2. Causal agent--Soil borne fungus; survive from year to year on dead tissue in soil (saprophyte); also survives on seed surfaces

3. Methods of control

a. Plant clean, disease-free seed

b. Chemical control--PCNB (Terraclor) treatment

c. Use good cultural practices

G. Translucent-end of potatoes

1. Symptoms--Affected tubers are irregularly shaped with pointed stem ends; affected tissue is low in starch content, has a glassy appearance and has become soft and spongy; tuber is high in sugars and low in solids

2. Causal agent--Stress placed on the growing crop some time during the season; can be caused by moisture deficiencies, high temperatures and excessive fertilization (N)

3. Methods of control

a. Maintain soil moisture above 65% available throughout the season

b. Follow University of Idaho nitrogen fertilization guide for potatoes

c. Use resistant variety, such as Butte

XV. Insects affecting potato production

A. Colorado Potato Beetle

1. Description--Hard bodied, yellowish-brown with 10 black stripes on its wing covers and black spots on its head; approximately 3/8 inch long

2. Damage--Both adults and larvae feed on potato stems and leaves; larval feeding is more damaging

3. Methods of control

a. Biological--Beetles are preyed upon in egg or larva stage by ladybird beetles, green lacewings, collops beetles and predatory shield bugs

b. Chemical--Soil treatment or foliage treatment

B. Wireworms

1. Description--Larvae stage of click beetle; larvae are hard bodied, slender, cylindrical, shiny, yellow-to-green "worms" with small legs

2. Damage--Bore holes in tuber, which looks as if it were made by stabbing tuber with a nail

3. Method of control--Chemical

C. Green Peach Aphid

1. Description--Wingless form: light green with yellow tint during summer to pink to red in the fall; winged form: dark brown with yellowish abdomen

2. Damage--Injures new growth; transmits potato leafroll virus which is responsible for net necrosis of potato tubers in susceptible varieties

3. Methods of control

a. Thoroughly spray peach and apricot trees in the spring

b. Chemical control--Application at planting or foliar applications

XVI. Weed competition with potatoes

A. Competition for water

B. Competition for nutrients

C. Competition for light

(Note: Potatoes and weeds have the same basic requirements for normal growth and development. In a mixed community of crops and weeds, the more aggressive species will dominate.)

XVII. Losses caused by weeds

A. Decreased yield

(Note: Uncontrolled weeds reduce Idaho potato yields an average of 11 sacks per acre and extremely weedy fields lose 35 sacks or more.)

B. Decreased crop quality

C. Cost of control activities

(Note: Uncontrolled weeds and cultivation for weed control are costing Idaho potato growers an average of $42.00 per acre or 13 million dollars a year. Better weed control practices can prevent or reduce these losses.)

XVIII. General categories of weeds

A. Annual--Complete life cycle within the period of one year

(Note: Wild oats, lambsquarter and redroot pigweed are examples.)

B. Perennial--Live for three years or more and can reproduce sexually and asexually by means of rhizomes and stolons

(Note: Perennial weeds reduce yields more than annual weeds. Canada thistle can reduce yield as much as 70%, field bindweed 16% and Russian knapweed 32%. Quackgrass will not only reduce yield but also cause quality reduction from tuber deformation. Growing potatoes in fields heavily infested with deep-rooted perennials is not recommended.)

C. Broadleaf--Plants with shorter, wider leaves that usually have pinnate or netted veination; dicots

D. Grass--Plants with longer, narrower leaves with parallel veination; monocots

XIX. Methods of weed control

A. Cultural

B. Mechanical

C. Chemical

XX. Types of cultivation

A. Hilling

1. Covers weeds

2. Gives cover for tuber from sun

B. Inter-row

1. Controls weeds

2. Aerates soil

(Note: Cultivation for weed control is a general practice which results in an average loss of 12 1/2 sacks or more per acre. Tests show that some growers lose 20% or more in yield, with quality loss because of cultivation.)

XXI. Reasons for killing potato vines prior to harvest

A. Stops growth

B. Hastens maturity

C. Toughens skin

D. Checks formation of hollow hearts

E. Reduces disease in seed fields

(Note: Mechanical vine killing is important when nature fails to do so.)

XXII. Ways to kill potato vines

A. Chemical sprays

B. Rollers

C. Vine beaters

D. Rotary mowers

E. Flaming

XXIII. Handling of potatoes to reduce bruising

(Note: Potatoes can be damaged considerably during any one of the operations involved in digging, picking, hauling, grading and storing. Careless handling of potatoes results in lower market price and excessive losses during storage. Immature tubers require particular care because they are high in water and their skin is easily "feathered" or rubbed off.)

A. Use rubber-coated chains

B. Drop distance held at a minimum (6 inches)

C. Speed of chains and speed of travel should coincide with harvester capacity

D. Do not step on or kick potatoes

E. Modify potato harvesting and handling equipment to reduce bruising

(Note: Refer to University of Idaho CIS #330--Modification to Potato Harvesting and Handling Equipment That Can Reduce Bruising.)

XXIV. Proper potato storage environment

A. What it should accomplish

1. Stimulate healing of bruises, cuts and other injuries
2. Maintain appearance and external quality of the tubers
3. Maintain internal quality of the tubers (food value, processability, etc.)
4. Keep rot development to a minimum
5. Keep weight loss to a minimum
6. Retard the growth of sprouts
7. Maintain seed potatoes in a healthy, vigorous and productive condition

B. What it consists of

1. Proper temperature
2. Proper humidity
3. Proper ventilation

C. How it is provided and controlled

1. Proper ventilation and management
2. Correct and adequate distribution of airflow
3. Humidification system

D. How it is evaluated

1. Weight loss
2. Rot loss

3. Quality change

   (Note: Refer to University of Idaho CIS #349, #299, #297 and #136 for further information and ideas on improving storage conditions for potatoes.)

XXV. Uses of potatoes

A. Fresh pack--Sold as fresh produce

B. Processed--Instant potatoes, french fries, tater tots, potato chips and snacks

C. Certified seed

D. Animal feed

E. Alcohol production

XXVI. Grading of potatoes for fresh pack

(Note: Grading is done by a qualified inspector.)

A. No. 1--A smooth uniform potato

B. No. 2--A larger, rough potato that can be trimmed

C. Cull--Small; bruised or odd-shaped potato

XXVII. Sizing of potatoes for fresh pack

(Note: Sizing is usually done by mechanical means.)

A. Bakers, larger 14 oz No. 1

B. Utility, larger 10-14 oz No. 2

C. 70 count, 12 oz No. 1

D. 80 count, 10 oz No. 1

E. 90 count, 9 oz No. 1

F. 100 count, 8 oz No. 1

G. 110 count, 7 oz No. 1

H. 120 count, 6 oz No. 1

I. US #1, Size A

XXVIII. Factors affecting the profitability of potato production

A. Operating or variable costs

1. Seed (registered, certified or common)

2. Fertilizer

3. Soil testing

4. Irrigation (equipment investment, interest on investment, electricity, etc.)

5. Interest on operating capital

6. Pest control (herbicides, fungicides, insecticides and soil fumigation)

7. Machinery and equipment operation (land preparation, chemical application, planting, harvesting, machine hire)

8. Fuel

9. Crop insurance

10. Land rent

11. Part-time labor (salary, social security taxes, disability insurance)

B. Fixed costs

1. Land (investment, interest on investment, interest on purchase, taxes)

2. Full-time labor (salary, social security taxes, disability insurance)

3. Machinery and equipment (investment, interest on investment, interest on purchase, maintenance and repairs, insurance, depreciation)

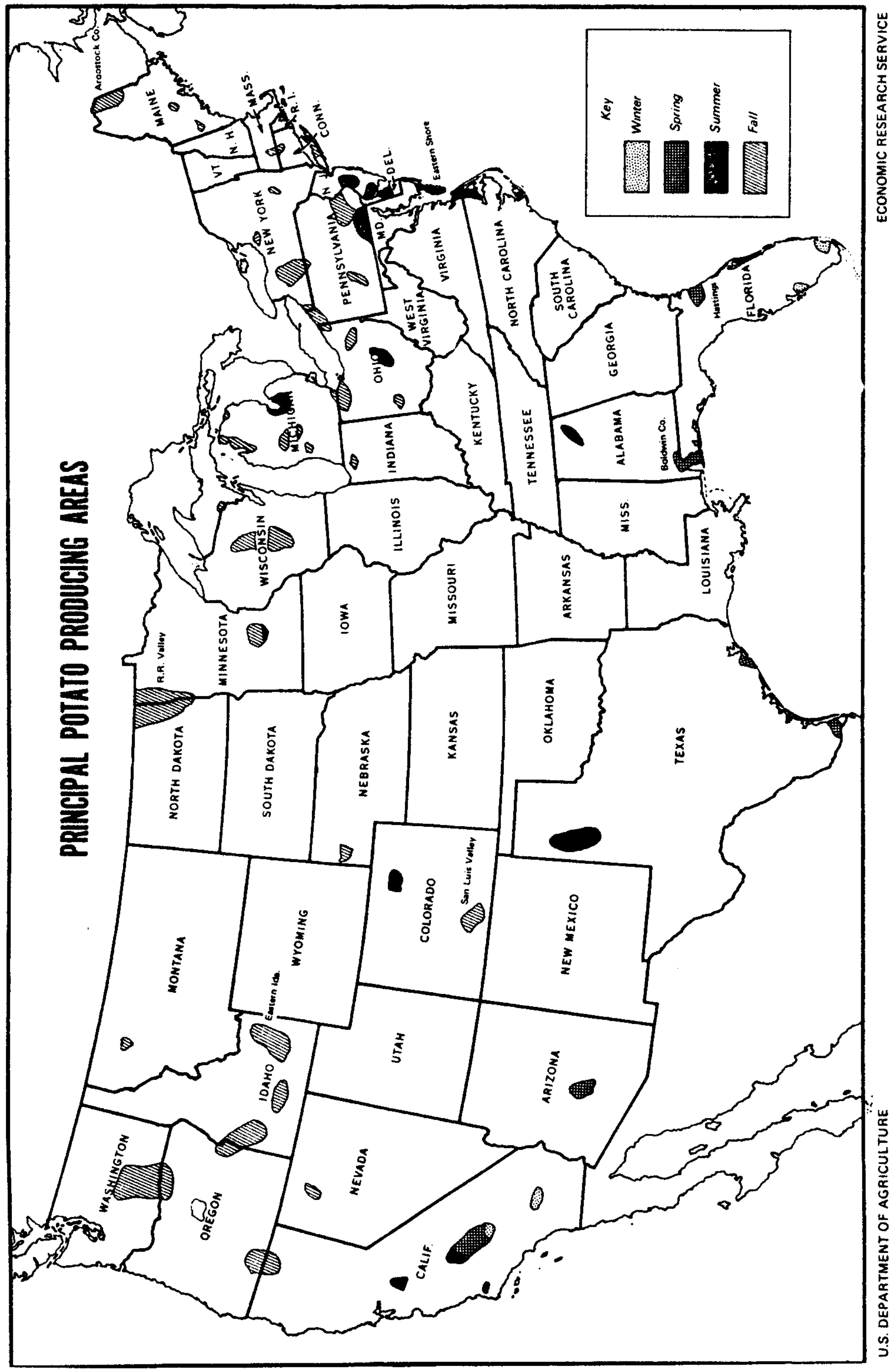
4. Buildings (investment, interest on investment, interest on purchase, maintenance and repairs, insurance, depreciation)

5. Farm liability insurance

C. Marketing

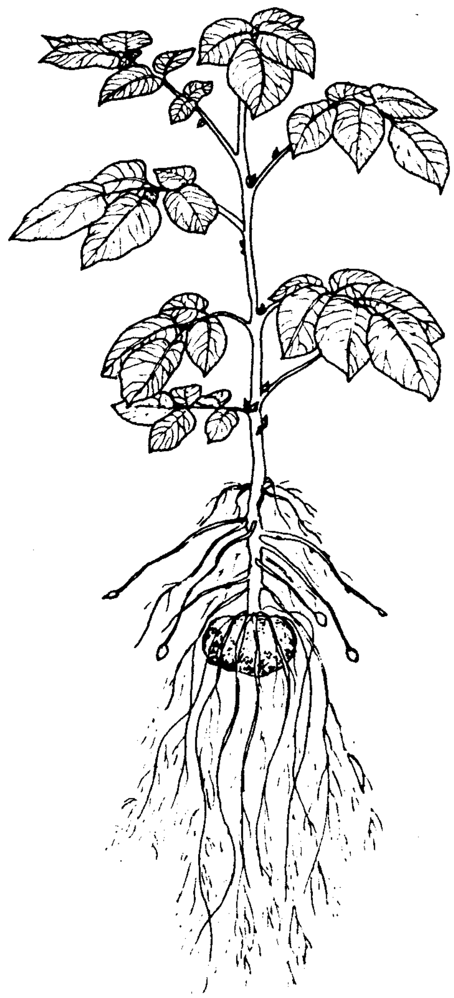
1. Transportation

2. Supply and demand



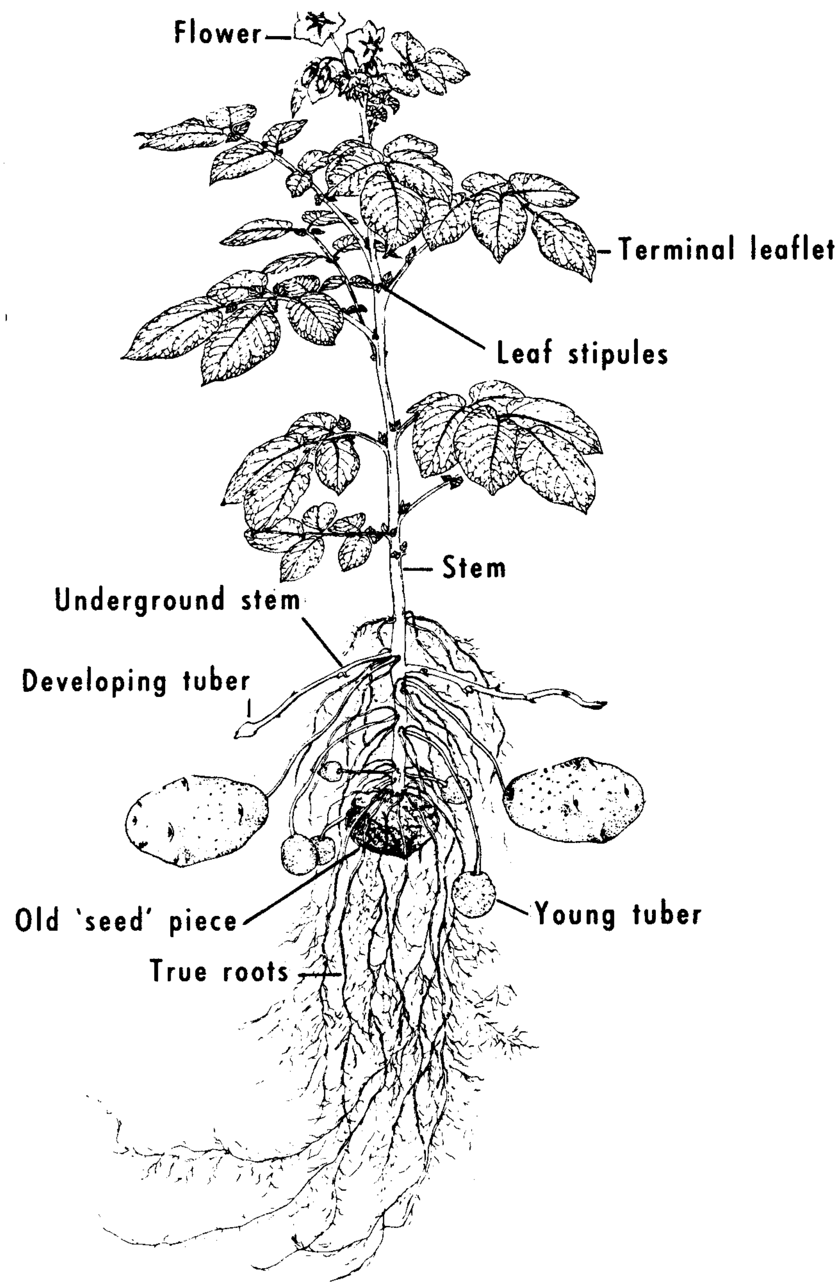
PRINCIPAL POTATO PRODUCING AREAS
Key
Winter
Spring
Summer
Fall
U.S. DEPARTMENT OF AGRICULTURE
ECONOMIC RESEARCH SERVICE
Aroostock Co.
MAINE
N. H.
VT
MASS.
R. I.
CONN.
NEW YORK
N. J.
PENNSYLVANIA
DEL.
MD.
Eastern Shore
VIRGINIA
WEST VIRGINIA
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
FLORIDA
Hastings
OHIO
MICHIGAN
INDIANA
KENTUCKY
TENNESSEE
ALABAMA
Baldwin Co.
MISS.
ILLINOIS
WISCONSIN
MINNESOTA
R.R. Valley
IOWA
MISSOURI
ARKANSAS
LOUISIANA
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
MONTANA
WYOMING
Eastern Ida.
COLORADO
San Luis Valley
NEW MEXICO
IDAHO
UTAH
ARIZONA
WASHINGTON
OREGON
NEVADA
CALIF.

Leading Potato Producing States

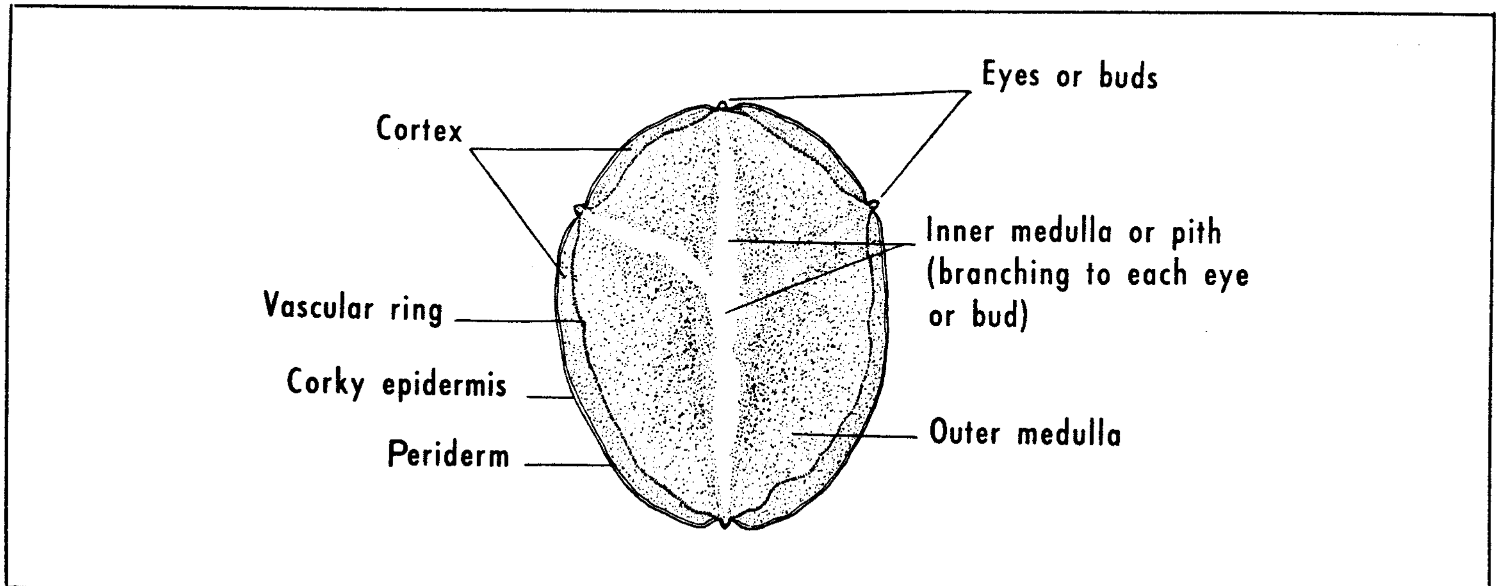


1. Idaho
2. Washington
3. Maine
4. Oregon
5. Colorado
6. Wisconsin

Parts of a Potato Plant



Cross Section of a Potato Tuber



POTATO PRODUCTION

AG 320 - B

ASSIGNMENT SHEET #1--MAKE FERTILIZER RECOMMENDATION FOR POTATOES

Name___________________________________ Score__________________________________

Using the information provided on the soil test report form for Jim Stevens, and University of Idaho CIS #261 - Idaho Fertilizer Guide for Potatoes, recommend the amount of each nutrient that will need to be applied to reach the yield goal. Refer to fertilizer guide for more complete directions.

Part I See next page

Soil Test Request and Report Form

Form #88

Analytical Services Laboratory
College of Agriculture
Moscow, ID 83843-4196
(208) 885-6201

University of Idaho

DO NOT WRITE IN THIS SPACE
Lab no.
Fee
Status: Paid Bill Other
Check no.

Mailing Name Jim Stevens
Address Power County

Phone:

Date:

FIELD INFORMATION			
Irrigation: ☐ Sprinkler ☐ Furrow ☐ None			
Rotation	Crop	Fertilizer applied lb/acre	Yield
Next crop	Potatoes	Anticipate	400 cwt
Previous crop	Wheat	residue	40 bu
Grown in 19( )		returned	
Grown in 19( )			

County:

Grower:

Sample Identification:

☑ CHECK TEST REQUIRED: Please make checks payable to Bursar, University of Idaho.

☒ Standard Fertility Test* ($10.00)
*Includes drying and grinding ($1.50), pH, P, K and O.M.

___ Bicarbonate P & K ___ Acetate P & K

☐ pH (soil reaction)	$ 1	7.0
☐ Available P (ppm P)	$ 3	8.2
☐ Available K (ppm K)	$ 3	120
☐ Organic matter (%)	$ 3	2.4
Other Tests:		
☐ Sulfate-S (ppm S)	$ 3	
☐ Boron (ppm B)	$ 5	
☐ Total Salts (E.C.) (mmhos/cm)	$ 2	
☐ Gypsum Requirement	$20	
☐ Lime Requirement	$ 4	
☐ Cation Exchange Capacity (meq/100g)	$ 7	
☒ Zinc (ppm Zn)	$ 4	0.4
☐ Copper (ppm Cu)	$ 4	
☐ Manganese (ppm Mn)	$ 4	
☐ Iron (ppm Fe)	$ 4	

Depth (feet)	Nitrate N (ppm)	Ammonium N (ppm)	Available Moisture (inches)
0-1	☒ 6.4	☒ 4.1	☐
1-2	☒ 2.4	☒ 8.3	☐
2-3	☐	☐	☐
3-4	☐	☐	☐
4-5	☐	☐	☐
5-6	☐	☐	☐
6-7	☐	☐	☐
Total			

$3 per test ppm × 4 = lb/acre

Cations:	Extractable	Soluble
Calcium	☐	☐
Magnesium	☐	☐
Sodium	☐	☐
Potassium	☐	☐

$3 per test SAR ______

Contact the Analytical Services Laboratory for other special analyses.

FERTILITY GUIDE

Pounds Per Acre						
N	P_2O_5	K_2O				

Remarks:

If you wish further details or have questions concerning the soil analysis, please contact your University of Idaho County Extension Agent.

White — Grower copy • Yellow — Fertilizer Dealer copy • Pink — Ag Agent copy • Goldenrod — Laboratory copy

Part II

A. Considering 20 bushel yield of wheat is equal to one ton of residue returned, answer the following questions:

   1. How many tons of wheat residue were returned to the soil?

   2. How much extra nitrogen will we need to apply to compensate for tie-up by the residue?

B. How deep should the soil sample be taken for the nitrogen test?

C. How deep should the soil sample be taken for the remainder of the tests?

D. What other factors could affect the potatoes ability to get nutrients from the soil (other than level of nutrients in the soil)?

University of Idaho
College of Agriculture

Cooperative Extension System
Agricultural Experiment Station

Current Information Series No. 261

Idaho Fertilizer Guide

Potatoes

R. E. McDole, D. T. Westermann, G. D. Kleinschmidt, G. E. Kleinkopf and J. C. Ojala

These fertilizer guidelines are based on relationships established between University of Idaho soil tests and crop yield response. The fertilizer rates suggested are based on research results and are designed to produce the yields shown if other factors are not limiting production. Thus, the fertilizer guide assumes good crop management.

The suggested fertilizer rates will be accurate for your field provided (1) the soil samples represent the area to be fertilized, and (2) the crop history information supplied is complete and accurate.

Nitrogen

Most Idaho potato fields will respond to fertilizer nitrogen (N). The N rate used, along with other management factors, particularly irrigation, can have a marked effect on the yield and quality of the potato crop.

Nitrogen fertilizer application rates depend upon one or more of the following: preceding crop, N carryover from the preceding crop, mineralized N, plant population, planting and harvest dates, crop residues incorporated into the soil, soil type and leaching losses from irrigation or precipitation.

Excess levels of soil N at or before tuberization can delay tuber growth, reduce yields and lower tuber specific gravity. Excess N in late summer and fall can delay maturity of the tubers. This delayed tuber maturity can adversely affect tuber storability and quality.

The N needs of the potato crop are best met by split-application of N fertilizer. This involves applying lower rates of N fertilizer preplant and at planting, with the remainder of the crop's N needs applied with the irrigation water (see "General Comments" 2 and 3 and CIS 637, *Scheduling Nitrogen Applications for Russet Burbank Potatoes*). Some cropping systems — for example, furrow irrigation — make it difficult to apply N fertilizer and get efficient plant uptake. Under these conditions most of the crop N needs are applied to the soil before planting.

The N recommendations provided in this guide are for the entire needs of the crop when most or all of the N is applied preplant, at planting or early in the growing season (topdress or sidedress). These N applications can be estimated with the aid of a preplant N soil test. Suggested N concentrations in potato petioles through the growing season are discussed in CIS 743, *Tissue Analysis — A Guide to Nitrogen Fertilization for Russet Burbank Potatoes.*

Nitrogen Soil Test

A soil test for N primarily evaluates the carryover N from the previous crop. A soil test is only as good as the sample taken and submitted to a soil testing laboratory for analysis. Depth of soil sampling is important since N, in the form of nitrate (NO_3^-), is mobile in the soil. Soil samples should include 0- to 12-inch and 12- to 24-inch soil depths or to the depth of rooting if less than 24 inches.

Soil samples should be taken in the spring before planting. Nitrogen soil test values obtained from these samples can be used to estimate the crop need for the season (Table 1). The soil test values in Table 1 represent the sum of the nitrate-nitrogen (NO_3-N) and ammonium-nitrogen (NH_4-N) in the top 2 feet of soil by 1 foot increments. (Multiply ppm N in each foot of soil by 4 then add to obtain pounds N/acre.)

Table 1. Nitrogen fertilizer rates[1] for crop season based on soil test when most or all of the N is applied preplant, at planting or early in the growing season.

Soil test nitrogen[2]	Seasonal nitrogen needs based on potential yield[3] 200	300	400	500	600
(N ppm)	(Pounds per acre)[4]				
0	100	150	200	250	300
10	60	110	160	210	260
20	20	70	120	170	220
30	0	30	80	130	180
40	0	0	40	90	140
50	0	0	0	50	100
60	0	0	0	0	60

[1] Does not include N needed for microbial decomposition of residue from previous crop. Add 15 pounds N for each ton of grain straw or nonlegume residue incorporated into soil up to 50 pounds N per acre.

[2] Total ppm of NO_3-N and NH_4-N in 0- to 12- and 12- to 24-inch samples (or to depth of rooting if less than 24 inches).

[3] Yield potential in cwt sacks per acre.

[4] Rates based on: $\dfrac{\text{crop need} - (\text{mineralized N} + \text{soil test N})}{0.65 \text{ (percent recovery of fertilizer N)}}$

Phosphorus

Potato plants need phosphorus (P) for plant growth and will respond to P fertilizer if the soil test concentration is low. Phosphorus soil test for potatoes is based on an extraction with sodium bicarbonate. Soil samples for a phosphorus soil test should be taken from 0- to 12-inch depth. This depth of sampling is critical to achieve an accurate soil test P level. Deviation in sampling depth from the 12-inch depth may drastically alter soil test results.

Phosphorus is immobile in soil and therefore does not move from where it is placed. Applied P fertilizer must be mixed into the seedbed before planting for best results. Banding P fertilizer along side plants has not been as effective as P fertilizer that has been broadcast and incorporated. Eroded or scraped areas, commonly referred to as "white soil" areas, may be low in available P because of its high content of "free lime." These areas should be tested and fertilized separately. To compensate for low P availability when free lime is present in the soil, rates of P are increased with increasing levels of free lime. Soil test concentrations and rates of P_2O_5 needed are shown in Table 2.

Table 2. Recommended phosphorus fertilizer rates based on a soil test for P and a soil test for free lime (CCE).

Soil test (0-12 inch sample depth)	Fertilizer to apply based on percent free lime[2] Less than 5%	10%	15% or more
(ppm P)[1]	(pounds P_2O_5 per acre)[3]		
0	240	360	480
5	160	280	400
10	80	200	320
15	0	120	240
20	0	40	160
25	0	0	80
30	0	0	0

[1] Soil extractant for P is $NaHCO_3$.

[2] Free lime is measured as calcium carbonate equivalent (CCE).

[3] Phosphorus is expressed as oxide (P_2O_5) form ($P_2O_5 \times 0.44 = P$).

Potassium

Potatoes require high levels of available soil potassium (K). Soil test concentrations and rates of fertilizer needed to produce potatoes are shown in Table 3. Potassium is relatively immobile in the soil. For best results, K fertilizers should be applied preplant and mixed into the seedbed. Banding beside the plants has been used successfully but is not as effective as K fertilizer which has been broadcast and incorporated.

Potassium fertilizer applications reduce specific gravity of harvested tubers. Potassium chloride fertilizer (KCl or muriate of potash) lowers specific gravity of tubers more than potassium sulfate fertilizer (K_2SO_4 or sulfate of potash). Growers should avoid over-fertilization of potatoes with K fertilizers. When specific gravity of tubers is important, potassium sulfate is the preferred K fertilizer source.

Table 3. Recommended potassium fertilizer rate based on a soil test.

Soil test (0-12 inch sample depth)	Fertilizer to apply
(ppm K)[1]	(pounds K_2O per acre)[2]
0	240
55	160
110	80
over 158	0

[1] Soil extractant for K is $NaHCO_3$.

[2] Potassium is expressed as the oxide (K_2O) form ($K_2O \times 0.86 = K$).

Sulfur

Potatoes generally do not respond to sulfur (S) fertilization. Sulfur response is most likely to occur in sandy soils and in areas where irrigation water sources are low in S. Water low in S includes mountain streams and some well waters. The more irrigation return-flow in the water source the greater the amount of dissolved, plant-available S. Thus, the Snake River in southwestern Idaho would contain relatively high amounts of S while the same stream and its tributaries in southeastern Idaho will be relatively low in dissolved S.

Soils testing low in S (less than 8 ppm SO_4-S in 0- to 12-inch soil depth) may respond to S fertilization, especially if the irrigation water source is low in S. Some N-P-K fertilizer materials also contain S, so the crop needs may be supplied when other nutrients are applied to the potato crop or even to other crops in the rotation.

Sulfur fertilizer sources should be in the water-soluble, plant-available sulfate (SO_4^{-2}) form. Elemental sulfur is not recommended because it is not immediately available to plants. Elemental sulfur will require several months from time of application until it is converted to plant-available form.

Micronutrients

"Shotgun" applications of micronutrients — i.e., complete mixes containing boron (B), copper (Cu), iron (Fe), manganese (Mn) and zinc (Zn) — "for insurance" are not recommended since these elements have not been shown to give an economical response. Soil tests for individual micronutrients are available and critical concentrations are shown in Table 4. Critical concentrations represent values below which a response from the application of that micronutrient may be obtained.

Zinc deficiencies have not been widespread on potatoes although some crops in certain areas of southern Idaho do show a Zn deficiency. When the soil test for Zn is below the critical concentration or where land leveling or erosion has exposed white subsoil containing free lime, apply Zn fertilizer at a rate which will supply 10 pounds of Zn per acre or equivalent. This amount of Zn should be sufficient for 4 to 6 years of crop production.

Table 4. Critical micronutrient soil test concentrations for potato production is on a 0- to 12-inch soil sample.

Micronutrient	B[1]	Cu[2]	Fe	Mn	Zn
	(ppm)				
Critical concentration	0.5	0.2	4.0	2.0	0.5

[1] Extracted with hot water.

[2] Zn, Cu, Mn and FE extracted with DTPA.

General Comments

1. Nitrogen fertilizer applied closest to time of plant need is used most efficiently. However, time of fertilizer application and placement is largely a matter of personal preference, convenience and availability of fertilizer material and application equipment.
2. Nitrogen applied with irrigation water is an effective way to supplement the crop during the growing season. Do not use aqua or anhydrous ammonia in sprinkler system applications. Applications through a sprinkler system are not foliar fertilization.
3. Nitrogen can be applied during the growing season to meet plant needs as indicated by petiole analysis. Be careful not to apply too much N late in the growing season. Charts showing concentrations of petiole nitrate-nitrogen (NO_3-N) needed to produce maximum yields of potatoes, depending on time of year and plant development, are included in College of Agriculture CIS 743, *Tissue Analysis — A Guide to Nitrogen Fertilization of Russet Burbank Potatoes*, and CIS 637, *Scheduling Nitrogen Applications for Russet Burbank Potatoes*.
4. Fertilizer materials containing P, K and Zn should be thoroughly incorporated into the root zone. These materials can be effectively applied in the fall.
5. The P, K and Zn nutritional status of the plant should also be monitored during the growing season. The same petiole sample used for NO_3-N concentrations can also be used for this purpose. Guidelines for adequate concentrations of these and other nutrients in the petiole can be obtained from your county agricultural Extension agent, consultant or fieldman.
6. Weed, insect and disease control significantly influence the efficiency and effectiveness of fertilizer applications and ultimate crop yield.
7. Over-irrigation and N leaching are hazards on sandy soils. Optimum management may require midseason applications to supply the crop needs.
8. Irrigation frequency and quantity are as important as fertilizer additions in producing a high yield of quality potatoes.

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About the Authors

R. E. McDole is Extension soils specialist at Moscow. G. D. Kleinschmidt and J. C. Ojala are Extension potato specialists at Twin Falls and Idaho Falls, respectively. G. E. Kleinkopf is a professor of plant science at Kimberly. All are in the University of Idaho Department of Plant, Soil and Entomological Sciences. D. T. Westermann is soil scientist with the USDA-ARS Soil and Water Management Unit at Kimberly.

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35 cents per copy

POTATO PRODUCTION

AG 320 - B

ANSWERS TO ASSIGNMENT SHEET

Assignment Sheet #1

Part I

FERTILITY GUIDE

Pounds Per Acre						
N	P_2O_5	K_2O	P	K	Zinc	
150	160	80	70	66	10	

Remarks: Probably requires Zn because of leveling for furrow irrigation.

Part II

A. 1. 2 tons

2. 30 lbs N per acre

B. 24 inches

C. Usually 12 inches, but may be 9 inches

D. Evaluated to satisfaction of instructor.

POTATO PRODUCTION

AG 320 - B

UNIT TEST

Name ______________________________________ Score________________________________

1. Match the terms associated with potato production to the correct definitions. Write the correct number in the blank.

_____a.	The healing over of the cut part of the seed	1.	Rhizomes
_____b.	Skin rubbed off at harvest	2.	Tubers
_____c.	Enlarged tips of rhizome	3.	Suberization
_____d.	Bud areas on tuber that give rise to new stems and roots	4.	Feathered
		5.	Eyes
_____e.	A subterranean stem		

2. Select from the following list leading potato producing states. Write an "X" in the blank before each correct answer.

_____a. Maine

_____b. Colorado

_____c. Oregon

_____d. Wisconsin

_____e. Washington

_____f. North Dakota

_____g. Idaho

_____h. California

3. Discuss the economic importance of potato production to Idaho.

____

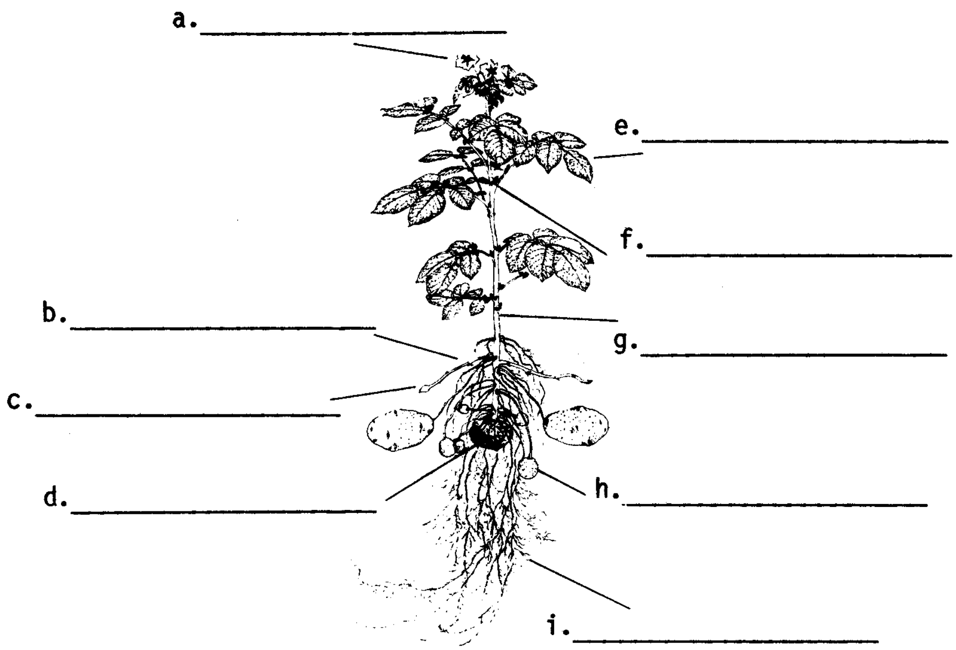
____

____

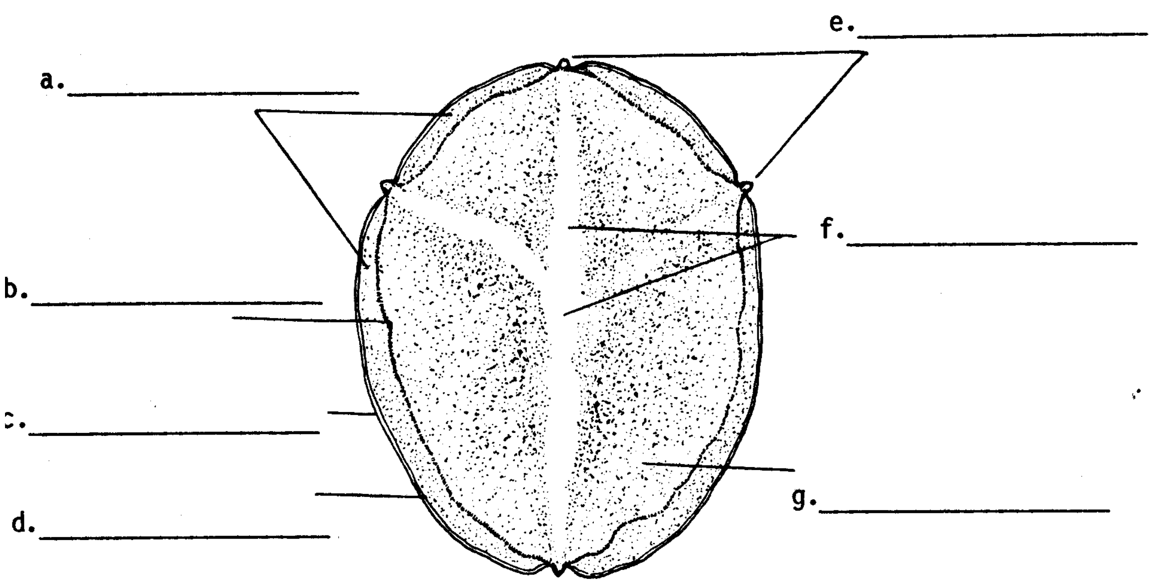
____

____

4. **Identify the parts of a potato plant. Write the correct names in the blanks.**



5. **Identify the parts of a potato tuber. Write the correct names in the blanks.**



6. Select from the following list characteristics of a desirable seedbed. Write an "X" in the blank before each correct answer.

_____a. Fairly level

_____b. Adequate moisture

_____c. Firm and compact

_____d. Free of weeds

_____e. Loose and mellow

_____f. Free of large clods

7. List three tillage operations involved in seedbed preparation.

a. ____________________

b. ____________________

c. ____________________

8. Name three common varieties of seed.

a. ____________________

b. ____________________

c. ____________________

9. Discuss the major points in selecting and preparing seed.

____

____

____

____

____

____

____

____

____

____

____

10. Name two types of planters.

a. ____

b. ____

11. Select from the following list factors to consider in planting potatoes. Write an "X" in the blank before each correct answer.

_____a. Row-spacing

_____b. Price of certified seed

_____c. How the potatoes will be marketed

_____d. Depth of seeding

_____e. Seed rates

_____f. Time of planting

12. Select from the following list factors that influence final plant populations. Write an "X" in the blank before each correct answer.

_____a. Germination percentage

_____b. Plant nutrient availability

_____c. Insect and disease damage

_____d. Percentage of bruised potatoes

_____e. Price of nitrogen fertilizer

_____f. Planting rate

_____g. Seedling vigor

_____h. Adequate moisture

_____i. Weed competition

13. Using the information provided on the soil test report for I.M. Dirty, recommend the amount of each nutrient that will need to be applied to reach the yield goal. Refer to fertilizer guide in making recommendations. Show all work.

Soil Test Request and Report Form

Form #68

Analytical Services Laboratory
College of Agriculture
Moscow, ID 83843-4196
(208) 885-6201

University of Idaho

DO NOT WRITE IN THIS SPACE
Lab no.
Fee
Status: Paid Bill Other
Check no.

Mailing Name I.M. Dirty
Address Parma, ID

Phone:

Date:

County:

Grower:

Sample Identification:

FIELD INFORMATION

Irrigation: ☐ Sprinkler ☐ Furrow ☐ None

Rotation	Crop	Fertilizer applied lb/acre	Yield
Next crop	Potatoes	Anticipate	500 cwt
Previous crop	Wheat	residue	100 bu.
Grown in 19( )		returned	
Grown in 19( )			

☑ CHECK TEST REQUIRED: Please make checks payable to Bursar, University of Idaho.

☒ Standard Fertility Test* ($10.00)
*Includes drying and grinding ($1.50), pH, P, K and O.M.

___ Bicarbonate P & K ___ Acetate P & K

☐ pH (soil reaction)	$ 1	7.4
☐ Available P (ppm P)	$ 3	6.0
☐ Available K (ppm K)	$ 3	111
☐ Organic matter (%)	$ 3	2.4
Other Tests:		
☐ Sulfate-S (ppm S)	$ 3	
☐ Boron (ppm B)	$ 5	
☐ Total Salts (E.C.) (mmhos/cm)	$ 2	
☐ Gypsum Requirement	$20	
☐ Lime Requirement	$ 4	
☐ Cation Exchange Capacity (meq/100g)	$ 7	
☒ Zinc (ppm Zn)	$ 4	0.4
☐ Copper (ppm Cu)	$ 4	
☐ Manganese (ppm Mn)	$ 4	
☐ Iron (ppm Fe)	$ 4	

Depth (feet)	Nitrate N (ppm)	Ammonium N (ppm)	Available Moisture (inches)
0-1	☒ 6.4	☒ 4.1	☐
1-2	☒ 2.4	☒ 7.1	☐
2-3	☐	☐	☐
3-4	☐	☐	☐
4-5	☐	☐	☐
5-6	☐	☐	☐
6-7	☐	☐	☐
Total			

$3 per test ppm x 4 = lb/acre

Cations:	Extractable	Soluble
Calcium	☐	☐
Magnesium	☐	☐
Sodium	☐	☐
Potassium	☐	☐

14. Name two potato diseases.

a. ______________________________

b. ______________________________

15. Name two harmful insects of potatoes.

a. ______________________________

b. ______________________________

16. Discuss how weeds compete with potatoes.

a. ____

____

b. ____

____

c. ____

____

17. List three ways weeds cause losses in potato production.

a. ____

b. ____

c. ____

18. Match the general categories of weeds to the correct description. Write the correct number in the blank.

_____a.	Plants with shorter, wider leaves that usually have pinnate or netted veination; dicots	1. Annual
_____b.	Live for three years or more and can reproduce sexually and asexually by means of rhizomes and stolons	2. Perennial
		3. Broadleaf
_____c.	Complete life cycle within the period of one year	4. Grass
_____d.	Plants with longer, narrower leaves with parallel veination; monocots	

19. Name three methods of weed control.

a. ____

b. ____

c. ____

20. List two types of cultivation.

a. ____

b. ____

21. Select from the following list reasons for killing vines prior to harvest. Write an "X" in the blank before each correct answer.

_____a. Increases yield per acre

_____b. Toughens the skin

_____c. Hastens maturity

_____d. Stops growth

_____e. Reduces disease in seed fields

_____f. Retards the growth of sprouts

22. Name two ways to kill potato vines.

a. ____

b. ____

23. Select from the following list methods of handling potatoes to reduce bruising. Write an "X" in the blank before each correct answer.

_____a. Modify harvesting equipment to reduce bruising

_____b. Storage at proper relative humidity

_____c. Use rubber coated chains

_____d. Drop distance held to a minimum

_____e. Correct and adequate distribution of airflow in storage

_____f. Do not step on or kick potatoes

24. Tell what a proper potato storage environment consists of and how it is provided.

____

____

____

____

____

____

____

____

25. List four uses of potatoes.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

26. Name three grades of potatoes for fresh pack.

a. ____________________

b. ____________________

c. ____________________

27. Discuss the sizing of potatoes for fresh pack.

____

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____

____

28. List ten factors that affect the profitability of potato production.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ______________________________

f. ______________________________

g. ______________________________

h. ______________________________

i. ______________________________

j. ______________________________

POTATO PRODUCTION

AG 320 - B

ANSWERS TO TEST

1. a. 3 b. 4 c. 2 d. 5 e. 1

2. a, b, c, d, e, g

3. Answer could include the following information:

   347,000 acres harvested; 286 cwt. yield per harvested acre; 99,320,000 cwt. total production; Economic value to the state is 348,985,000

4.

a.	Flower	b.	Underground stem	c.	Developing tuber
d.	Old seed piece	e.	Terminal leaflet	f.	Leaf stipules
g.	Stem	h.	Young tuber	i.	True roots

5.

a.	Cortex	b.	Vascular ring	c.	Corky epidermis
d.	Periderm	e.	Eyes or buds	f.	Inner medulla or pith
g.	Outer medulla				

6. a, b, d, e, f

7. Answer should include three of the following:

   Moldboard plow; Ripper (chisel plow); Disk; Chisel; Harrow

8. Answer should include three of the following:

   Russett Burbank; Butte; Norgold; Lemhi; Nooksack

9. Answer could include the following information:

   Use only certified seed; Avoid seed that has been chilled, frosted, heated, sprouted; Cutting seed: Warm to 50^{o} F to 55^{o} F before cutting; Cut seed into pieces from 1 3/4 oz to 3 oz; Screen out slivers and rotted seed; Handling cut seed: Cut in draft-free area; Wet down floors for high humidity; Treat seed pieces to help heal and protect against disease; Plant immediately after cutting when possible; If stored, store at 50^{o}F to 55^{o}F with ventilation and humidity for two weeks; Protect from sun and wind

10. a. Picker-type b. Cup-type

11. a, c, d, e, f

12. a, b, c, f, g, h, i

13. N--230; P_20_5--160; P--70; K_20--80; K--66; Zinc--10; Sulfur--0; Boron--0

14. Answer should include two of the following:

    Early blight; Early dying; Potato ring rot; Blackleg; Common scab; Rhizoctonia; Translucent-end

15. Answer should include two of the following: Colorado Potato Beetle; Wireworms; Green Peach Aphid

16. Competition for water; Competition for nutrients; Competition for light

17. Decreased yield; Decreased crop quality; Cost of control activities

18. a. 3 b. 2 c. 1 d. 4

19. Cultural; Mechanical; Chemical

20. Hilling; Inter-row

21. b, c, d, e

22. Answer should include two of the following:

    Chemical sprays; Rollers; Vine beaters; Rotary mowers; Flaming

23. a, c, d, f

24. Answer could include the following information:

    What it should accomplish: Stimulate healing of bruises, cuts and other injuries; Maintain appearance and external quality of the tubers; Maintain internal quality of the tubers (food value, processability, etc.); Keep rot development to a minimum; Keep weight loss to a minimum; Retard the growth of sprouts; Maintain seed potatoes in a healthy, vigorous and productive condition
    What it consists of: Proper temperature; Proper humidity; Proper ventilation
    How it is provided and controlled: Proper ventilation and management; Correct and adequate distribution of airflow; Humidification system
    How it is evaluated: Weight loss; Rot loss; Quality change

25. Answer should include four of the following:

    Fresh pack; Processed; Certified seed; Animal feed; Alcohol production

26. a. No. 1 b. No. 2 c. Culls

27. Answer could include the following information:

    Bakers, larger 14 oz No. 1; Utility, larger 10-14 oz No. 2; 70 count, 12 oz No. 1; 80 count, 10 oz No. 1; 90 count, 9 oz No. 1; 100 count, 8 oz No. 1; 110 count, 7 oz No. 1; 120 count, 6 oz No. 1; US #1, Size A

28. Answer should include the following information:

Operating or variable costs: Seed (registered, certified or common); Fertilizer; Soil testing; Irrigation (equipment investment, interest on investment, electricity, etc.); Interest on operating capital; Pest control (herbicides, fungicides, insecticides and soil fumigation); Machinery and equipment operation (land preparation, chemical application, planting, harvesting, machine hire); Fuel; Crop insurance; Land rent; Part-time labor (salary, social security taxes, disability insurance)
Fixed costs: Land (investment, interest on investment, interest on purchase, taxes); Full-time labor (salary, social security taxes, disability insurance); Machinery and equipment (investment, interest on investment, interest on purchase, maintenance and repairs, insurance, depreciation); Buildings (investment, interest on investment, interest on purchase, maintenance and repairs, insurance, depreciation); Farm liability insurance
Marketing: Transportation; Supply and demand

SMALL GRAIN PRODUCTION

AG 320 - C

UNIT OBJECTIVE

After completion of this unit, students should be able to describe small grain production techniques involved in seedbed preparation, fertilizer requirements, planting, disease and insect control, weed control, harvest, storage and marketing. This knowledge will be demonstrated by completion of the unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with small grain production to the correct definitions.
2. List three uses of small grains.
3. Select leading wheat producing states.
4. Discuss the economic importance of small grain production to Idaho.
5. Identify the parts of a wheat plant.
6. Arrange in order the stages of growth of small grains.
7. Select characteristics of a desirable seedbed.
8. List three tillage operations involved in seedbed preparation.
9. Name two types of grain drills.
10. Name two classes of wheat and what they are used for.
11. List two common varieties of seed for soft white spring wheat and soft white winter wheat.
12. Select factors to consider in planting small grains.
13. List four factors to consider in selecting small grain seed.
14. Select factors that influence final plant populations.
15. Name two small grain diseases.
16. Name two harmful insects of small grains.
17. List three ways weeds compete with small grains.
18. List three ways weeds cause losses in small grain production.
19. Match the general categories of weeds to the correct description.

20. Name three methods of weed control.

21. Discuss approved practices for harvesting and storing small grains.

22. List three qualities of a good storage facility for small grains.

23. Match the types of grain markets to the correct description.

24. List two main factors in grading grain.

25. List and discuss the three major factors affecting the profitability of small grain production.

26. Make fertilizer recommendations for wheat.

SMALL GRAIN PRODUCTION

AG 320 - C

SUGGESTED ACTIVITIES

I. Suggested activities for instructor

A. Order materials to supplement unit.

1. Literature

a. *Oats*, instructional unit; available from Agri-Farm Publications, Inc., 1019 Market St., Gowrie, Iowa 50543; approximate cost $7.50; order no. 210; also available: *Oat Production Guide*, approximate cost $4.80; order no. 2105.

b. *Oats Production*, 17 transparency masters; available from IAVIM, 208 Davidson Hall, Iowa State University, Ames, Iowa 50011; approximate cost $2.25; order no. 516.

c. The following Current Information Series publications are available from Agricultural Communications Center, Ag Publications Building, University of Idaho, Moscow, Idaho 83843-4196, (208-885-7982).

CIS 215 Barley Varieties for Southern Idaho $.45

CIS 276 Producing Malting Barley in Idaho $.45

CIS 312 Insect Control in Farm-Stored Grain $.35

CIS 373 Idaho Fertilizer Guide: Irrigated Wheat $.35

CIS 395 Oat Varieties for Idaho $.35

CIS 408 Winter Wheat Varieties--For Dryland and Irrigated Areas of Southern Idaho and Irrigated Areas of the Treasure Valley, Eastern Oregon $.35

CIS 440 Idaho Fertilizer Guide: Spring and Winter Wheat on Eastern Idaho Dryland $.25

CIS 449 Buying and Selling High-Moisture Grain $.35

CIS 453 Northern Idaho Fertilizer Guide: Winter Wheat $.35

CIS 536 Aeration for Grain Storage $.45

CIS 639 Spring Wheat Varieties for Northern Idaho $.25

CIS 644 Fumigation of Farm-stored Grain $.25

CIS	672	Barley Yellow Dwarf $.25
CIS	728	The "Mixed Wheat" Grade--What it Means and How to Avoid It $.35
CIS	737	Footrot Control in Winter Wheat Using Tillage, Rotation, Variety, Fungicides and Nitrogen Variables $.35
CIS	758	Northern Idaho Fertilizer Guide: Feed Barley $.35
CIS	767	Weed Seed Contamination of Cereal Grain Seedlots $.25
CIS	778	Development and Control of the English Grain Aphid on Wheat $.45
CIS	783	Scab of Wheat and Barley $.25
CIS	784	Black Chaff of Wheat and Barley $.25
CIS	810	Idaho Fertilizer Guide: Malting Barley $.35
CIS	828	Idaho Fertilizer Guide: Irrigated Spring Wheat, Southern Idaho $.35
CIS	833	Seedborne Diseases of Cereals $.35
EXP	636	Idaho Grain Producers: Adoption of New Marketing Methods $1.50
EXP	653	Transporting and Marketing Idaho's Wheats and Barleys $.75
EXP	682	Spring Wheat Varieties for Idaho $.75
WREP 1		Farmer Use of Wheat Futures in the Pacific Northwest $.50

2. Filmstrips, slideshows, etc.

   a. *Barley Stripe*, Program #182; 6 minutes, VHS or Beta format; describes history, symptomology and treatment; available from each University of Idaho District Extension Office; purchase cost $25; rental cost $10 for 14 days.

   b. *Black Chaff or Bacterial Leaf Blight of Wheat and Barley*, Program #180; 11 1/2 minutes, VHS or Beta format; describes history, symptomology and treatment; available from each University of Idaho District Extension Office; purchase cost $25; rental cost $10 for 14 days.

c. *Diseases of Wheat*, filmstrip and study guide; available from Ohio Agriculture Education Curriculum Materials Center, Ohio State University, Columbus, Ohio 43210; approximate cost $7.60; order no. 110X.

d. *Loose Smut of Wheat and Barley*, Program #183; 5 1/2 minutes, VHS or Beta format; describes history, symptomology and treatment; available from each University of Idaho District Extension Office; purchase cost $25; rental cost $10 for 14 days.

e. *Powdery Mildew of Wheat and Barley*, Program #181; 6 minutes, VHS or Beta format; describes history, symptomology and treatment; available from each University of Idaho District Extension Office; purchase cost $25; rental cost $10 for 14 days.

f. *Protecting Your Stored Grain*, Program #225; 8 1/2 minutes, VHS or Beta format; describes system to prevent loss of stored grain from mold and insects; available from each University of Idaho District Extension Office; purchase cost $25; rental cost $10 for 14 days.

g. *Stored Grain Pest Management Video Conference*, Program #417; 2 hours, VHS or Beta format; offers tips on how to minimize loss to pests or fungus; covers insect management, mold prevention, aeration management and the economics of grain storage; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196, (208-885-6436).

h. *Stripe Rust of Wheat*, Program #160; 9 minutes, VHS or Beta format; describes history, symptomology and treatment; available from each University of Idaho District Extension Office; purchase cost $25; rental cost $10 for 14 days.

B. Make transparencies and necessary copies of materials.

C. Provide students with objective sheet and discuss.

D. Provide students with information and assignment sheets and discuss.

E. Do a community survey of small grain production and publish the results in local newspaper.

F. Calibrate a grain drill as a class project.

G. Invite resource person to speak on small grain production.

H. Arrange for a field trip to a local elevator to discuss storage and marketing of grains.

I. Review and give test.

J. Reteach and retest if necessary.

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Spring Wheat Harvested

2. TM 2--Winter Wheat Harvested

3. TM 3--Parts of a Wheat Plant

4. TM 4--Wheat Germination and Seedling Growth

5. TM 5--Vegetative Growth Stages of Wheat

6. TM 6--Heading Stage of Wheat

7. TM 7--Classes of Wheat

E. Assignment sheet

1. AS 1--Make Fertilizer Recommendations for Wheat

F. Answers to assignment sheet

G. Test

H. Answers to test

III. Unit references

A. Delorit, R.J., et al., *Crop Production*, 4th edition, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

B. Harris, M.S., *Diseases of Cereal Crops in Washington*, Washington State University, Extension Bulletin No. 559, Pullman, Washington, 1964.

C. Roylance, H.B, *Producing Small Grains Under Irrigation in Southern Idaho*, University of Idaho, Current Information Series No. 266, Moscow, Idaho, 1975.

D. Wesenberg, D.M., et al., *Producing Malting Barley in Idaho*, University of Idaho, Current Information Series No. 276, Moscow, Idaho, 1978.

SMALL GRAIN PRODUCTION

AG 320 - C

INFORMATION SHEET

I. Terms and definitions

A. Cool-season crop--Makes best growth under relatively cool conditions; are generally damaged by hot weather; includes wheat, barley and oats

B. Vernalization--Cold treatment of a plant, plant part or seed to initiate reproduction

C. Long-day plant--Requires relatively short nights for the formation of flowers; short days increase vegetative growth

D. Coleoptile--Sheath which covers the first leaf of grass seedlings during emergence

E. Crop residue--Plant material, such as wheat stubble, which is left on or in ground after harvest

F. Erosion--Removal of topsoil by tillage, wind and/or water

G. Stubble mulching--Tillage beneath stubble without covering all of the residue

H. Strip cropping--Alternate strips of crop and summer fallow to reduce erosion and conserve moisture

I. Contour cropping--Planting and cultivating parallel with the lay of the land to prevent erosion

J. No-till--System of reduced tillage where cultivation and seeding are accomplished at the same time

K. Minimum tillage--Any practice which reduces the number of tillage operations on a field

II. Uses of small grains

A. Baking flour

B. Livestock feed

C. Breakfast cereal

D. Hay

E. Pasture

F. Protein supplements

G. Glue products

H. Bedding (straw)

I. Malt

III. Leading small grain producing states (Transparencies 1, 2)

A. Wheat

1. Kansas
2. Oklahoma
3. Washington
4. North Dakota
5. Texas
6. Colorado

B. Barley

1. Idaho
2. North Dakota
3. Washington
4. Montana
5. Minnesota
6. California

C. Oats

1. Iowa
2. Minnesota
3. South Dakota
4. Wisconsin
5. Pennsylvania
6. Nebraska

IV. Economic importance of small grain production to Idaho (1988)

A. Wheat

1. Idaho ranks 8th in production of all wheat in U.S.
2. 1,150,000 acres harvested
3. Total annual production of 75,520,000 bushels
4. Average yield of 65.7 bushels/acre
5. Annual value of $299,610,000

B. Barley

1. Idaho ranks 1st in production of barley in U.S.
2. 850,000 acres harvested
3. Total annual production of 51,000,000 bushels
4. Average yield of 60.0 bushels/acre
5. Annual value of $143,350

C. Oats

1. Idaho ranks 17th in production of oats in the U.S.
2. 45,000 acres harvested
3. Total annual production of 3,060,000 bushels
4. Average yield of 68 bushels/acre

V. Parts of a wheat plant (Transparency 3)

A. Head or flower

B. Flag leaf

C. Leaves

D. Stem

E. Roots

VI. Stages of growth of small grains (Transparencies 4, 5, 6)

A. Germination

B. Seedling

C. Tillering or stooling

D. Jointing

E. Boot

F. Heading

G. Flowering

H. Milk

I. Soft dough

J. Hard dough

K. Mature

VII. Characteristics of a desirable seedbed

A. Loose and mellow

B. Fairly level

C. Free of large clods

(Note: The clod size needed will be determined by erosion potential. For high erosion potential, leave larger size clod. For low erosion potential, leave smaller size clod.)

D. Adequate available moisture

E. Free of weeds

VIII. Tillage operations involved in seedbed preparation

A. Primary tillage

1. Moldboard plow

a. Time--Spring or fall

b. Depth--6 to 8 inches

c. Moisture needed

2. Ripper (chisel plow)

a. Time--Fall

b. Depth--12 to 14 inches

c. Dry conditions needed

B. Secondary tillage

1. Disk

a. Time--Spring

b. Depth--3 to 4 inches

2. Harrow

a. Time--Spring

b. Depth--3 to 4 inches

3. Roller

a. Time--Spring

b. Depth--Surface

IX. Types of grain drills

A. End-wheel drill--Wheels on sides support and drive the seed metering mechanisms

B. Press-wheel drill--Press-wheel gangs mounted on rear of the drill; press wheels act to firm the soil over the seed, drive the metering mechanism and support the rear of the drill

(Note: Planting done with grain drills is called solid planting. It is called this because the rows are too close to permit cultivating or other cultural practices between them. Solid planting is normally used for small grains, grasses and legumes.)

X. Classes of wheat (Transparency 7)

A. Hard red spring wheat

1. Produced mainly in North Dakota, South Dakota, Minnesota, Nebraska and Montana

2. Use: Bread flour

3. Grown in southeastern Idaho

B. Hard red winter wheat

1. Produced mainly in Kansas, Oklahoma and Texas

2. Use: Bread flour

3. Grown in southeastern Idaho

C. Soft white wheat

1. Produced mainly in western U.S.

2. Use: Flour for pastries, cakes, cookies, breakfast foods and all-purpose flour. Exported to other countries for use in flat breads

3. Primary class of wheat raised in Idaho

a. Northern Idaho--98%

b. Southwestern Idaho--99%

c. South central Idaho--99%

D. Soft red wheat

1. Produced mainly in Ohio, Missouri, Indiana, Pennsylvania and Illinois (areas of more than 30" of rainfall)

2. Use: Same as soft white wheat

3. None in Idaho

E. Durum wheats (durum and red durum)

1. Produced mainly in North Dakota, South Dakota, Minnesota and Montana (spring wheat, similar to hard red spring)

2. Use: Noodles, macaroni, spaghetti and similar products

3. Small amount grown in Idaho

XI. Common varieties

A. Soft white winter wheat

1. Daws

2. Nugaines

3. Stephens

4. Hill 81

5. Lewjain

B. Soft white spring wheat

1. Fielder

2. Twin

3. Fieldwin

C. Hard red spring wheat

1. Borah
2. Peak 72
3. Fremont

D. Feed barley, 2-row spring

1. Caribou
2. Otis

E. Feed barley, 6-row spring

1. Steptoe
2. Steveland
3. Woodvale
4. Gem
5. Vale 70

F. Feed barley, 6-row winter

1. Schuyler
2. Luther
3. Kamiak

G. Malting barley, 6-row

1. Trail
2. Larker
3. Karl

H. Malting barley, 2-row

1. Klages
2. Shabet
3. Piroline
4. Vanguard
5. Moravian III

I. Oats

1. Cayuse

2. Park

XII. Factors to consider in planting small grains

A. Time of planting

B. Seeding depth--1 to 2 inches

(Note: Deeper planting is practiced on sandy soils or when limited amounts of moisture are available.)

C. Seeding rate

(Note: As soil and climatic conditions improve the more seeds per foot of row can be produced. Average planting rates are 60-80 lbs/acre for winter wheat, 80-150 lbs/acre for spring wheat, and 80-130 lbs/acre for barley.)

D. Row spacing--6 to 7 inches

XIII. Factors to consider in selecting small grain seed

A. Plump kernels

B. Large kernels

C. Uniform size

D. High test weight

E. No discoloration

F. Certified (or registered)

XIV. Factors that influence final plant populations

A. Planting rate

B. Planting depth

C. Germination percentage

D. Vigor of seedling

E. Availability of plant nutrients

F. Moisture availability

G. Competition from weeds

H. Damage from disease and insects

XV. Fertilizer requirements

A. Soil testing

(Note: Use soil test results in conjunction with University of Idaho Fertilizer Guides. Nutrients of concern for soil test include nitrogen, phosphorus, potassium and sulphur. Applications of other nutrients have not been shown to be responsive or economical and are not recommended.)

XVI. Small grain diseases

A. Leaf rust

1. Crop affected--Wheat, barley

2. Symptoms--Appears as small, round to oval, orange-yellow dusty pustules on the leaves and sheaths; resistant varieties show only small yellow flecks or spots

3. Causal agent--Fungus; requires alternate host

4. Methods of control--At present, the best control is in the use of resistant varieties; planting early or using early maturing varieties may help; chemical control

B. Stem rust

1. Crop affected--Wheat, oats, barley

2. Symptoms--Appears as oblong, reddish-brown pustules on stems, leaves, sheaths and heads; as wheat matures, the pustules gradually turn black

3. Causal agent--Fungus; requires alternate host

4. Methods of control

a. Plant resistant, early maturing varieties

b. Plant spring grains as early as possible

c. Control alternate host

C. Powdery mildew

1. Crop affected--Wheat, barley

2. Symptoms--White or brownish gray powder or mold on leaf surface or spikelet

3. Causal agent--Fungus; survives on living and dead plants

4. Methods of control--At present, the best control is in the use of resistant varieties; chemical control

D. Seed decay and seedling blight

1. Crop affected--Wheat, oats, barley

2. Symptoms--Seeds decay before or after germination; thin stands; plants weak and stunted

3. Causal agent--Several soil-borne fungi

4. Method of control--Chemical seed treatment

E. Root, crown and foot rots

1. Crop affected--Mostly wheat, but also barley

2. Symptoms--Roots brown to black and sparse; crown and foot discolored; stems often shortened; heads ripen prematurely; kernels shriveled; stems sometimes fall over or lodge

3. Causal agent--Several soil-borne fungi

4. Methods of control--Crop rotation with non-cereal crop; chemical seed treatment; balanced fertility, particularly nitrogen and phosphorus; prevent moisture stress

F. Smuts

1. Crop affected--The different smuts are specific to either wheat, barley or oats

2. Symptoms--Kernels are replaced by a brown to black powdery mass of smut spores

3. Causal agent--Various species of smut fungi

4. Methods of control--Resistant varieties; chemical seed treatment

G. Barley yellow dwarf virus

1. Crop affected--Wheat, barley, oats

2. Symptoms--Plants stunted; leaves of wheat are yellow to reddish purple, leaves of barley are yellow, leaves of oats are reddish; kernels may be shriveled or absent

3. Causal agent--A virus transmitted by aphids

4. Methods of control--Seed winter cereals late in the fall and spring cereals early in the spring; maintain adequate moisture and nitrogen during the growing season

H. Stripe rust

1. Crop affected--Wheat

2. Symptoms--Orange yellow stripes appear on leaves, leaf sheaths and heads

3. Causal agent--Fungus; does not require an alternate host, but survives the winter on winter wheat

4. Methods of control--Resistant varieties; chemical control

XVII. Insects affecting small grain production

A. Greenbug

1. Description--Adult is usually pale green, wingless form with darker green strip down the center of its back (an aphid)

2. Damage--Feeds on the plant's fluids, transmits barley yellow dwarf virus and other disease-causing organisms

3. Method of control--Insecticides

B. Russian Wheat Aphid

1. Description--Light green, elongated and spindle-shaped; the antennae are very short; has wart-like projection above the tail that gives it a two-tailed appearance; very small

2. Damage--Secretes a toxin that causes leaf rolling and white (in warm weather) or purple (in cool weather) streaking on the leaves; heavily infested plants are severely stunted and sometimes flattened

3. Method of control--Insecticides

XVIII. Weed competition with small grains

A. Competition for water

B. Competition for nutrients

C. Competition for light

(Note: Small grains and weeds have the same basic requirements for normal growth and development. In a mixed community of crops and weeds, the more aggressive species will dominate.)

XIX. Losses caused by weeds

A. Decreased yield

B. Decreased crop quality

C. Cost of control activities

XX. General categories of weeds

A. Annual--Complete life cycle within the period of one year

(Note: Wild oats, lambsquarter and redroot pigweed are examples.)

B. Perennial--Lives for three years or more and can reproduce sexually and asexually by means of rhizomes and stolons

(Note: Canada thistle, field bindweed and Russian knapweed are examples.)

C. Broadleaf--Plants with shorter, wider leaves that usually have pinnate or netted veination; dicots

D. Grass--Plants with longer, narrower leaves with parallel veination; monocots

XXI. Methods of weed control

A. Cultural

(Note: Wheat and barley are excellent competitors with weeds.)

B. Mechanical

(Note: Mechanical weed control in small grains is restricted to pre-plant tillage practices because of narrow row spacing.)

C. Chemical

(Note: A wide spectrum of chemicals are available for use on small grains for weed control.)

XXII. Harvesting and storing small grains

A. Practically all small grains in the United States are harvested with the combine

B. Test wheat grain for moisture and harvest for storage when moisture is below 14 percent

C. Properly adjust the combine to prevent harvesting losses; always stop the combine before cleaning if clogged or making other adjustments

D. Store the grain in a dry, vermin-proof bin until marketed or fed

E. Clean and spray all storage bins prior to harvest

(Note: If the small grain crop is to be used as a forage crop or other use, methods of harvesting and storing will change accordingly.)

F. Check stored grain often for heating and/or presence of insects

(Note: Heating is most likely to occur in grain stored at a moisture level higher than 13 1/2 percent.)

XXIII. Qualities of a good storage facility

A. Weather-proof

B. Rodent-proof

C. Constructed of easy-to-clean material

XXIV. Grain markets

A. Cash market--Operates in same manner in which livestock is sold; the price paid is the market offering for the day the grain is sold

B. Futures market--Forward contracting to purchase or deliver a certain amount of grain on a given date at a given price

(Note: This ensures the producer of a market for his grain and reduces the risk of declining market prices. This ensures the buyer of delivery of grain at a certain time and reduces the risk of rising market prices.)

XXV. Main factors in grading grain

A. Minimum weight per bushel

B. Maximum percentage of damaged kernels

C. Maximum percentage of foreign matter

XXVI. Factors affecting profitability of small grain production

A. Operating or variable costs

1. Seed (certified, registered, common)

2. Fertilizer

3. Soil testing

4. Irrigation (equipment investment, interest on investment, electricity)

5. Interest on operating capital

6. Pest control (herbicides, fungicides, insecticides, soil fumigation)

7. Machinery and equipment operation (land preparation, chemical application, planting, harvesting, machine hire)

8. Fuel

9. Crop insurance

10. Land rent

11. Part-time labor (salary, social security taxes, disability insurance)

B. Fixed costs

1. Land (investment, interest on investment, taxes)

2. Full-time labor (salary, social security taxes, disability insurance)

3. Machinery and equipment (investment, interest on investment, maintenance and repairs, insurance, depreciation)

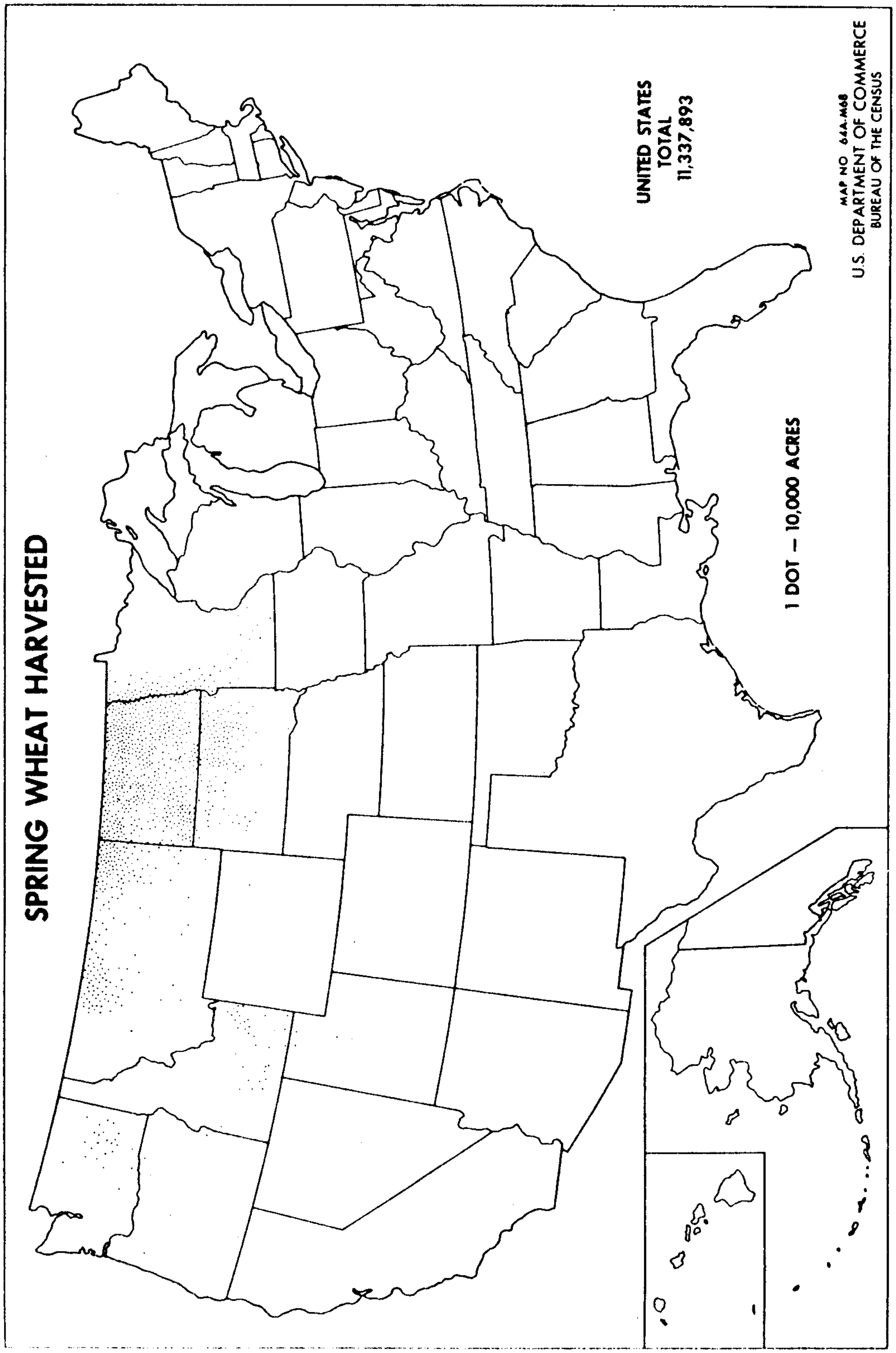
4. Buildings (investment, interest on investment, maintenance and repairs, insurance, depreciation)

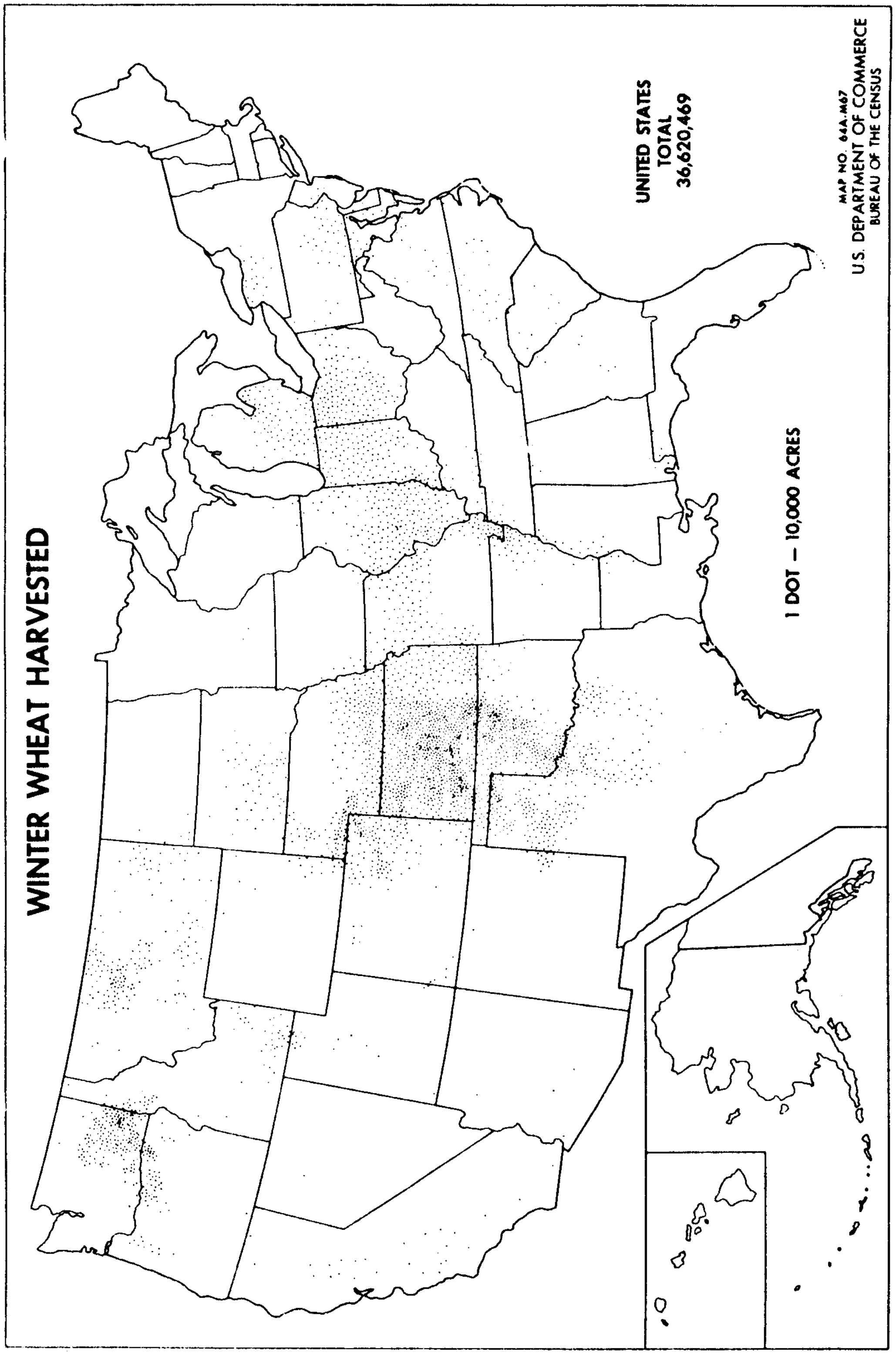
5. Farm liability insurance

C. Marketing

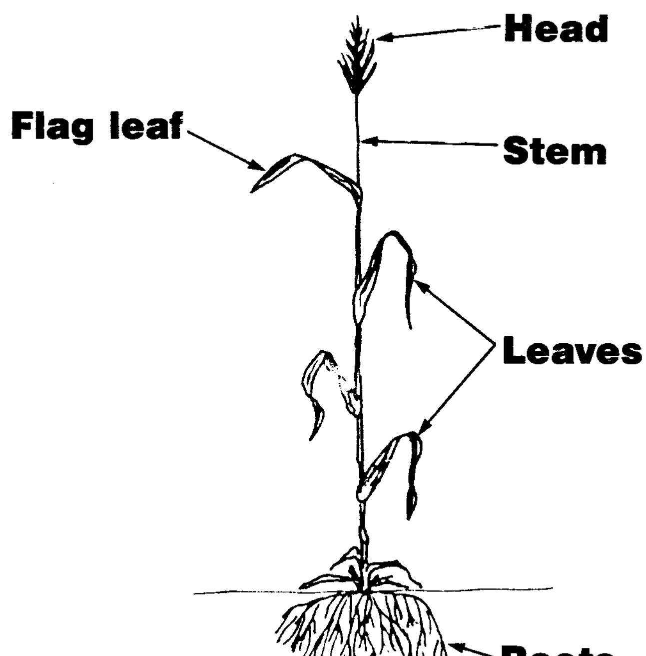
1. Transportation

2. Supply and demand

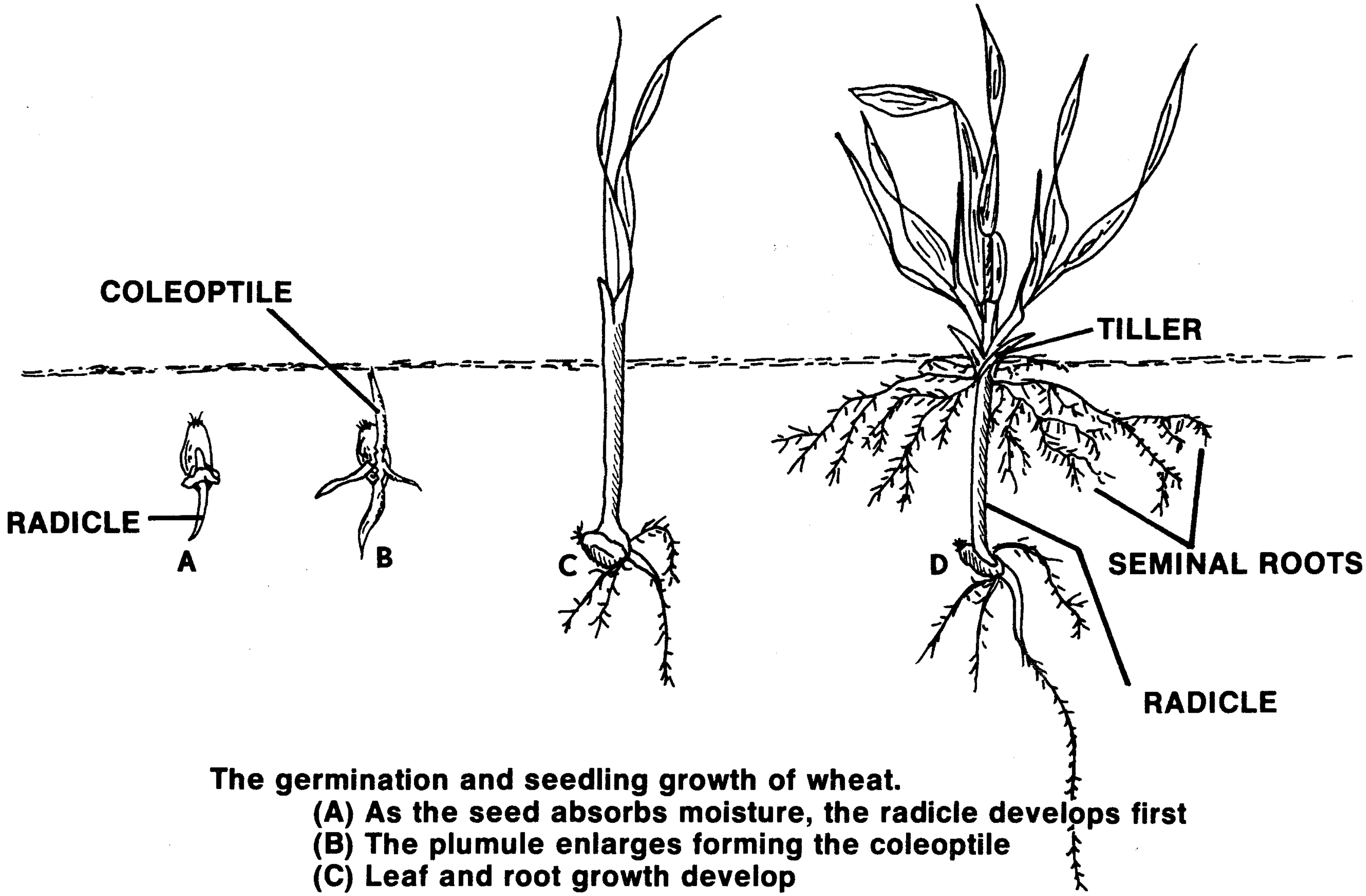

SPRING WHEAT HARVESTED
UNITED STATES
TOTAL
11,337,893
1 DOT – 10,000 ACRES
MAP NO 64A-M68
U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS


WINTER WHEAT HARVESTED
UNITED STATES
TOTAL
36,620,469
1 DOT — 10,000 ACRES
MAP NO. 64A-M67
U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

Parts of a Wheat Plant



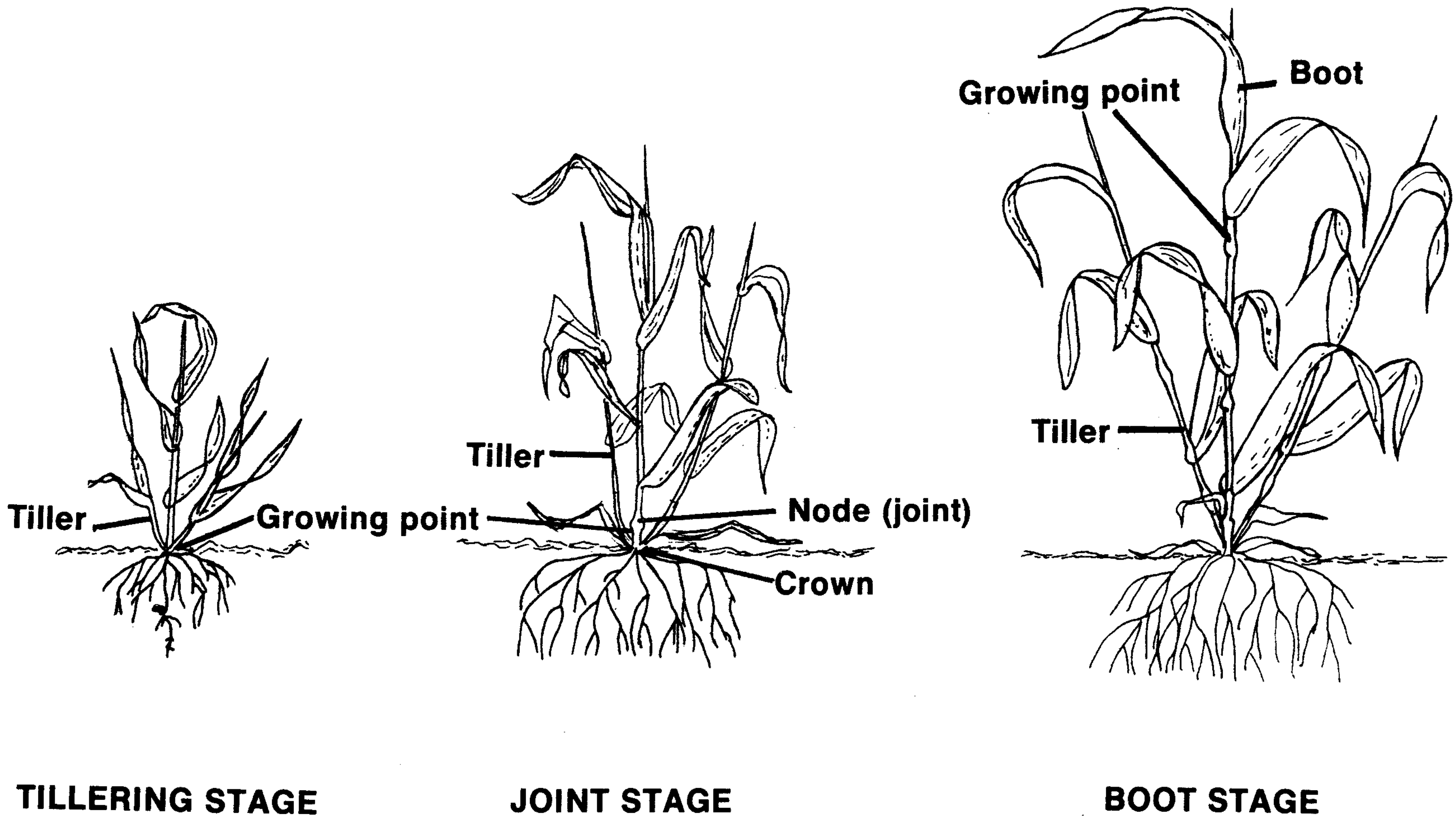
WHEAT GERMINATION AND SEEDLING GROWTH



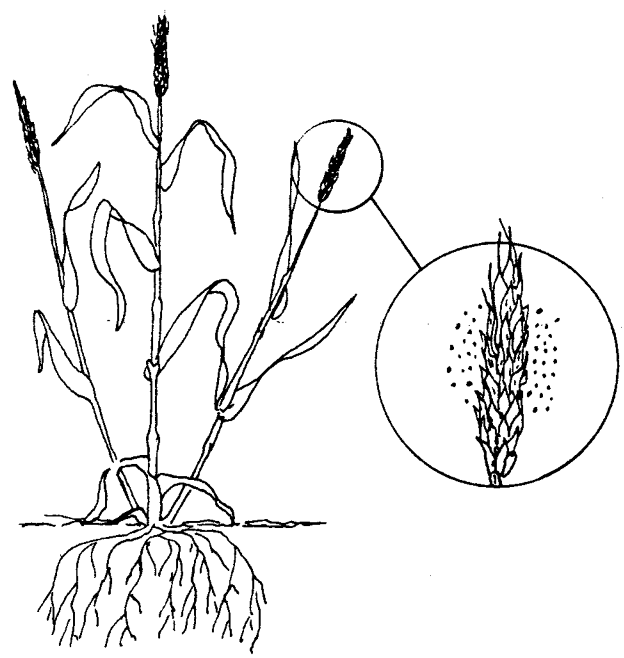
The germination and seedling growth of wheat.

(A) As the seed absorbs moisture, the radicle develops first
(B) The plumule enlarges forming the coleoptile
(C) Leaf and root growth develop
(D) Seminal roots develop and tiller development starts

VEGETATIVE GROWTH STAGES OF WHEAT



Heading Stage of Wheat



Classes of Wheat

1. **Hard Red Spring Wheat**
2. **Hard Red Winter Wheat**
3. **Soft White Wheat**
4. **Soft Red Wheat**
5. **Durum Wheat**

SMALL GRAIN PRODUCTION

AG 320 - C

ASSIGNMENT SHEET #1--MAKE FERTILIZER RECOMMENDATIONS FOR WHEAT

Name ______________________________________ Score________________________________

Using the information provided on the soil test report for Tommy Doe, and University of Idaho CIS #453 - North Idaho Fertilizer Guide for Wheat, recommend the amount of each nutrient that will need to be applied to reach the yield goal. Refer to fertilizer guide for more complete directions.

Part I See next page

Soil Test Request and Report Form

Form #88

DO NOT WRITE IN THIS SPACE
Lab no. ______
Fee ______
Status: Paid Bill Other ______
Check no. ______

Analytical Services Laboratory
College of Agriculture
Moscow, ID 83843-4196
(208) 885-6201

University of Idaho

Mailing Name Tommy Doe
Address Lewis County

Phone: ______

Date: ______

County: Lewis
Grower: ______
Sample Identification: ______

FIELD INFORMATION			
Irrigation: ☐ Sprinkler ☐ Furrow ☐ None			
Rotation	Crop	Fertilizer applied lb/acre	Yield
Next crop	Winter Wheat	Pct.	100 bu.
Previous crop	Peas	residue	
Grown in 19( )		returned	
Grown in 19( )			

☑ CHECK TEST REQUIRED: Please make checks payable to **Bursar, University of Idaho.**

☒ Standard Fertility Test* ($10.00)
*Includes drying and grinding ($1.50), pH, P, K and O.M.

___ Bicarbonate P & K ___ Acetate P & K

☐ pH (soil reaction)	$ 1	6.7
☐ Available P (ppm P)	$ 3	4.5
☐ Available K (ppm K)	$ 3	145
☐ Organic matter (%)	$ 3	4.0
Other Tests:		
☒ Sulfate-S (ppm S)	$ 3	12
☒ Boron (ppm B)	$ 5	0.4
☐ Total Salts (E.C.) (mmhos/cm)	$ 2	
☐ Gypsum Requirement	$20	
☐ Lime Requirement	$ 4	
☐ Cation Exchange Capacity (meq/100g)	$ 7	
☐ Zinc (ppm Zn)	$ 4	
☐ Copper (ppm Cu)	$ 4	
☐ Manganese (ppm Mn)	$ 4	
☐ Iron (ppm Fe)	$ 4	

Depth (feet)	Nitrate N (ppm)	Ammonium N (ppm)	Available Moisture (inches)
0-1	☒ 8	☒ 1	☐
1-2	☒ 3	☒ 1	☐
2-3	☒ 2	☒ 1	☐
3-4	☐	☐	☐
4-5	☐	☐	☐
5-6	☐	☐	☐
6-7	☐	☐	☐
Total			

$3 per test ppm × 4 = lb/acre

Cations:	Extractable	Soluble
Calcium	☐	☐
Magnesium	☐	☐
Sodium	☐	☐
Potassium	☐	☐

$3 per test SAR ______

Contact the Analytical Services Laboratory for other special analyses.

FERTILITY GUIDE

Pounds Per Acre						
N	P_2O_5	K_2O				

Remarks: ______

If you wish further details or have questions concerning the soil analysis, please contact your University of Idaho County Extension Agent.

White — Grower copy • Yellow — Fertilizer Dealer copy • Pink — Ag Agent copy • Goldenrod — Laboratory copy

Part II

A. How many pounds of available nitrogen are necessary to produce one bushel of wheat?

B. What is mineralizable nitrogen? How many pounds of mineralizable nitrogen will be released in this situation?

C. Make the following calculations:

Total nitrogen needed	______________________________
Minus mineralizable nitrogen	______________________________
Minus soil test nitrogen (lb/acre)	______________________________
Nitrogen fertilizer required (lb/acre)	______________________________

D. How deep should the soil sample be taken for the nitrogen test?

E. What other factors could affect the ability of wheat to get nutrients from the soil (other than level of nutrients in the soil)?

University of Idaho
College of Agriculture
Cooperative Extension Service
Agricultural Experiment Station

Current Information Series No. 453

Northern Idaho Fertilizer Guide

Winter Wheat

R. E. McDole and R. L. Mahler

These fertilizer guidelines have been developed through research conducted by the University of Idaho and Washington State University and are based on relationships between soil test and yield response. The fertilizer rates suggested are based on research results and are designed to produce above average yields if other factors are not limiting production. Thus, the fertilizer guide assumes good management.

The suggested fertilizer rates will be accurate for your field provided: (1) the soil samples were properly taken and represent the area to be fertilized, and (2) the crop history information supplied is complete and accurate.

Optimum production and economical returns from wheat are achieved when the crop is managed properly. Lack of adequate fertilization, poor stands and poor pest control are major contributors to low yield.

Nitrogen

The amount of nitrogen (N) fertilizer required on any field depends on:

1. The wheat variety chosen and its potential in your location. The N guidelines in this publication were developed over many years using several varieties. Modern varieties require high levels of available soil nutrients and superior management to achieve their high yield potential. New varieties such as 'Stephens,' 'Daws' and 'Hill 81' have very high yield potentials.
2. Potential yield or average yield obtained from the field in past years. Research has shown that 2.7 pounds available N per acre is needed to produce 1 bushel of wheat.
3. The amount of usable N in the soil profile. This includes mineralizable nitrogen (released from organic matter during the growing season) and inorganic nitrogen in the form of nitrate (NO_3) and ammonium (NH_4).
4. Total annual precipitation and other climatic factors.
5. Density of plant stand.

In areas of low precipitation (16 inches or less annually), soil moisture in the profile should be determined to adjust the N fertilizer rates. In these low moisture areas and in areas with shallow soils (2 to 3 feet maximum depth), the recommended N fertilizer rate should be adjusted to fit available soil moisture.

Total N Needed Based On Potential Yield

Estimates of N fertilizer needed to produce a crop of winter wheat require knowledge of the potential yield for the field for which the fertilizer recommendation is being made. This potential yield should be the long-term average for the selected field. Based on the potential yield, the amount of N needed can be calculated using the factor 2.7 pounds N per bushel of wheat (Table 1). This factor has been derived through research conducted in northern Idaho and eastern Washington.

Table 1. Estimated total nitrogen needed by wheat crop based on potential yield.

bu/acre*	40	60	80	100	120	140
lb/acre N**	110	160	220	270	320	375

*Potential maximum yield of wheat produced on a northern Idaho farm for which fertilizer recommendation is being made.
**Research has shown that 2.7 pounds N per acre is needed to produce 1 bushel of wheat.

Once the total amount of N needed to produce a winter wheat crop is known, a simple equation can be used to determine the amount of fertilizer N to be applied to meet this need. This equation requires the following inputs:

$$\begin{array}{l} \text{total N} \\ \text{needed} \\ \text{based on} \\ \text{potential} \\ \text{yield} \\ \text{(Table 1)} \end{array} - \left[\begin{array}{cc} \text{mineral-} & \text{soil} \\ \text{izable N} + & \text{test N} \\ \text{(Table 2)} & \text{(Table 3)} \end{array} \right] = \begin{array}{l} \text{fertil-} \\ \text{izer N} \\ \text{needed} \end{array}$$

Mineralizable Nitrogen

Soils vary in their capacity to release N from organic matter during the growing season. Since this is a factor in determining the amount of fertilizer N required to produce a wheat crop, an estimation of mineralizable N must be made. The rate or amount of N released depends on factors such as the amount of soil organic matter, soil erosion, available soil moisture and soil temperature during the growing season.

Five different levels of mineralizable N release are used for northern Idaho soils (Table 2). Low release levels are found on severely eroded clay knobs and hill tops, cut-over timberland soils, soils in areas of low precipitation, soils with low waterholding capacities and soils with low organic matter content.

Nitrogen Soil Test

The amount of N in the soil can be evaluated most effectively with a soil test. The soil samples should represent the rooting depth of the crop since nitrate-nitrogen (NO_3-N) is mobile in the soil. Winter wheat is capable of removing N to a depth of 4 to 5 feet or more.

Soil test values includes both NO_3-N and ammonium-nitrogen (NH_4-N). To convert soil test NO_3-N and NH_4-N values to pounds N per acre, add the N values (ppm) for each foot increment of sampling depth and multiply by 4 (Table 3).

The calculation for N fertilizer needed is:

Total N needed (Table 1)	________
Minus mineralizable N (Table 2)	–________
Minus soil test N (lb/acre) (Table 3)	–________
N fertilizer required (lb/acre)	________

With potential yield of 100 bushels per acre, medium level of mineralizable N and soil test values from the example above, application of 138 pounds N per acre is needed:

	lb/acre
Total N needed (Table 1)	270
Minus mineralizable N (Table 2)	– 40
Minus soil test N (Table 3)	– 92
N fertilizer required (lb/acre)	138

Add 15 pounds available N for each ton of straw or nonlegume residue incorporated into the soil up to 50 pounds N per acre. Remember that 1 ton of residue is produced for each 20 bushels of wheat or 1,400 pounds of barley grain produced.

Estimate Based on Previous Crop

You also may estimate the amount of N fertilizer required for wheat on the basis of the previous crop. The values in Table 4 are generalized recommendations based on field experiments and observations of production following the various crops. **Note, however, that N recommendations based on the previous crop are not as accurate as a recommendation based on a good soil test.**

Table 2. Mineralizable nitrogen release rates for northern Idaho soils.

		Organic matter content			
	Severely eroded	less than 2%	2 to 3%	3 to 4%	more than 4%
Release level	low	moderately low	medium	moderately high	high
Pounds N released	20	30	40	50	60

Table 3. Example of calculation to convert N soil test results (ppm) to pounds N per acre. Ammonium (NH_4-N) is usually low and is often not included in soil test analysis.

	Soil test reads			
Depth	NO_3-N	NH_4-N	Total	Total N*
(inches)	(ppm)	(ppm)	(ppm)	(lb/acre)
0 to 12	5	1	6	24
12 to 24	6	2	8	32
24 to 36	8	1	9	36
36 to 48	(include if available)			
Total	19	4	23	92

*ppm × 4 = lb/acre

Table 4. Estimated nitrogen fertilizer requirements for winter wheat based on previous crop.

Previous crop	Potential yield (bu/acre) 40	60	80	100
	Estimated nitrogen fertilizer to apply (lb/acre)			
Grain (residue returned)	50 to 70*	70 to 90	90 to 110	110 to 130
Grain (residue removed), peas, lentils, fallow	20 to 30	30 to 50	50 to 65	65 to 80
Alfalfa or green manure crop	0 to 15	15 to 30	30 to 55	55 to 75

*A range in values is given to allow for differences in mineralizable N.

Phosphorus

Wheat has a relatively low demand for phosphorus (P) but does require a minimal amount in the soil (Table 5). Incorporate P fertilizer into the soil during seedbed preparation before or at planting.

Broadcast-plowdown, broadcast-seedbed incorporated or drill-banding are all commonly used methods of application. Drill-branded P is usually the most efficient application method allowing placement with, below or to the side of the seed. The choice of application methods usually depends on convenience to the grower.

Table 5. Phosphorus fertilizer rates based on soil test.

Soil test* (0 to 12 inches)	Apply (lb/acre)	
(ppm P)	(P_2O_5)	(P)**
0 to 2	60	26
2 to 4	40	18
over 4	0	0

*Sodium acetate extractable P

**$P_2O_5 \times 0.44 = P$ or $P \times 2.29 = P_2O_5$

Potassium

Wheat needs little potassium (K). Most probable areas of need are eroded knobs and hilltops. Incorporate K fertilizer into the soil during seedbed preparation before or at planting. Apply K fertilizer as needed according to soil test (Table 6).

Broadcast-plowdown, broadcast-seedbed incorporated or drill-banding are all effective methods of application. Drill-banding fertilizer can be placed with, below or to the side of the seed. When applied with the seed, the total of N plus K (as K_2O) should not exceed a maximum of 25 pounds per acre. The choice of application method depends upon which one is most convenient to the grower.

Table 6. Potassium fertilizer rates based on soil test.

Soil test* (0 to 12 inches)	Apply (lb/acre)	
(ppm K)	(K_2O)	(K)**
0 to 35	80	66
35 to 75	60	50
over 75	0	0

*Sodium acetate extractable K

**$K_2O \times 0.83 = K$ or $K \times 1.20 = K_2O$

Sulfur

Wheat requires sulfur (S) to produce maximum yields and a good quality flour. Sulfur requirements for winter wheat are influenced by soil texture, soil organic matter, previous crop and fertilizer history. Apply 20 pounds S per acre to soils testing less than 10 ppm SO_4-S in the 0 to 12 inch layer. Use of elemental S should be avoided. Sulfur deficiency appears as a yellowing of the plant early in the growing season and is visually impossible to distinguish from a N deficiency.

Micronutrients and Lime

Response of wheat to micronutrients in northern Idaho has not been observed. If you are in doubt, have your soil tested.

Lime applications on highly acid soils (less than pH 5.2) should be tried on an experimental basis to determine if an economical response is derived. When needed, apply 1 to 2 tons per acre and mix well into the soil.

General Comments

1. N and S are the major plant nutrients needed for wheat production. P and K may also be needed. The need for these nutrients can best be determined by a soil test.
2. Split or fall applications of N may be used. If the fall application is applied too early (depending on soil moisture and temperature), N leaching may occur in areas of heavy winter precipitation. If a large amount of N is to be applied, split the application between fall and spring, especially if heavy winter precipitation is a common occurrence in the area.
3. In areas of heavy winter precipitation or sandy soils, spring applications of N may be more desirable than fall applications.
4. The ammoniacal forms of N (ammonium and ammonia) and urea are not as subject to leaching as the NO_3 form. When temperature and moisture are favorable for plant growth, however, ammoniacal N and urea are quickly converted to the NO_3 form. Thus, early fall applications of N, regardless of form, are subject to leaching in areas of heavy winter precipitation.
5. N-serve and other N stabilizers block conversion of NH_4–N to the NO_3–N. At best, results obtained with these N stabilizers are inconsistent. Favorable results, with reduced N fertilizer losses, have been obtained in some areas. N stabilizers have not been effective in deep, dark-colored soils that have a high organic matter content. For more details, refer to University of Idaho CIS No. 313, *N-Serve and Its Potential Use in Northern Idaho.*
6. Areas of cut-over timberland (which usually have clayey subsoils) used for wheat production are not as susceptible to leaching losses because of the slow permeability of the subsoil. Slow permeability, however, also makes these soils subject to wetness or waterlogging that can result in a loss of N by denitrification. This process converts NO_3–N to gaseous forms of N that are dissipated into the atmosphere.
7. Test the top 2 feet of soil for NO_3–N in the spring, and topdress with additional N if needed.

8. Use caution in topdressing with N in the spring since N applied after the boot stage or at excessive rates can result in undesirably high-protein levels in soft white wheats. Excessive rates also increase the lodging hazard.

9. Banding fertilizer improves N and P use efficiency. Consequently, if applying N and/or P in a band, cut the recommended fertilizer application rate 10 to 15 percent.

If you have questions regarding the interpretation of this information, contact your Extension county agricultural agent or your fertilizer dealer.

About the Authors — Robert D. McDole is an Extension soil specialist, and Robert L. Mahler is a research soil scientist, both in the University of Idaho Department of Plant, Soil and Entomological Sciences, Moscow.

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35 cents per copy

SMALL GRAIN PRODUCTION

AG 320 - C

ANSWERS TO ASSIGNMENT SHEET

Assignment Sheet #1

Part I

Soil Fertility Guide

Pounds Per Acre						
N	P_2O_5	K_2O				
156	0	0				

Fertilizer rate suggestions are based on soil test data shown above and research results.

Part II

A. 2.7

B. Nitrogen released from organic matter during the growing season; 40 pound mineralizable nitrogen

C.

Total nitrogen needed	270
Minus mineralizable nitrogen	50
Minus soil test nitrogen (lb/acre)	64
Nitrogen fertilizer required (lb/acre)	156

D. 36 inches

E. Evaluated to satisfaction of instructor.

SMALL GRAIN PRODUCTION

AG 320 - C

UNIT TEST

Name ______________________________________ Score________________________________

1. Match terms associated with small grain production to the correct definitions. Write the correct number in the blank.

_____a.	Planting and cultivating parallel with the lay of the land to prevent erosion	1.	Cool-season crop
_____b.	Sheath which covers the first leaf of grass seedlings during emergence	2.	Vernalization
_____c.	Cold treatment of a plant, plant part or seed to initiate reproduction	3.	Long-day plant
_____d.	Tillage beneath stubble without covering all of the residue	4.	Coleoptile
_____e.	Any practice which reduces the number of tillage operations on a field	5.	Crop residue
_____f.	Plant material which is left on or in ground after harvest	6.	Erosion
_____g.	Makes best growth under relatively cool conditions; are generally damaged by hot weather; includes wheat, barley and oats	7.	Stubble mulching
_____h.	System of reduced tillage where cultivation and seeding are accomplished at the same time	8.	Strip cropping
_____i.	Requires relatively short nights for the formation of flowers; short days increase vegetative growth	9.	Contour cropping
_____j.	Alternate strips of crop and summer fallow to reduce erosion and conserve moisture	10.	No-till
_____k.	Removal of topsoil by tillage, wind and/or water	11.	Minimum tillage

2. List three uses of small grains.

a.____

b. ____

c.____

3. Select from the following list leading wheat producing states. Write an "X" in the blank before each correct answer.

_____a. Idaho _____g. Iowa

_____b. Montana _____h. Texas

_____c. Washington _____i. Colorado

_____d. North Dakota

_____e. Kansas

_____f. Oklahoma

4. Discuss the economic importance of small grain production to Idaho.

____

____

____

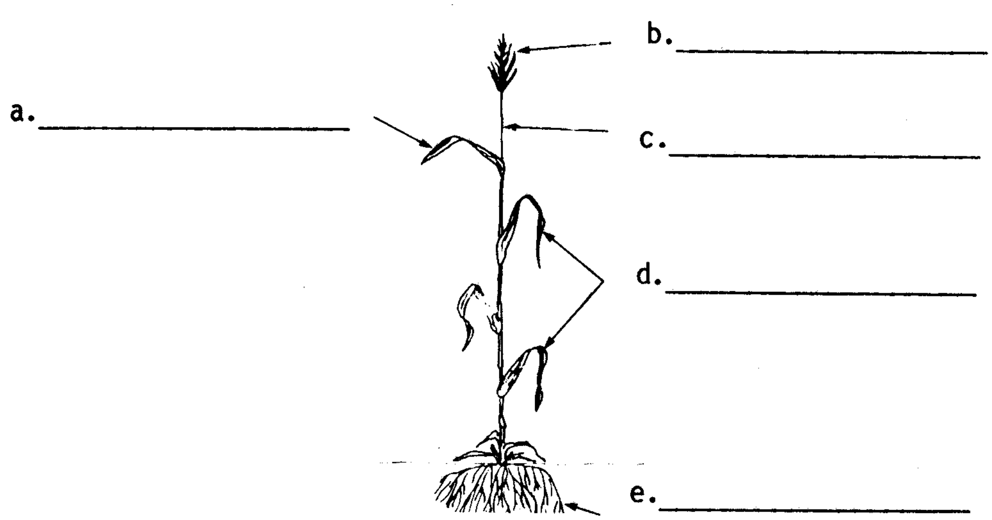
____

____

____

____

5. Identify the parts of a wheat plant. Write the correct names in the blanks.



6. Arrange in order the stages of growth of small grains. Write a "1" before the first step, a "2" before the second step, and so on.

_____a. Flowering

_____b. Jointing

_____c. Seedling

_____d. Milk

_____e. Soft dough

_____f. Germination

_____g. Heading

_____h. Hard dough

_____i. Stooling

_____j. Boot

_____k. Mature

7. Select from the following list characteristics of a desirable seedbed. Write an "X" in the blank before each correct answer.

_____a. Reasonably level

_____b. Availability of moisture adequate

_____c. Free of large clods for low erosion situation

_____d. Moderate amount of larger size clods for high erosion potential

_____e. Minimum weed competition

_____f. Growing season of 210 to 240 days

8. List three tillage operations involved in seedbed preparation.

a.____

b. ____

c.____

9. Name two types of grain drills.

a.____

b. ____

10. Name two classes of wheat and what they are used for.

a.____

b. ____

11. List two common varieties of seed for soft white spring wheat and soft white winter wheat.

Soft white spring wheat

a.____

b. ____

Soft white winter wheat

a.____

b. ____

12. Select from the following list factors to consider in planting small grains. Write an "X" in the blank before each correct answer.

_____a. Time of planting

_____b. Price of nitrogen fertilizer

_____c. Cost of certified seed

_____d. Seeding depth

_____e. Row spacing

_____f. Seeding rates

13. List four factors to consider in selecting small grain seed.

a.____

b. ____

c.____

d. ____

14. Select from the following list factors that influence final plant populations. Write an "X" in the blank before each correct answer.

_____a. Adequate soil moisture

_____b. Insect and disease damage

_____c. Seedling vigor

_____d. Planting rate

_____e. Fertilizer recommendations

_____f. Planting depth

_____g. Availability of plant nutrients

_____h. Type of grain drill used

_____i. Competition from weeds

_____j. Germination percentage

15. Name two small grain diseases.

    a.____

    b. ____

16. Name two harmful insects of small grains.

    a.____

    b. ____

17. List three ways weeds compete with small grains.

    a.____

    b. ____

    c.____

18. List three ways weeds cause losses in small grain production.

    a.____

    b. ____

    c.____

19. Match the general categories of weeds to the correct description. Write the correct number in the blank.

_____a. Lives for three or more years and can reproduce sexually or asexually by means of rhizomes and stolons

_____b. Plants with shorter, wider leaves that usually have pinnate or netted veination; dicots

_____c. Plants with longer, narrower leaves with parallel veination; monocots

_____d. Completes life cycle within the period of one year

1. Annual
2. Perennial
3. Broadleaf
4. Grass

20. Name three methods of weed control.

a.______________________________

b. ______________________________

c.______________________________

21. Discuss approved practices for harvesting and storing small grains.

____

____

____

____

____

____

____

22. List three qualities of a good storage facility for small grains.

a.______________________________

b. ______________________________

c.______________________________

23. Match the types of grain markets to the correct description. Write the correct number in the blank.

_____a.	Operates in same manner in which livestock is sold; the price paid is the market offering for the day the grain is sold	1.	Cash market
		2.	Futures market
_____b.	Contracting to purchase or deliver a certain amount of grain on a given date at a given price		

24. List two main factors in grading grain.

a.______________________________

b. ______________________________

25. List and discuss the three major factors affecting the profitability of small grain production.

SMALL GRAIN PRODUCTION

AG 320 - C

ANSWERS TO TEST

1.

a.	9	d.	7	g.	1	j.	8
b.	4	e.	11	h.	10	k.	6
c.	2	f.	5	i.	3		

2. Answer should include three of the following:

   Baking flour; Livestock feed; Breakfast cereal; Hay; Pasture; Protein supplements; Glue products; Bedding; Malt

3. c, d, e, f, h, i

4. Answer could include the following information:

   <u>Wheat</u>: Idaho ranks 8th in production of all wheat in U.S.; 1,150,000 acres harvested; Total annual production of 75,520,000 bushels; Average yield of 65.7 bushels/acre; Annual value of $299,610,000
   <u>Barley</u>: Idaho ranks 3rd in production of barley in U.S.; 850,000 acres harvested; Total annual production of 51,000,000 bushels; Average yield of 60.0 bushels/acre; Annual value of $143,350
   <u>Oats</u>: Idaho ranks 17th in production of oats in the U.S.; 45,000 acres harvested; Total annual production of 3,060,000 bushels; Average yield of 68 bushels/acre

5.

a.	Flag leaf	d.	Leaves
b.	Head or flower	e.	Roots
c.	Stem		

6.

a.	7	g.	6
b.	4	h.	10
c.	2	i.	3
d.	8	j.	5
e.	9	k.	11
f.	1		

7. a, b, c, d, e

8. Answers should include three of the following:

   Moldboard plow; Ripper (chisel plow); Disk; Harrow; Roller

9. End-wheel; Press-wheel drill

10. Answer should include two of the following:

    Hard red spring wheat--Bread flour; Hard red winter wheat--Bread flour; Soft white wheat--Flour for pastries; Soft red wheat--Flour for pastries; Durum wheat--Noodles and similar products

11. a. Answer should include two of the following: Fielder; Twin; Fieldwin
    b. Answer should include two of the following: Daws; Nugaines; Stephens; Hill 81; Lewjain

12. a, d, e, f

13. Answer should include four of the following:

    Plump kernels; Large kernels; Uniform size; High test weight; No discoloration; Certified (or registered)

14. a, b, c, d, f, g, i, j

15. Answer should include two of the following:

    Leaf rust; Stem rust; Powdery mildew; Seed decay and seedling blight; Root, crown and foot rots; Smuts; Barley yellow dwarf virus; Stripe rust

16. Greenbug; Russian wheat aphid

17. Competition for water; Competition for nutrients; Competition for light

18. Decreased yields; Decreased crop quality; Cost of control activities

19. a. 2 b. 3 c. 4 d. 1

20. Cultural; Mechanical; Chemical

21. Answer could include the following information:

    Practically all small grains in the United States are harvested with the combine; Test wheat grain for moisture and harvest for storage when moisture is below 14 percent; Properly adjust the combine to prevent harvesting losses; always stop the combine before cleaning if clogged or making other adjustments; Store the grain in a dry, vermin-proof bin until marketed or fed; Clean and spray all storage bins prior to harvest; Check stored grain often for heating and/or presence of insects

22. Weatherproof; Rodent-proof; Constructed of easy-to-clean material

23. a. 1 b. 2

24. Answer could include two of the following:

    Minimum weight per bushel; Maximum percentage of damaged kernels; Maximum percentage of foreign matter

25. Operating or variable costs: Seed (certified, registered, common); Fertilizer; Soil testing; Irrigation (equipment investment, interest on investment, electricity); Interest on operating capital; Pest control (herbicides, fungicides, insecticides, soil fumigation); Machinery and equipment operation (land preparation, chemical application, planting, harvesting, machine hire); Fuel; Crop insurance; Land rent; Part-time labor (salary, social security taxes, disability insurance)
Fixed costs: Land (investment, interest on investment, taxes); Full-time labor (salary, social security taxes, disability insurance); Machinery and equipment (investment, interest on investment, maintenance and repairs, insurance, depreciation); Buildings (investment, interest on investment, maintenance and repairs, insurance, depreciation); Farm liability insurance
Marketing: Transportation; Supply and demand

CORN PRODUCTION

AG 320 - D

UNIT OBJECTIVE

After completion of this unit, students should be able to describe corn production techniques involved in seedbed preparation, fertilizer requirements, planting, disease and insect control, weed control, harvest, storage and marketing. This knowledge will be demonstrated by completion of the unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with corn production to the correct definitions.
2. List three uses of corn.
3. List three leading field corn producing states and three sweet corn producing states.
4. Select true corn facts.
5. Discuss the economic importance of corn production to Idaho.
6. Name three types of corn.
7. Identify the parts of a corn plant.
8. Arrange in order the stages of growth of the corn plant.
9. List three purposes for which corn is grown in Idaho.
10. Select advantages of using hybrid corn.
11. List three tillage operations involved in seedbed preparation.
12. Select characteristics of a desirable seedbed.
13. Select factors to consider in planting corn.
14. List three factors that influence rate of planting.
15. Select factors that influence final plant populations.
16. Name two corn diseases.
17. Name two harmful insects of corn.
18. List three ways weeds compete with corn.
19. List three ways weeds cause losses in corn production.

20. Match the general categories of weeds to the correct description.

21. Name three methods of weed control.

22. List three characteristics of high quality silage.

23. Select factors to consider in harvesting high quality silage.

24. Discuss the harvesting and storing of grain corn.

25. Match the types of corn markets to the correct description.

26. List and discuss the three major factors affecting the profitability of corn production.

27. Make fertilizer recommendations for field corn.

28. Make fertilizer recommendations for sweet corn.

CORN PRODUCTION

AG 320 - D

SUGGESTED ACTIVITIES

I. Suggested activities for instructor

A. Order materials to supplement unit.

1. Literature

a. *Corn*, instructional unit; available from Agri-Farm Publications, Inc., 1019 Market St., Gowrie, Iowa 50543; approximate cost $19.75; order no. 201.

b. *Modern Corn Production*, available from Hobar Publications, 1234 Tiller Lane, St. Paul, Minnesota 55112, (612-633-3170); approximate cost $30.95.

c. *Silage*, instructional unit; available from Agri-Farm Publications, Inc., 1019 Market St., Gowrie, Iowa 50543; approximate cost $10.90; order no. 207.

d. The following Current Information Series (CIS) publications are available from your local University of Idaho County Extension Office or from Agricultural Communications Center, Ag Publications Building, University of Idaho, Moscow, Idaho 83843-4196, (208-885-7982).

CIS 302	Western Bean Cutworm on Beans and Corn $.25
CIS 348	Buying and Selling Alfalfa Hay, Corn Silage, Barley $.25
CIS 366	Timing Corn Earworm Control $.35
CIS 372	Idaho Fertilizer Guide: Irrigated Field Corn for Silage or Grain $.25
CIS 376	Idaho Fertilizer Guide: Sweet Corn for Seed and Processing $.25
CIS 436	Sweet Corn Cultivars for Idaho's Cooler Regions $.25
CIS 521	Water Stress and Sweet Corn Seed Production $.35
CIS 533	The Western Corn Rootworm: A New Insect Pest of Corn in Idaho $.35

CIS 745 High Moisture Earcorn $.35

CIS 750 Corn Harvest Alternatives $.35

2. Filmstrips, slideshows, etc.

   a. *Corn Production*, 10 cassettes, 10 filmstrips and study guide; available from Teaching Aids, Inc., P. O. Box 1798, Costa Mesa, California 92626; approximate cost $359.00; order no. B262.

   b. *Corn Production*, 10 filmstrips, 10 cassettes, 18-22 minutes each and study guide; available from Agrimedia Corporation, Garden City, New York 11530; approximate cost $257.00; order no. 262.

   c. *Feeding and Handling High Moisture Corn*, 46-frame filmstrip with script; available from IAVIM, 208 Davidson Hall, Iowa State University, Ames, Iowa 50011; approximate cost $6.50; order no. 327.

   d. *Growing Corn and Beans No-Till in Crop Residues*, 130-frame filmstrip with script; available from IAVIM, 208 Davidson Hall, Iowa State University, Ames, Iowa 50011; approximate cost $16.50; order no. 333.

   e. *Growing Corn No-Till in Sod*, 97-frame filmstrip with cassette and script; available from IAVIM, 208 Davidson Hall, Iowa State University, Ames, Iowa 50011; approximate cost $12.50; order no. 334.

   f. *Sweet Corn Production*, Program #305; 19 minutes, VHS or Beta format; Idaho sweet corn production in detail, starting with pre-planting and going through harvesting; available from the Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196, (208-885-6436); purchase cost $25; rental cost $10 for 14 days.

B. Make transparencies and necessary copies of materials.

C. Provide students with objective sheet and discuss.

D. Provide students with information and assignment sheets and discuss.

E. Do a community survey on corn production and publish the results in a local newspaper.

F. Calibrate a corn planter as a class project.

G. Invite a local corn specialist to speak on corn production.

H. Arrange for a field trip to a corn processing plant.

I. Arrange for a field trip to a local grain elevator to discuss storage and marketing of corn.

J. Make arrangements with a seed company for class to visit local test plots and variety trials.

K. Review and give test.

L. Reteach and retest if necessary.

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Uses of Corn

2. TM 2--World Corn Production

3. TM 3--Corn Harvested For All Purposes

4. TM 4--Leading Corn Producing States

5. TM 5--Parts of a Corn Plant

6. TM 6--Corn Germination and Seedling Growth

7. TM 7--Vegetative Growth Stages of Corn

8. TM 8--Development of an Ear of Corn

E. Assignment sheets

1. AS 1--Make Fertilizer Recommendations for Field Corn

2. AS 2--Make Fertilizer Recommendations for Sweet Corn

F. Answers to assignment sheets

G. Test

H. Answers to test

III. Unit references

A. *1983 Corn Annual*, Corn Refiners Association, Inc., Washington, DC.

B. *1984 Corn Annual*, Corn Refiners Association, Inc., Washington, DC.

C. Aldrich, S.R., et al., *Modern Corn Production*, 2nd edition, A & L Publications, Champaign, Illinois, 1982.

D. Delorit. R.J., et al, *Crop Production*, 4th edition, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

E. Ensign, R.D., et al., *Idaho Forage Crop Handbook*, University of Idaho CIS No. 547, Moscow, Idaho, 1975.

F. Painter, C.G., et al., *Idaho Fertilizer Guide - Irrigated Field Corn for Silage or Grain*, University of Idaho CIS No. 372 and 376, Moscow, Idaho, 1978.

CORN PRODUCTION

AG 320 - D

INFORMATION SHEET

I. Terms and definitions

A. Forage--Vegetative material in a fresh, dried or ensiled state which is fed to livestock

B. Grain--The seed of cereal or grain crops such as corn, wheat, barley and oats

C. Ensile--A process wherein fresh or slightly wilted forage is placed in airtight storage and allowed to ferment and produce acids which then preserve it

D. Silage--Forage chopped and stored at 60 to 70 percent moisture and allowed to ferment and produce acids, which then preserve it

E. Hybrid--The offspring of two parents that differ in one or more heritable characteristics

F. Tassel--The flower on the upper portion of the stem of corn; it contains the stamens

G. Lodging--A condition that occurs when the stems are not strong enough to hold the plants erect and they bend or break over

H. Stover--The mature stalks of corn from which the grain has been removed

I. Fodder--The entire plant of grasses, such as corn (including the grain), which is harvested, cured and fed

J. Cultivation--Tillage to control weeds

K. Competition--Process whereby individuals or groups directly inhibit the growth of others by utilizing resources potentially available to all

II. Uses of corn (Transparency 1)

A. Livestock feed

(Note: Most corn grown in the U.S. is fed to livestock.)

B. Products for human consumption

1. Corn meal

2. Corn hominy

3. Corn flakes

4. Popcorn

C. Industrial products

1. Alcohol

2. Corn starch

3. Corn oil

III. Leading corn producing states (Transparencies 2, 3, 4)

A. Field corn

1. Iowa

2. Nebraska

3. Illinois

4. Indiana

5. Minnesota

6. Ohio

B. Sweet corn

1. Wisconsin

2. Minnesota

3. Washington

4. Oregon

5. Idaho

6. Illinois

IV. Corn facts

A. Corn can be grown in every state except Alaska

B. Corn ranks second to wheat in acreage among field crops in the world

C. The United States exports 48,300,000 metric tons of corn annually, which accounts for 77% of world corn exports

D. U.S. produces 31% of world crop

E. Corn is represented in the FFA emblem and stands for common agricultural interest because it is grown in every state

V. Economic importance of corn production to Idaho (1988)

A. Field corn harvested for grain

1. 50,000 acres harvested

2. 130 bushels grain yield per harvested acre

3. 65,834,000 bushels total production

4. Economic value to the state of $20,475,000

B. Field corn harvested for silage

1. 58,000 acres harvested

2. 23.0 tons silage per harvested acre

3. 1,334,000 tons total production

C. Sweet corn for processing

1. 18,200 acres harvested

2. 9.0 tons per harvested acres

3. 163,000 tons total production (in husk)

4. Economic value to the state of $8,829,000

VI. Types of corn

A. Dent

(Note: About 95% of all corn grown in the U.S. is dent corn. This type is characterized by denting of the crowns of the kernels as the grain ripens.)

B. Sweet

C. Popcorn

D. Flour corn

E. Waxy corn

VII. Parts of a corn plant (Transparency 5)

A. Tassel

B. Ear

C. Stem

D. Leaves

E. Roots

VIII. Stages of growth of the corn plant (Transparencies 6, 7, 8)

(Note: The corn plant is one of nature's most amazing energy-storing devices. From a seed that weighs little more than one-hundredth of an ounce, a plant 7 to 10 feet tall develops in about nine weeks. In the following two months, this plant produces 600 to 1,000 seeds similar to the one from which it started. For perspective, the corn plant's achievement can be compared with that of small grains: wheat produces a 50-fold yield per seed planted.)

A. Two-leaf stage--Occurs about two weeks after the first leaf emerges above the soil surface

(Note: Until this time, the plant has been dependent for nourishment on the food stored in the endosperm of the seed. At the two-leaf stage, the young plant is nearly ready to function independently. The plant growth processes of photosynthesis, respiration, transpiration and absorption need to function for growth to occur.)

B. Six-leaf stage

(Note: From the two-leaf stage until the six-leaf stage, root and leaf development takes place at a rapid rate. Root hairs develop, and the absorption of moisture and nutrients increase as the plant grows. Secondary roots are developing rapidly.)

C. Ten-leaf stage--The tenth leaf should be fully emerged in a period of five weeks from plant emergence

(Note: During the ten-leaf stage nutrient needs increase. Photosynthesis and absorption must function efficiently for suitable growth of both leaves and roots.)

D. Fourteen-leaf stage

(Note: In the fourteen-leaf stage the unseen tassel and the stalk are developing rapidly. Dry weight of the plant has increased rapidly. Any nutrient or moisture deficiencies can seriously reduce the number of kernels that will develop on the ears. For optimal growth, the plant processes of photosynthesis, respiration and absorption must function very efficiently from this stage until the ear has completely developed.)

E. Tassel emergence

(Note: When a corn plant is about eight weeks old, the tip of the tassel can be seen emerging from the leaf whorls at the top of the plant. The tassel starts to develop below ground when the plant is four weeks old. At nine weeks the very small ear shoot can be seen.)

F. Pollination and fertilization

(Note: When the corn plant is about nine-and-a-half weeks of age, the tassel has fully emerged and is starting to shed pollen. After a pollen grain alights on the silk of a corn plant, a pollen tube grows toward the ovary.)

G. Blister stage

(Note: At about 11 weeks, pollination is complete. Silks have started to turn brown. The kernels are somewhat round and not yet fully formed.)

H. Dough stage (roasting ear stage)

(Note: At about 13 weeks, the kernels are full of moisture and taking shape. Growth is rapid and starch is accumulating in the endosperm.)

I. Dent stage

(Note: At 15 weeks, kernels are dented and almost fully developed.)

J. Mature stage

(Note: At 17 weeks, the ear development is complete. Most of the husk and leaf blades have started to die. Moisture is at 35 percent. The ear is considered mature.)

IX. Purposes for which corn is grown in Idaho

A. Field corn for grain

1. DX 1096--6.67 tons/acre (Dairyland's)

2. G 4342--6.672 tons/acre (Funks)

3. SS 70--6.61 tons/acre (Crookham)

B. Field corn for silage

1. TXSH5A--62.4 tons/acre (DeKalb)

2. PAG5X 351--41.6 tons/acre (PAG)

3. KS 1150--41.2 tons/acre (Kelton)

C. Sweet corn for processing

1. Jubilee--7-9 tons/acre (Roger Bros.)

2. Dominator--5-9 tons/acre (Roger Bros.)

3. Style Pak--6-9 tons/acre (Ferry Morse)

X. Advantages of using hybrid corn

A. Produces better quality grain and forage

B. Better uniformity of growth and maturity

C. Produces higher yields

D. Greater resistance to diseases and certain insects

E. More resistant to lodging

F. Withstands drought better

XI. Tillage operations involved in seedbed preparation

A. Primary tillage

1. Moldboard plow

a. Time--Spring or fall

b. Depth--9 inches

c. Moisture needed

2. Ripper (chisel plow)

a. Time--Fall

b. Depth--12 to 14 inches

c. Dry conditions needed

B. Secondary tillage

1. Disk

a. Time--Spring

b. Depth--3 to 6 inches

2. Harrow

a. Time--Spring

b. Depth--3 to 4 inches

3. Roller

a. Time--Spring

b. Depth--Surface

4. Field cultivator

a. Time--One to two weeks following emergence, and as necessary to control weeds until corn is too high for cultivation

b. Depth--1 inch

XII. Characteristics of a desirable seedbed

A. Fine enough to give good contact between seed and soil

B. Loose enough for good air circulation

C. Warm

D. Adequate available moisture

E. Minimum of weeds

XIII. Factors to consider in planting corn

A. Plant early

(Note: Earlier than normal planting is the single best opportunity for most good corn growers to increase yields. Planting dates range from April 5 to June 18.)

B. Plant when soil temperature has reached 60^{o}F

(Note: Most types of corn will not germinate or germination is very slow at temperatures less than 60^{o}F. The longer germination takes the more susceptible the seed and seedling will be to soil-borne diseases. By the time the soil has warmed up to 60^{o}F, germination is prompt and the seedling will be above ground in 7 to 10 days after planting.)

C. Seeding depth

1. Early plantings--1 1/2 - 2 inches

2. Later plantings--2 - 3 inches

(Note: The two factors that most influence seeding depth are soil temperature and level of moisture in the soil.)

D. Seeding rates--One seed every 8 inches in row; approximate plant population of 18,000-21,000 plants per acre

E. Row spacing--30 inches

(Note: Row spacing should correspond with harvesting equipment you will be using.)

XIV. Factors that influence rate of planting

A. Time of planting

(Note: When planting extra early, you can plant 2,000 to 3,000 more kernels per acre because seedling mortality is a little greater.)

B. Fertility of the soil

C. Available supply of moisture

(Note: This is not a factor if adequate irrigation water is available.)

D. Variety

E. Purpose for which crop is grown

XV. Factors which influence final plant populations

A. Time of planting

B. Planting rate

C. Planting depth

D. Germination percentage

E. Vigor of seedling

F. Availability of plant nutrients

G. Adequate moisture available

H. Competition from weeds

I. Damage from disease and insects

XVI. Fertilizer requirement

A. Soil testing

(Note: Use soil test results in conjunction with University of Idaho Fertilizer Guides--CIS #372 and #376. Nutrients of concern for soil test include nitrogen, phosphorus, potassium, sulphur and zinc. Applications of other nutrients have not been shown to be responsive or economical and are not suggested. Consult your local county extension agent or field man for more help in calculating fertilizer requirements.)

XVII. Corn diseases

A. Corn smut

1. Symptoms--Grayish-white galls that are filled with black spores on tassel, ear, as well as all other above-ground parts of the corn plant

2. Causal agent--Fungus

3. Control--Rotation of crops, clean plowing, and cutting and destroying infected stalks; application of fresh barnyard manure will increase occurrence

B. Northern leaf blight

1. Symptoms--Small grayish-green spots on leaves which later turn dark tan; the lesions enlarge and develop a characteristic spindle shape

2. Causal agent--Fungus

3. Control--Use resistant varieties; plants grown in soils high in potassium suffer less from the disease

XVIII. Insects affecting corn production

A. Western corn rootworm

1. Description--Beetle about 1/4 inch long, slender, yellowish-green with three dark stripes or a dark area formed by the merger of these stripes on the back

2. Damage--The larvae feed on root hairs and tunnel into corn roots for about a month before they are full grown; this feeding may stunt the plant and reduce yields; damaged plants may lodge, increasing harvesting costs

3. Control

a. Crop rotation

b. Chemical control

(1) Adults--Foliar application

(2) Larvae--Soil treatment

(Note: Refer to University of Idaho CIS #533--The Western Corn Rootworm, for further information on chemical control of this pest.)

B. Corn earworm

1. Description--Moths are attracted to silking corn and deposit eggs on the silks; the eggs hatch, producing caterpillars, which infest corn from silking to maturity

2. Damage--Caterpillars infest and feed on ears

3. Control--Chemical control of larvae on the silk before the worms enter the ears

C. Western bean cutworm

1. Description--Adult is millermoth with brown wings with light tan shading on the outer margin; the larvae are creamy white to light gray with a black head, and turn tan color when mature; the segment behind the head has three longitudinal white stripes

2. Damage--Newly hatched larvae feed on leaves and in the emerging tassel; larger worms tunnel into ears at any point and feed on kernels, lowering yields and quality

3. Control--Chemical control

(Note: Refer to University of Idaho CIS #302, Western Bean Cutworm on Beans and Corn for further information on chemical control of this pest.)

XIX. How weeds compete with corn

A. Competition for water

B. Competition for plant nutrients

C. Competition for light

(Note: Corn and weeds have the same basic requirements for normal growth and development. In a mixed community of crops and weeds, the more aggressive species will dominate.)

XX. Losses caused by weeds

A. Decreased yield

B. Decreased crop quality

C. Cost of control activities

XXI. General categories of weeds

A. Annual--Completes life cycle within a period of one year

B. Perennial--Lives for three years or more, and can reproduce sexually and asexually by means of rhizomes and stolons

C. Broadleaf--Plant with shorter, wider leaves that usually have pinnate or netted veination; dicots

D. Grass--Plant with longer, narrower leaves with parallel veination; monocots

XXII. Methods of weed control

A. Cultural

B. Mechanical

C. Chemical

XXIII. Characteristics of high quality silage

A. High energy with plenty of grain, showing that it was cut late enough for near maximum yield

B. Good palatability from cutting at the right time and ensiling properly

C. Good keeping quality, no mold

D. Not enough nitrates to be a problem

XXIV. Factors to consider in harvesting high quality silage

A. Harvest when moisture content of plant is 60 to 65 percent

(Note: To determine moisture content, take 5 pounds of chopped material and place in oven at 200^{o}F for 2 to 3 hours, and then reweigh. Subtract the dry weight from the beginning weight, and multiply by 20 to get the percent of moisture.)

B. Pack silage tightly in pit or silo

(Note: Silage must be packed tightly so that all the air will be used up so that mold cannot grow. The heat that develops during the first two days after corn is ensiled is caused by respiration of the still-living cells of the corn plant. About the third day, the growth of mold begins to contribute to the heating. If the silage is well packed, the air supply is soon exhausted, the mold stops growing and the heating ceases.)

C. Add water to bring silage to 65% moisture if necessary

(Note: When the corn crop is too dry for ideal silage because it was frosted or is too nearly ripe, it does not pack well and the air is not forced out. Mold begins to grow. Two things can be done to reduce the amount of air in the silage. First, chop finer to facilitate packing. Second, add water to soften corn leaves and stalks so they will pack better.)

D. Cover pit with air-proof material

XXV. Harvesting and storing grain corn

A. A combine with a corn head is the most efficient harvester of corn

(Note: Lowest losses of all are for combine harvest and storage as high-moisture corn.)

B. Corn is mature when the grain has about 30 to 32 percent moisture; the best time to harvest depends on your harvest and storage system

(Note: Early harvesting of corn generally is best because you have less lodging from stalk rot, ear drop is less, and less grain is shelled when the ear hits the snapping rolls.)

C. For long-term storage, shelled corn should be down to 13 percent moisture

(Note: The drawback to early harvesting is that the grain must be dried to an acceptable level for storage.)

XXVI. Corn markets

A. Cash market--Operates in the same manner in which livestock is sold; the price paid is the market offering for the day the grain is sold

(Note: If you grow corn for the market, you have to decide whether you can make more profit by selling direct from the field or by storing the crop for a while. The important factors are the cost of farm storage and your prediction on trends in corn prices after harvest.)

B. Futures market--Forward contracting to purchase or deliver a certain amount of grain on a given date at a given price

(Note: This ensures the producer a market for his grain and reduces the risk of declining market prices. This ensures the buyer of delivery of grain at a certain time and reduces the risk of rising market prices.)

XXVII. Factors affecting profitability of corn production

A. Operating or variable costs

1. Seed (certified, registered, common)
2. Fertilizer
3. Soil testing
4. Irrigation (equipment, investment, interest on investment, electricity)
5. Interest on operating capital
6. Pest control (herbicides, fungicides, insecticides, soil fumigation)
7. Machinery and equipment operation (land preparation, chemical application, planting, harvesting, machine hire)

8. Fuel

9. Crop insurance

10. Land rent

11. Part-time labor (salary, social security taxes, disability insurance)

B. Fixed costs

1. Land (investment, interest on investment, taxes)

2. Full-time labor (salary, social security taxes, disability insurance)

3. Machinery and equipment (investment, interest on investment, maintenance and repairs, insurance, depreciation)

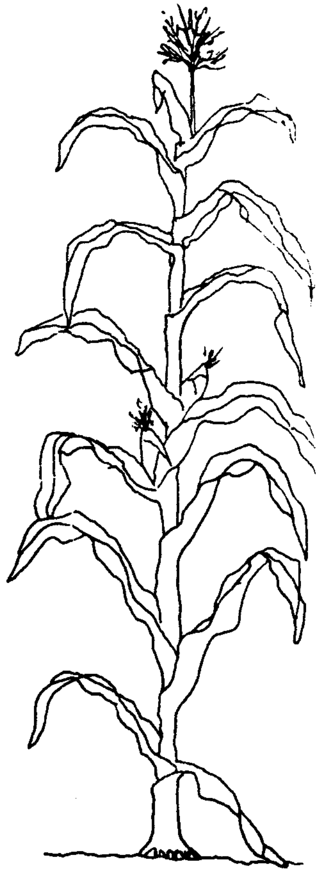
4. Buildings (investment, interest on investment, maintenance and repairs, insurance, depreciation)

5. Farm liability insurance

C. Marketing

1. Transportation

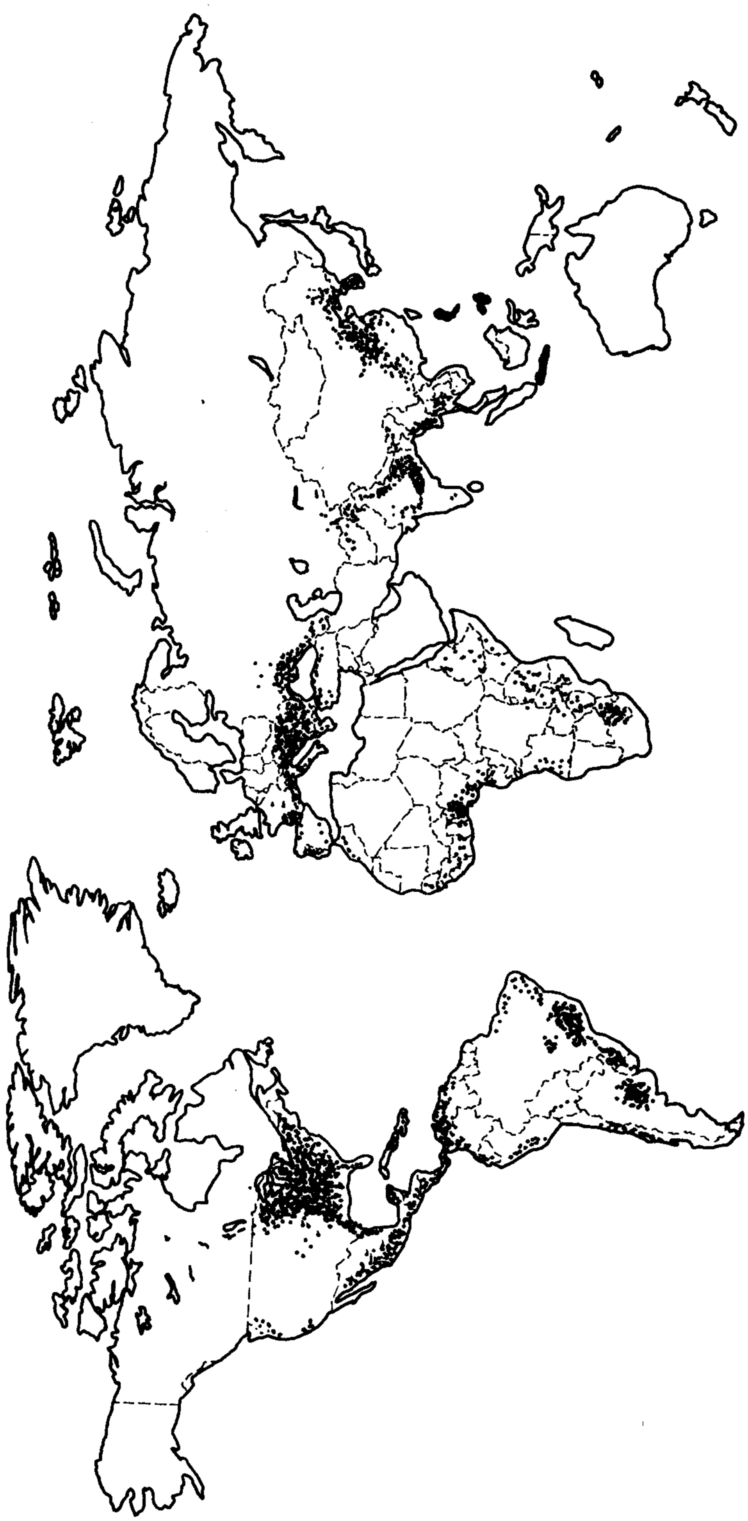
2. Supply and demand

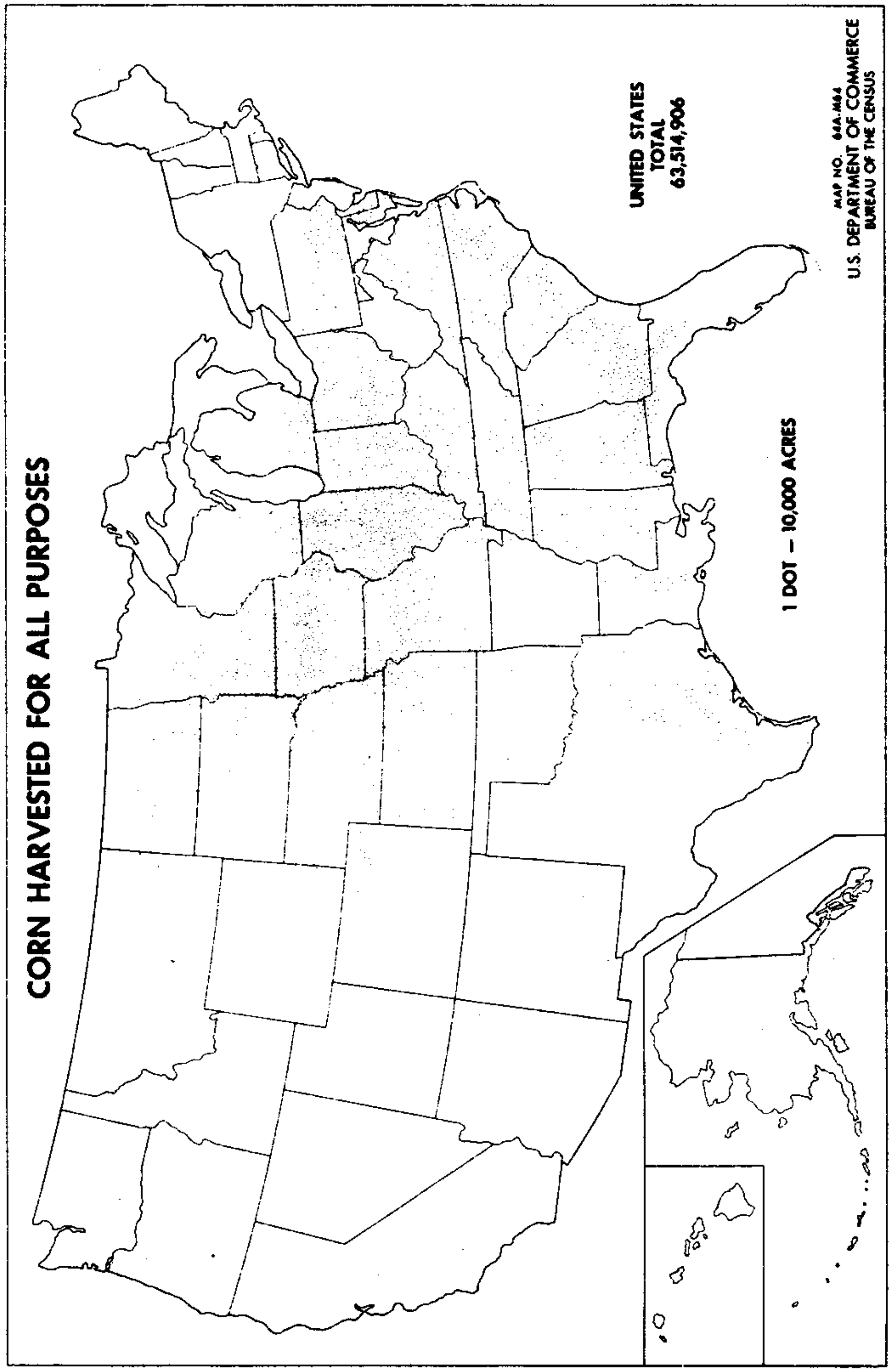


Uses of Corn

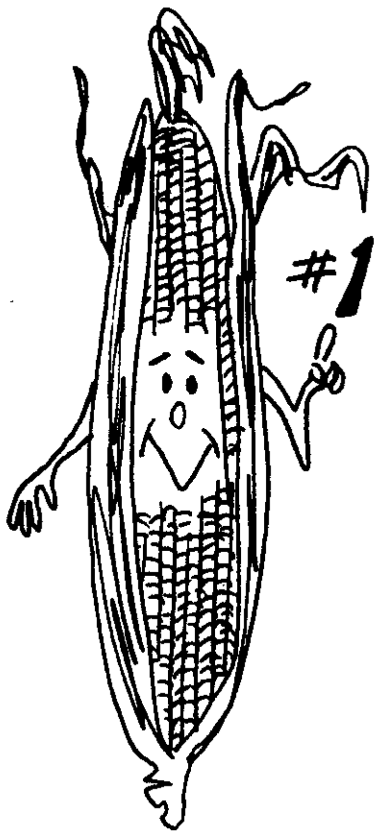
1. Livestock Feed
2. Products for Human Consumption
   - Corn Meal
   - Corn Hominy
   - Corn Flakes
3. Industrial Products
   - Alcohol
   - Corn Starch
   - Corn Oil

World Corn Production



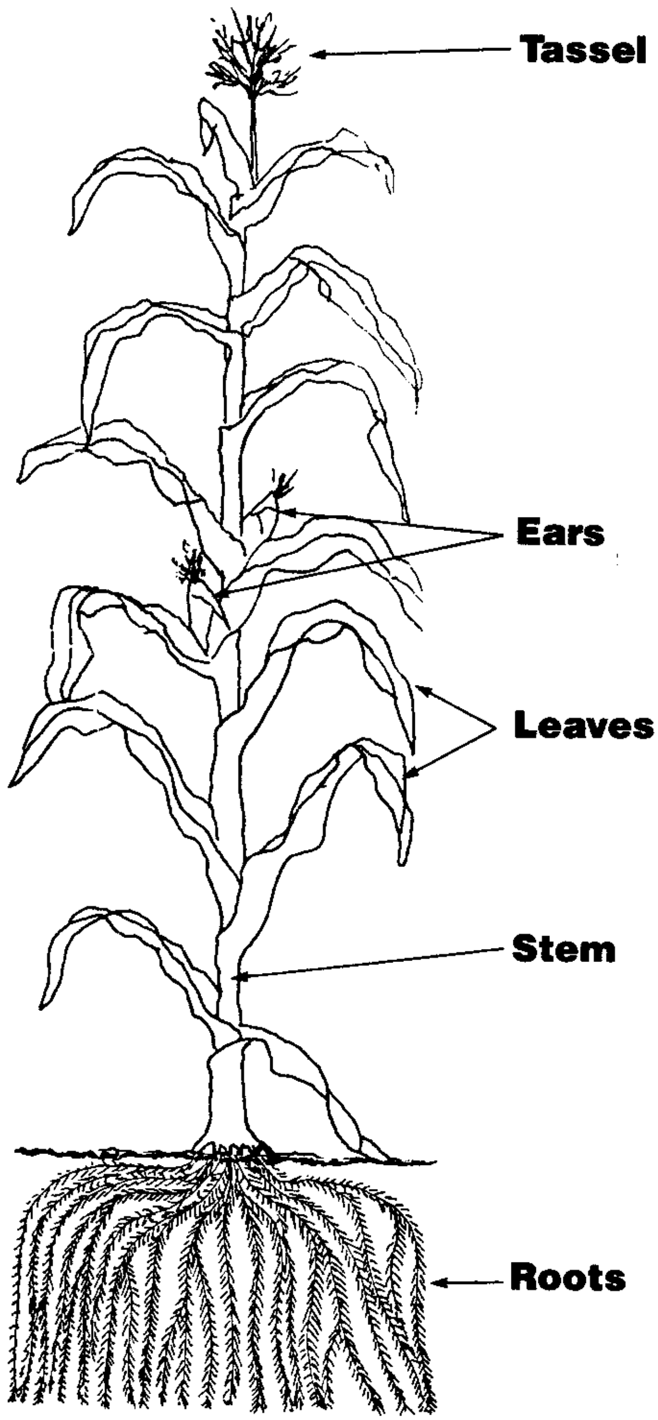

CORN HARVESTED FOR ALL PURPOSES
UNITED STATES
TOTAL
63,514,906
1 DOT – 10,000 ACRES
U.S. DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

Leading Corn Producing States

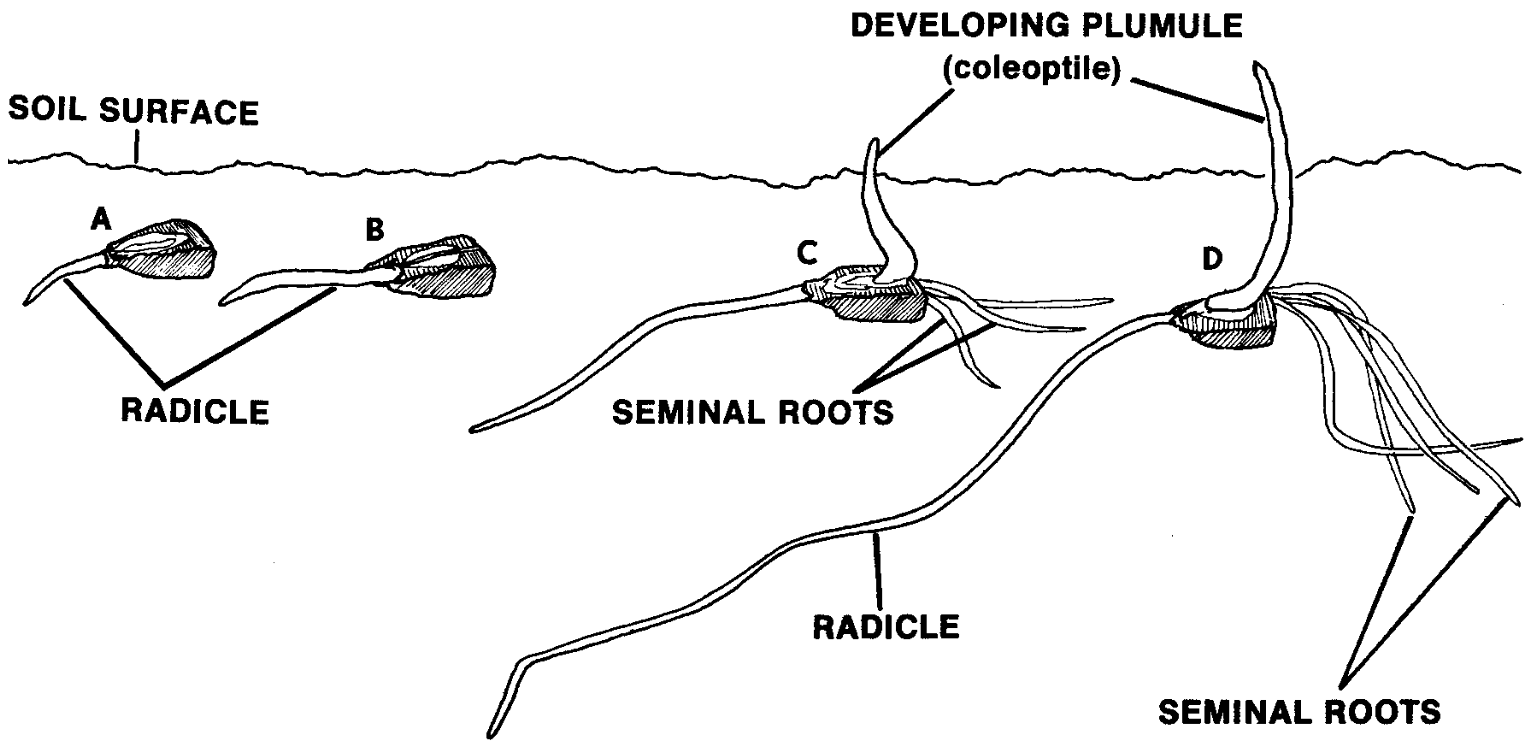


Field Corn	Iowa Nebraska Illinois Minnesota Ohio
Sweet Corn	Wisconsin Minnesota Washington Oregon Idaho Illinois

Parts of a Corn Plant

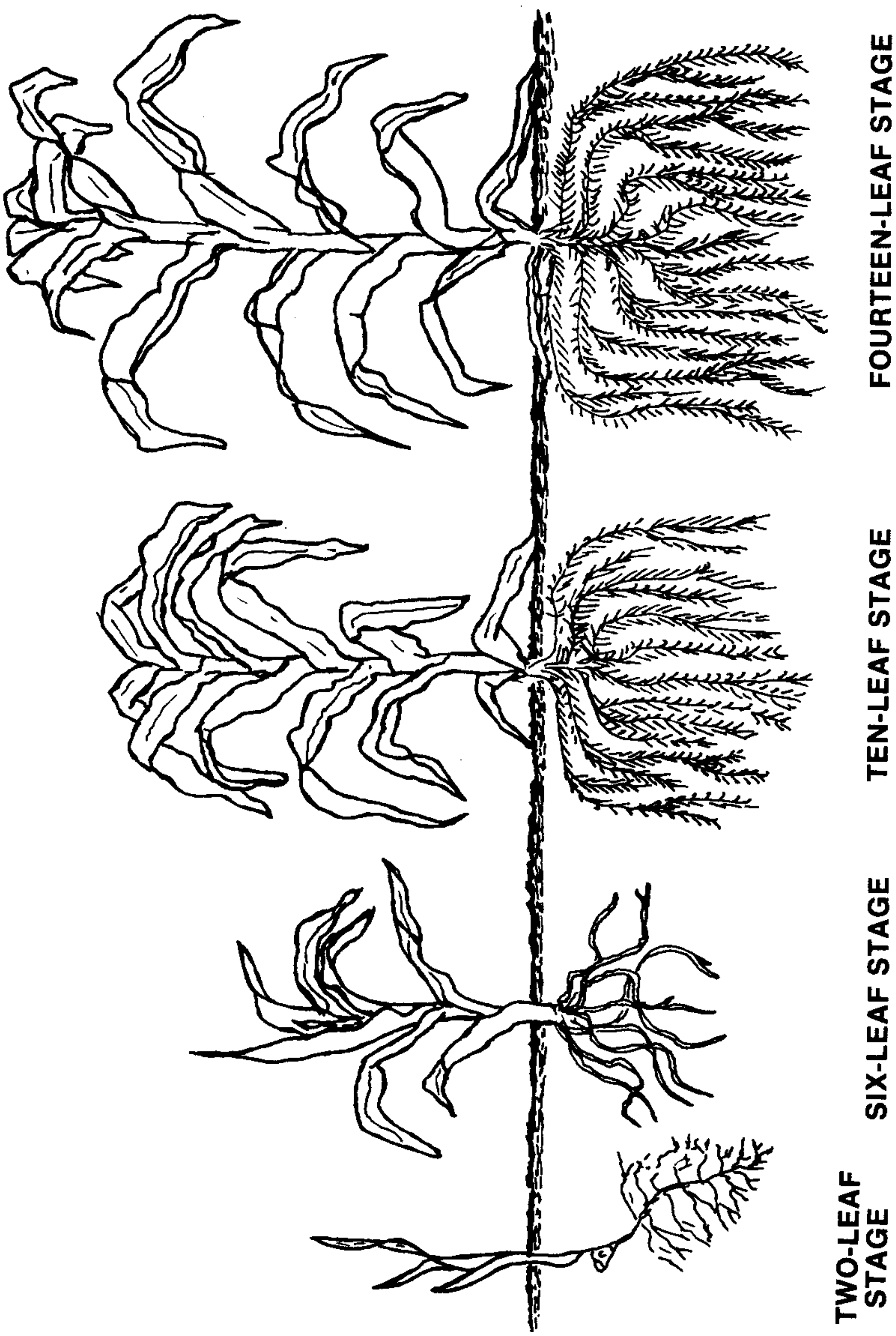


CORN GERMINATION AND SEEDLING GROWTH

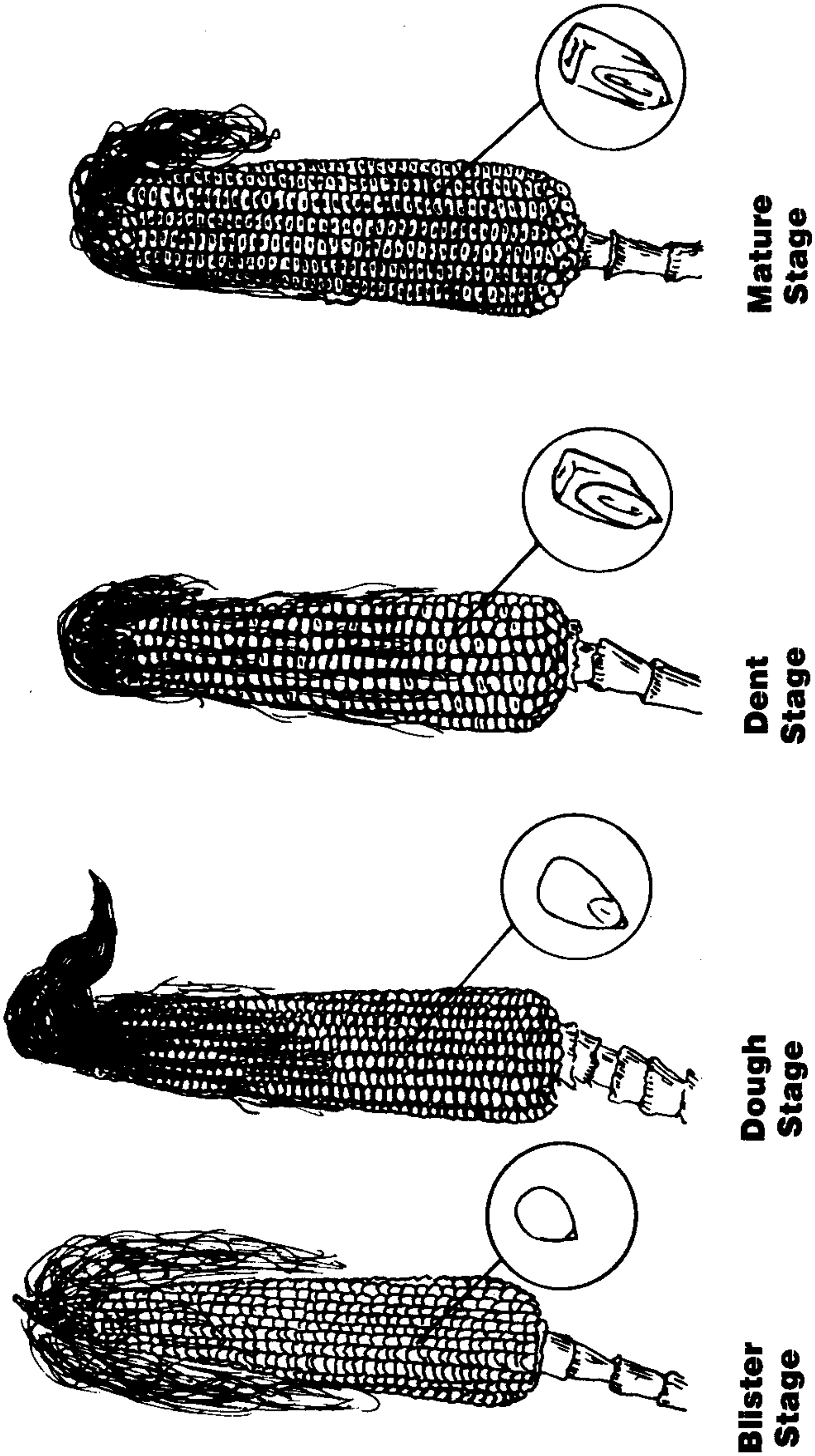


The germination and seedling growth of a corn plant
(A and B) The radicle enlarges and starts to grow in the soil.
(C and D) The plumule and seminal root start to develop.

VEGETATIVE GROWTH STAGES OF CORN



Development of an Ear of Corn



CORN PRODUCTION

AG 320 - D

ASSIGNMENT SHEET #1--MAKE FERTILIZER RECOMMENDATIONS FOR FIELD CORN

Name ______________________________________ Score________________________________

Using the information provided on the soil test report for E. Z. Tymes, and University of Idaho CIS #372--Idaho Fertilizer Guide for Irrigated Field Corn, recommend the amount of each nutrient that will need to be applied to achieve an average yield. Refer to the fertilizer guide for more complete directions.

Part I See next page

Soil Test Request and Report Form

Form #88

DO NOT WRITE IN THIS SPACE
Lab no.
Fee
Status: Paid Bill Other
Check no.

Analytical Services Laboratory
College of Agriculture
Moscow, ID 83843-4196
(208) 885-6201

University of Idaho

Mailing Name E. Z. Tymes
Address Nampa, ID

Phone:

Date:

County:

Grower:

Sample Identification:

FIELD INFORMATION			
Irrigation: ☐ Sprinkler ☐ Furrow ☐ None			
Rotation	Crop	Fertilizer applied lb/acre	Yield
Next crop	Field corn for grain		
Previous crop	wheat	residue returned	80 bu/AC
Grown in 19( )			
Grown in 19( )			

☑ CHECK TEST REQUIRED: Please make checks payable to Bursar, University of Idaho.

☒ Standard Fertility Test* ($10.00)
*Includes drying and grinding ($1.50), pH, P, K and O.M.

___ Bicarbonate P & K ___ Acetate P & K

☐ pH (soil reaction)	$ 1	6.8
☐ Available P (ppm P)	$ 3	4.5
☐ Available K (ppm K)	$ 3	79
☐ Organic matter (%)	$ 3	4.0
Other Tests:		
☒ Sulfate-S (ppm S)	$ 3	8
☐ Boron (ppm B)	$ 5	
☐ Total Salts (E.C.) (mmhos/cm)	$ 2	
☐ Gypsum Requirement	$20	
☐ Lime Requirement	$ 4	
☐ Cation Exchange Capacity (meq/100g)	$ 7	
☒ Zinc (ppm Zn)	$ 4	1.0
☐ Copper (ppm Cu)	$ 4	
☐ Manganese (ppm Mn)	$ 4	
☐ Iron (ppm Fe)	$ 4	

Depth (feet)	Nitrate N (ppm)	Ammonium N (ppm)	Available Moisture (inches)
0-1	☒ 0	☒ 1	☐
1-2	☒ 2.5	☒ 3	☐
2-3	☐	☐	☐
3-4	☐	☐	☐
4-5	☐	☐	☐
5-6	☐	☐	☐
6-7	☐	☐	☐
Total			

$3 per test ppm × 4 = lb/acre

Cations:	Extractable	Soluble
Calcium	☐	☐
Magnesium	☐	☐
Sodium	☐	☐
Potassium	☐	☐

$3 per test SAR ______

Contact the Analytical Services Laboratory for other special analyses.

FERTILITY GUIDE

Pounds Per Acre						
N	P_2O_5	K_2O				

Remarks:

If you wish further details or have questions concerning the soil analysis, please contact your University of Idaho County Extension Agent.

White — Grower copy • Yellow — Fertilizer Dealer copy • Pink — Ag Agent copy • Goldenrod — Laboratory copy

Part II

A. Considering 20 bushel yield of wheat is equal to one ton of residue returned, answer the following questions:

1. How many tons of wheat residue were returned to the soil?

2. How much extra nitrogen will we need to apply to compensate for tie-up by the residue?

B. How deep should the soil sample be taken for the nitrogen test?

C. How deep should the soil test be for the remainder of the tests?

D. What other factors could affect the ability of field corn to get nutrients from the soil (other than level of nutrients in the soil)?

University of Idaho
College of Agriculture
Cooperative Extension Service
Agricultural Experiment Station

Current Information Series No. 372

Idaho Fertilizer Guide

Irrigated Field Corn for Silage or Grain

B. D. Brown and D. T. Westermann

The following fertilizer guidelines are based on relationships established between University of Idaho soil tests and crop yield response. The fertilizer rates suggested are designed to produce the yields shown if other factors are not limiting production. The rates will be accurate for your field provided (1) the soil samples are properly taken and represent the area to be fertilized; (2) the crop history information supplied is complete and accurate; (3) the yield goal is realistic; and (4) good crop management practices are used.

Nitrogen (N)

Adequate N is necessary for maximum economic production of irrigated field corn used for silage or grain. Fertilizer N represents by far the largest share of the fertilizer costs for field corn in Idaho. The amount of N required depends on many factors that influence total corn production and quality. These factors include length of growing season, corn hybrid, previous crop, past fertilizer use, soil type, leaching hazard and previous manuring. Estimates of both the N available to corn during the season and the yield potential of the corp should be considered when determining N fertilizer rates.

Nitrogen Soil Test — A N soil test can evaluate the carryover N (NO_3-N plus NH_4-N) from previously fertilized crops as well as the N mineralized (organic N release) since the last crop was actively growing. Soil samples should be collected before planting in foot increments to a depth of 2 feet unless the roots are limited by restrictive soil horizons or high water tables. Deeper sampling may be justified if the effective rooting depth extends below 2 feet.

Potential Yield — Fertilizer N rates should reflect the corn yield growers can reasonably expect under their soil and management conditions. The historic yield obtained in a specific field or area provides a fair approximation of yield potential given a grower's traditional crop management. Projected changes in crop management designed to appreciably alter production may require upward or downward adjustment of yield potential.

Fertilizer N Requirement — The fertilizer N requirements for field corn silage or grain based on soil test N and potential yield are shown in Tables 1 and 2. The N requirements for grain are 10 to 15 pounds per acre higher than those for silage. Grain yield is more susceptible to N shortages than silage yield. The

Table 1. Recommended fertilizer N rates (lb/acre) for field corn harvested for silage as affected by yield level and soil test N.

	Silage yield (tons/acre)				
Soil test N	20	25	30	35	40
(ppm)	lb N/acre				
0[1]	210	230	250	270	295
10	170	190	210	230	255
20	130	150	170	190	215
30	90	110	130	150	175
40	50	70	90	110	135
50	10	30	50	70	95
60	0	0	10	30	55
70	0	0	0	0	15

[1]Soil test N values summed for the 0 to 12 and 12 to 24 inch depths.

Table 2. Recommended fertilizer N rates (lb/acre) for field corn harvested for grain as affected by yield level and soil test N.

	Grain yield (bu/acre)						
Soil test N	100	125	150	175	200	225	250
(ppm)	lb N/acre						
0[1]	215	235	255	280	300	320	340
10	175	195	215	240	260	280	300
20	135	155	175	200	220	240	260
30	95	115	135	160	180	200	220
40	55	75	95	120	140	160	180
50	15	35	55	80	100	120	140
60	0	0	15	40	60	80	100
70	0	0	0	0	20	40	60

[1]Soil test N values summed for the 0 to 12 and 12 to 24 inch depths.

fertilizer N requirements are based solely on soil test N and yield potential and do not reflect differences among soils in their organic N release rates.

The recommended fertilizer N rates do not account for N cycling as influenced by previous crops. Add 20 pounds N per acre for each ton of straw or stover plowed under to a maximum of 50 pounds per acre. Straw yields are normally 3 to 4 tons per acre and are not always related to grain yields. Winter wheat generally produces more straw than spring wheat or barley. Fertilizer N rates should be reduced 60 pounds per acre when corn follows alfalfa.

Timing N Applications — Coarse-textured soils, including sandy loams, loamy soils and sands, may lose N from leaching. For these soils, sidedress a portion of the N at the time of the last cultivation. Sprinkler irrigation of corn under center pivots provides increased flexibility for providing N during the season. With sprinklers N can be injected into the system and applied with the water. On silt loam soils, split applications of N have not proven more effective as long as preplant N is adequately incorporated.

High N rates (approaching 300 pounds per acre) broadcast and incorporated before planting may reduce early season corn growth. If high N rates are needed, split applications should be considered.

Phosphorus (P)

Adequate P is necessary for maximum production of field corn. The soil test for P is based on samples collected from the first foot of soil. The soil is extracted with sodium bicarbonate. Economic response to fertilizer P is more likely with cooler soil temperatures and soils with high lime content, particularly when planting long season hybrids. Fertilizer P rates based on soil test P and soil lime contents are given in Table 3. Phosphorus is an immobile nutrient that does not move appreciably from where it is placed. It should be mixed into the seedbed or banded within easy reach of the seedling roots before or during the planting operation.

Table 3. Fertilizer P rates (lb/acre) based on soil test P and soil lime contents.

Soil test P[1]	Lime content[2] 5	10	15 or more
(ppm)	--------- P_2O_5 lb/acre		---------
0	180[3]	240	300
5	100	160	220
10	20	80	140
15	0	0	60
20	0	0	0

[1]Soil extractant is $NaHCO_3$.
[2]Lime content measured as calcium carbonate equivalent.
[3]$P_2O_5 \times 0.44 = P$ or $P \times 2.29 = P_2O_5$.

Potassium (K)

Field corn requires adequate K for optimum growth. Soil test K can be useful in determining the need for K fertilizers. The soil sample is taken from the first foot of soil and extracted with sodium bicarbonate. Fertilizer K rates based on soil test K are given in Table 4.

Table 4. Fertilizer K rates (lb/acre) based on soil test K.

Soil test[1]	Apply
(ppm)	(K_2O lb/acre)
0	240[2]
50	160
100	80
150	0

[1]Soil extractant is $NaHCO_3$.
[2]$K_2O \times 0.83 = K$ or $K \times 1.20 = K_2O$.

Micronutrients (B, Cu, Fe, Mn, Zn)

Zinc (Zn) deficiencies occur primarily on soils that are eroded, leveled or where the exposed subsoil is higher in lime. The DTPA test on soil samples collected from the first foot can be used for identifying Zn fertilizer needs. Apply 10 pounds of Zn per acre when the soil test measures less than 0.6 ppm.

Other micronutrients have not been shown to limit corn production. "Shotgun" applications of micronutrient mixtures containing boron (B), copper (Cu), iron (Fe) and manganese (Mn) "for insurance" have not been shown to be economical and are not recommended.

Sulfur (S)

The major corn-growing regions of Idaho should not experience shortages of S. Areas with S deficiencies include some irrigated areas where both the soil and irrigation water are low in S. Snake River water is known to have high S concentrations. Coarse-textured soils including sandy loams, loamy sands and sands would be more susceptible to S deficiencies than silt loam soils. Where the need for S is evident, use 30 pounds per acre of sulfate-sulfur (SO_4-S).

Salinity (Salts)

Field corn has a low to moderate tolerance to accumulated salts. Soils with total salt readings above 3 or 4 mmhos/cm can be cropped effectively. Readings up to 6 are also satisfactory although more careful water management may be required.

General Comments

1. High plant populations (above 28,000 to 30,000) and early plantings of longer season hybrids in the Treasure Valley will respond to high N rates provided there are no other limiting factors.

2. High N rates will not compensate for reductions in stand or delayed plantings.

3. High plant populations of field corn are more susceptible to N shortages because of greater competition among plants for limited N.

4. Sidedressing may cause root pruning depending on plant size, distance of shank from the row and placement depth.

5. Irrigation, weed and disease control, corn hybrid variety and plant population all can influence the effectiveness of fertilizer applications.

6. High N rates (above 300 pounds per acre) broadcast and incorporated before planting may reduce early season corn growth. If high N rates are needed, split applications should be considered.

7. On sandy textured soils subject to leaching, sidedress a portion of the N at the time of the last cultivation. Under sprinkler irrigation, N can be injected through the lines throughout the season. On silt loam soils, split applications of N have not proven more effective as long as preplant N is adequately incorporated.

9. Add 20 pounds N per acre for each ton of straw or stover plowed under up to a maximum of 50 pounds per acre.

The Authors — B. D. Brown is Extension crop management specialist and assistant Extension professor of plant science at the University of Idaho Southwest Idaho Research and Extension Center, Parma. D. T. Westermann is affiliate professor of soil science, cooperating USDA, at the Snake River Conservation Research Center, Kimberly.

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2M, 12-78; 1,000, January 1988 (revised)

25 cents per copy

CORN PRODUCTION

AG 320 - D

ASSIGNMENT SHEET #2--MAKE FERTILIZER RECOMMENDATIONS FOR SWEET CORN

Name ______________________________________ Score________________________________

Using the information provided on the soil test report for Blue Bonnett, and University of Idaho CIS #376--Idaho Fertilizer Guide for Sweet Corn, recommend the amount of each nutrient that will need to be applied to achieve an average yield. Refer to the fertilizer guide for more complete directions.

Part I See next page

Soil Test Request and Report Form

Form #88

DO NOT WRITE IN THIS SPACE
Lab no.
Fee
Status: Paid Bill Other
Check no.

Analytical Services Laboratory
College of Agriculture
Moscow, ID 83843-4196
(208) 885-6201

University of Idaho

Mailing Name Blue Bonnett
Address Caldwell, Idaho

Phone:

Date:

FIELD INFORMATION			
Irrigation: ☐ Sprinkler ☐ Furrow ☐ None			
Rotation	Crop	Fertilizer applied lb/acre	Yield
Next crop	Sweet Corn For seed		
Previous crop	Onions		
Grown in 19( )			
Grown in 19( )			

County:

Grower:

Sample Identification:

☑ CHECK TEST REQUIRED: Please make checks payable to Bursar, University of Idaho.

☒ Standard Fertility Test* ($10.00)
*Includes drying and grinding ($1.50), pH, P, K and O.M.

___ Bicarbonate P & K ___ Acetate P & K

☐ pH (soil reaction)	$ 1	7.1
☐ Available P (ppm P)	$ 3	25
☐ Available K (ppm K)	$ 3	145
☐ Organic matter (%)	$ 3	4.0
Other Tests:		
☒ Sulfate-S (ppm S)	$ 3	12
☐ Boron (ppm B)	$ 5	
☐ Total Salts (E.C.) (mmhos/cm)	$ 2	
☐ Gypsum Requirement	$20	
☐ Lime Requirement	$ 4	
☐ Cation Exchange Capacity (meq/100g)	$ 7	
☒ Zinc (ppm Zn)	$ 4	0.6
☐ Copper (ppm Cu)	$ 4	
☐ Manganese (ppm Mn)	$ 4	
☐ Iron (ppm Fe)	$ 4	

Depth (feet)	Nitrate N (ppm)	Ammonium N (ppm)	Available Moisture (inches)
0-1	☒ 1.4	☒ 3	☐
1-2	☒ 2.6	☒ 9	☐
2-3	☐	☐	☐
3-4	☐	☐	☐
4-5	☐	☐	☐
5-6	☐	☐	☐
6-7	☐	☐	☐
Total			

$3 per test ppm x 4 = lb/acre

Cations:	Extractable	Soluble
Calcium	☐	☐
Magnesium	☐	☐
Sodium	☐	☐
Potassium	☐	☐

$3 per test SAR ___

Contact the Analytical Services Laboratory for other special analyses.

FERTILITY GUIDE

Pounds Per Acre						
N	P_2O_5	K_2O				

Remarks:

If you wish further details or have questions concerning the soil analysis, please contact your University of Idaho County Extension Agent.

White — Grower copy • Yellow — Fertilizer Dealer copy • Pink — Ag Agent copy • Goldenrod — Laboratory copy

Part II

A. What factors will affect the amount of nitrogen to be applied?

B. How and when should nitrogen fertilizer be applied to sweet corn? Why is side dressing discouraged?

C. What is the maximum amount of nitrogen that should be applied to compensate for nitrogen tie-up by incorporated crop residue?

D. What other factors could affect the ability of sweet corn to get nutrients from the soil (other than level of nutrients in the soil)?

University of Idaho
College of Agriculture
Cooperative Extension Service
Agricultural Experiment Station

Current Information Series No. 376

Idaho Fertilizer Guide

Sweet Corn for Seed and Processing

W. R. Simpson and Brad Brown

The following fertilizer guidelines are based on relationships established between University of Idaho soil test and crop yield response. The fertilizer rates suggested are based on research results and are designed to produce above average yields if other factors are not limiting production. Thus the fertilizer guide assumes use of good crop management practices.

The suggested fertilizer rates will be accurate for your field provided (1) the soil samples represent the area to be fertilized, and (2) the crop history information supplied is complete and accurate.

NITROGEN (N)

Nitrogen rates depend upon some of the following factors: previous crop, past fertilizer use, soil type and leaching hazard and a realistic yield goal for the grower and the area.

Nitrogen fertilizer should be applied pre-plant and incorporated into the soil. Late side dressing will encourage stalk rot which is more prevalent in seed than processed corn. If side dressing is necessary; for seed, apply no later than early emergence. For processing, apply at time of last cultivation. The ammonium (NH_4) source of nitrogen will increase stalk rot when compared with the nitrate (NO_3) source. Nitrogen rates suggested for optimum sweet corn production as influenced by previous crop are shown in Table 1.

Table 1. Nitrogen fertilizer rates based on previous crops.

Previous crops	Lb. N/acre*
Grain or corn (residue returned)	200
Grain or corn (residue removed)	160
Row crop	140
Beans, peas, alfalfa stubble	100
Green manure legumes	80

*Reduce rates 20 pounds per acre for seed corn.

Nitrogen Soil Test

A nitrogen soil test can evaluate the carryover from heavily fertilized row crops such as onions, beets or potatoes. Since nitrate nitrogen (NO_3-N) is mobile, the soil samples should represent soil depths of 0 to 12 and 12 to 24 inches, or the effective root zone. (Nitrogen soil test following alfalfa has limited value.)

The soil test values in Table 2 represent the sum of the nitrate nitrogen and ammonium nitrogen in the top 2 feet of soil by 1 foot increments.

Table 2. Nitrogen fertilizer rates based on soil test.

0-24 inch depth or effective root zone N (ppm)*	Nitrogen application Lb./acre**
0	160
10	120
20	80
30	40
40 plus	0

* ppm x 4 = pounds nitrogen per acre

** reduce rates 20 pounds per acre for seed corn. Add 15 pounds nitrogen for each ton of grain straw or non-legume residue plowed under up to 50 pounds nitrogen per acre. Straw yields are normally 3 to 4 tons per acre.

PHOSPHORUS (P)

Corn will respond to phosphorus fertilizer if soil levels are low. The soil test is based on available phosphorus present to the depth of plowing and the soil samples should represent this area. Phosphorus should be plowed down or banded in the seedbed.

Table 3 shows soil test levels and rates of phosphorus to apply. Since soil samples are being taken both at plow depth (0 to 9 inches) and at 0- to 12-inch depth, levels for both depths are shown.

Table 3. Phosphorus fertilizer rate based on soil test.

Soil test inches soil depth 0-9	0-12	Apply lb./acre P_2O_5	(P)**
phosphorus (P) ppm*			
0	0	240	106
4	3	160	70
8	6	80	35
12 plus	10 plus	0	0

* Phosphorus (P) is by $NaHCO_3$ extraction.

** Phosphorus is expressed as both the oxide and elemental forms: $P_2O_5 \times 0.44 = P$ or $P \times 2.29 = P_2O_5$.

POTASSIUM (K)

Corn has a moderate requirement for potassium. Fertilizer should be applied in fall or early spring and worked into seed bed. Table 4 shows soil test levels and rates of potassium to apply. Since soil samples are taken at both plow depth and the 0- to 12-inch soil depth, K levels for both depths are given.

Table 4. Potassium fertilizer rate based on soil test.

Soil test inches soil depth 0-9	0-12	Apply lb./acre K_2O	(K)**
potassium (K) ppm*			
0	0	240	200
30	22	160	133
60	45	80	66
90	68	40	33
120	90 plus	0	0

* Potassium (K) is by $NaHCO_3$ extractant.

** Potassium is expressed as both the oxide and elemental forms: $K_2O \times 0.83 = K$ or $K \times 1.20 = K_2O$.

MICRONUTRIENTS

Zinc (Zn) — Corn is sensitive to zinc deficiency particularly on leveled or exposed limey subsoil areas. When the soil test for zinc is less than 0.6 ppm in the 0- to 12-inch soil depth, or if sub-soils are exposed, apply zinc fertilizer to supply 10 pounds of zinc per acre or equivalent.

Other micronutrients have not been shown to be limiting corn production and "shotgun" application of micronutrient mixtures containing boron, manganese, iron and copper "for insurance" have not been shown to be responsive and are not suggested.

SULFUR (S)

The major corn growing regions of Idaho should not experience sulfur deficiency. Soil testing less than 8 ppm SO_4-S in the 0- to 12-inch soil depth or areas known to be deficient in sulfur should receive 30 pounds sulfur per acre.

SALINITY (SALTS)

Some sweet corn inbred lines have a low tolerance to salty soils. Soils over 3 to 4 mmhos/cm may be too salty for salt sensitive inbreds. Field corn varieties will normally tolerate more salt than sweet corn varieties.

GENERAL COMMENTS

1. Results from fertilizer research trials are available in Idaho Experiment Station Bulletin 501, *Fertilizing Sweet Corn for Seed Production*, by C. G. Painter and W. R. Simpson.

2. Side-dressing may cause root pruning depending upon plant size, distance of shank from the row, and depth. Stalk rot incidence is also increased by this practice.

3. Over-irrigation and nitrogen leaching are a hazard on all soils, particularly sandy-textured soils.

4. Irrigation, weed and disease control, variety, and plant population will influence the effectiveness of your fertilizer applications.

If you have any questions regarding the interpretation of this information, please contact your County Extension Agent.

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25 cents per copy

CORN PRODUCTION

AG 320 - D

ANSWERS TO ASSIGNMENT SHEETS

Assignment Sheet #1

Part I

Soil Fertility Guide

Pounds Per Acre						
N	P_2O_5	K_2O	P	K		
196	120	20	53	17		

Part II

A. 1. 4 tons/acre

2. 50 lbs N/acre

B. 24 inches

C. 12 inches

D. Evaluated to satisfaction of instructor.

Assignment Sheet #2

Part I

Soil Fertility Guide

Pounds Per Acre						
N	P_2O_5	K_2O	P	K		
80	173	0	76	0		

Part II

A. Nitrogen rates depend on some of the following factors: length of growing season, previous crop, past fertilizer use, soil type and leaching hazard, and a realistic yield goal for the grower and the area

B. Nitrogen fertilizer should be applied preplant and incorporated. Late side dressing will encourage stalk rot which is more prevalent in seed than processed corn

C. 50 lbs N/acre

D. Evaluated to satisfaction of instructor.

CORN PRODUCTION

AG 320 - D

UNIT TEST

Name ______________________________________ Score________________________________

1. Match terms associated with corn production to the correct definitions. Write the correct number in the blank.

_____a. Tillage to control weeds

_____b. Forage chopped and stored at 60 to 70 percent moisture and allowed to ferment and produce acids which then preserve it

_____c. Vegetative material in a fresh, dried or ensiled state which is fed to livestock

_____d. Process whereby individuals or groups directly inhibit the growth of others by utilizing resources potentially available to all

_____e. The mature stalks of corn from which the grain has been removed

_____f. The offspring of two parents which differ in one or more heritable characteristics

_____g. The seed of crops such as corn, wheat, barley and oats

_____h. The flower on the upper portion of the stem of corn; it contains the stamens

_____i. The entire plant of grasses, such as corn, which is harvested, cured and fed

_____j. A process wherein fresh or slightly wilted forage is placed in air-tight storage and allowed to ferment and produce acids which then preserve it

_____k. A condition that occurs when the stems are not strong enough to hold the plants erect and they bend or break over

1. Forage
2. Grain
3. Ensile
4. Silage
5. Hybrid
6. Tassel
7. Lodging
8. Stover
9. Fodder
10. Cultivation
11. Competition

2. List three uses of corn.

   a.____

   b. ____

   c.____

3. List three field corn producing states and three sweet corn producing states.

   Field corn

   a.____

   b. ____

   c.____

   Sweet corn

   a.____

   b. ____

   c.____

4. Select from the following list true corn facts. Write an "X" in the blank before each correct answer.

   _____a. U.S. produces over 30% of world corn crop

   _____b. Corn can be grown in every state, except Alaska

   _____c. Corn ranks first in acreage among field crops in the world

   _____d. The U.S. accounts for over 75% of world corn exports

   _____e. Corn is represented in the FFA emblem

5. Discuss the economic importance of corn production to Idaho.

   ____

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   ____

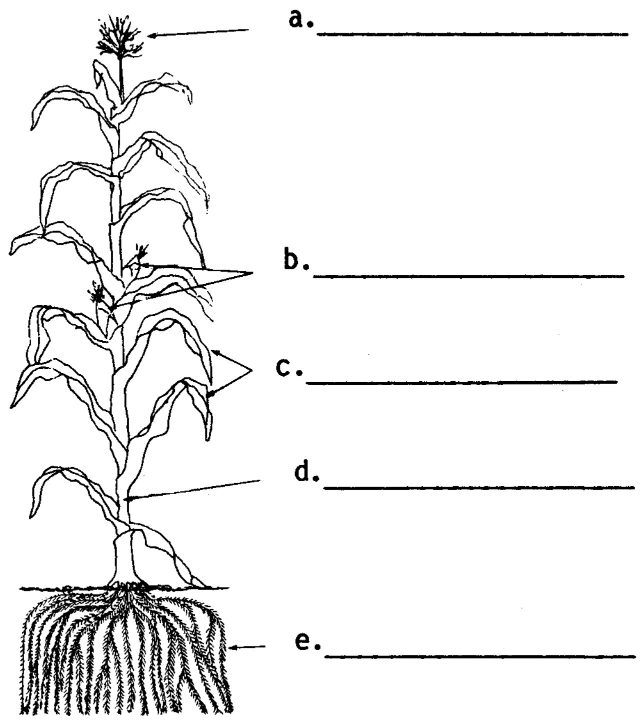
6. Name three types of corn.

   a.____

   b. ____

   c.____

7. Identify the parts of a corn plant. Write the correct name in the blank.



8. Arrange in order the stages of growth of the corn plant. Write a "1" before the first stage, a "2" before the second stage, and so on.

__________	a.	Mature stage	__________	f.	Ten-leaf stage
__________	b.	Two-leaf stage	__________	g.	Blister stage
__________	c.	Dent stage	__________	h.	Fourteen-leaf stage
__________	d.	Six-leaf stage	__________	i.	Pollination and fertilization
__________	e.	Dough stage	__________	j.	Tassel emergence

9. List three purposes for which corn is grown in Idaho.

   a.____

   b. ____

   c.____

10. Select from the following list advantages of using hybrid corn. Write an "X" in the blank before each correct answer.

   _____a. Withstands drought better

   _____b. Requires less fertilizer

   _____c. Produces higher yields

   _____d. Better quality grain and forage

   _____e. Irrigation is not required

11. List three tillage operations involved in seedbed operation.

   a.____

   b. ____

   c.____

12. Select from the following list characteristics of a desirable seedbed. Write an "X" in the blank before each correct answer.

   _____a. Relatively cold

   _____b. Moisture availability adequate

   _____c. Loose enough for good air circulation

   _____d. Minimum of competition from weeds

   _____e. Warm

   _____f. Fine enough to give good contact between seed and soil

13. Select from the following list factors to consider in planting corn. Write an "X" in the blank before each correct answer.

   _____a. Time of planting

   _____b. Soil temperature

   _____c. Seeding depth

   _____d. Plant population per acre

   _____e. Row spacing

14. List three factors that influence rate of planting.

    a.____

    b. ____

    c.____

15. Select from the following list factors that influence final plant populations. Write an "X" in the blank before each correct answer.

    _____a. Vigor of seedling

    _____b. Cost of additional plant nutrients

    _____c. Availability of plant nutrients

    _____d. Amount of seed planted

    _____e. Depth at which seed is sown

    _____f. Germination percentage of seed

    _____g. State in which crop is being raised

    _____h. Price of certified seed

    _____i. Competition from weeds

    _____j. Time of planting

16. Name two corn diseases.

    a.____

    b. ____

17. Name two harmful insects of corn.

    a.____

    b. ____

18. List three ways weeds compete with corn.

    a.____

    b. ____

    c.____

19. List three ways weeds cause losses in corn production.

a.____

b. ____

c.____

20. Match the general categories of weeds to the correct description. Write the correct number in the blank.

_____a.	Plant with longer, narrower leaves with parallel veination; monocots	1.	Annual
_____b.	Completes life cycle within a period of one year	2.	Perennial
_____c.	Lives for three years or more, and can reproduce sexually and asexually by means of rhizomes and stolons	3.	Broadleaf
_____d.	Plant with shorter, wider leaves that usually has pinnate or netted veination; dicots	4.	Grass

21. Name three methods of weed control.

a.____

b. ____

c.____

22. List three characteristics of high quality silage.

a.____

b. ____

c.____

23. Select from the following list factors to consider in harvesting high quality silage. Write an "X" in the blank before each correct answer.

_____a. Harvest at correct plant moisture content

_____b. Pack tightly in pit or silo

_____c. Add water to bring silage to 65% moisture, if necessary

_____d. Cover pit with air-proof material

_____e. Leave pit uncovered so air can circulate

24. Discuss the harvesting and storing of grain corn.

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25. Match the types of corn markets to the correct description. Write the correct number in the blank.

_____a.	Contracting to purchase or deliver a certain amount of grain on a given date at a given price	1.	Cash market
_____b.	Operates in the same manner in which livestock is sold; the price paid is the market offering for the day the grain is sold	2.	Futures market

26. List and discuss the three major factors affecting the profitability of corn production.

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CORN PRODUCTION

AG 320 - D

ANSWERS TO TEST

1.

a.	10	d.	11	g.	2	j.	3
b.	4	e.	8	h.	6	k.	7
c.	1	f.	5	i.	9		

2. Livestock feed; Products for human consumption; Industrial products

3. Answer should include three of the following for both categories:

   Field corn: Iowa; Nebraska; Illinois; Indiana; Minnesota; Ohio
   Sweet corn: Wisconsin; Minnesota; Washington; Oregon; Idaho; Illinois

4. a, b, d, e

5. Answer could include the following information:

   <u>Field corn harvested for grain</u>: 50,000 acres harvested; 130 bushels grain yield per harvested acre; 65,834,000 bushels total production; Economic value to the state of $20,475,000
   <u>Field corn harvested for silage</u>: 58,000 acres harvested; 23.0 tons silage per harvested acre; 1,334,000 tons total production
   <u>Sweet corn for processing</u>: 18,200 acres harvested; 9.0 tons per harvested acres; 163,000 tons total production (in husk); Economic value to the state of $8,829,000

6. Answer should include three of the following: Dent; Sweet; Popcorn; Flour corn; Waxy corn

7.

a.	Tassel	d.	Stem
b.	Ear	e.	Roots
c.	Leaves		

8.

a.	10	d.	2	g.	7	j.	5
b.	1	e.	8	h.	4		
c.	9	f.	3	i.	6		

9. Field corn for grain; Field corn for silage; Sweet corn for processing or seed

10. a, c, d,

11. Answer should include three of the following:
    Moldboard plow; Ripper (chisel plow); Disk; Harrow; Roller; Field cultivator

12. b, c, d, e, f

13. a, b, c, d, e

14. Answer should include three of the following:
    Time of planting; Fertility of the soil; Available supply of moisture; Variety; Purpose for which crop is grown

15. a, c, d, e, f, i, j

16. Corn smut; Northern leaf blight

17. Answer should include two of the following:
Western corn rootworm; Corn earworm; Western bean cutworm

18. Competition for water; Competition for plant nutrients; Competition for light

19. Decreased yield; Decreased crop quality; Cost of control activities

20. a. 4 b. 1 c. 2 d. 3

21. Cultural; Mechanical; Chemical

22. Answer should include three of the following:

High energy with plenty of grain, showing that it was cut late enough for near maximum yield; Good palatability from cutting at the right time and ensiling properly; Good keeping quality, no mold; Not enough nitrate to be a problem

23. a, b, c, d

24. Answer could include the following information:

A combine with a corn head is the most efficient harvester of corn; Corn is mature when the grain has about 30 to 32 percent moisture; the best time to harvest depends on your harvest and storage system; For long-term storage, shelled corn should be down to 13 percent moisture

25. a. 2 b. 1

26. Answer should include the following information:

<u>Operating or variable costs</u>: Seed (certified, registered, common); Fertilizer; Soil testing; Irrigation (equipment, investment, interest on investment, electricity); Interest on operating capital; Pest control (herbicides, fungicides, insecticides, soil fumigation); Machinery and equipment operation (land preparation, chemical application, planting, harvesting, machine hire); Fuel; Crop insurance; Land rent; Part-time labor (salary, social security taxes, disability insurance)
<u>Fixed costs</u>: Land (investment, interest on investment, taxes); Full-time labor (salary, social security taxes, disability insurance); Machinery and equipment (investment, interest on investment, maintenance and repairs, insurance, depreciation); Buildings (investment, interest on investment, maintenance and repairs, insurance, depreciation); Farm liability insurance
<u>Marketing</u>: Transportation; Supply and demand

FORAGE PRODUCTION

AG 320 - E

UNIT OBJECTIVE

After completion of this unit, students should be able to describe forage production techniques involved with seedbed preparation, fertilizer requirements, planting, disease and insect control, weed control, harvest, storage and marketing. This knowledge will be demonstrated by completion of the unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with forage production to the correct definitions.
2. Name the top three alfalfa producing states.
3. Discuss the economic importance of forage production to Idaho.
4. Name two legumes and two non-legume forage crops.
5. Identify the parts of an alfalfa plant.
6. Select factors to consider in selecting an alfalfa variety.
7. Select characteristics of a desirable seedbed.
8. Select factors to consider in planting.
9. List two advantages of a companion crop.
10. List two disadvantages of a companion crop.
11. Name three companion crops.
12. Name two forage diseases.
13. Name two beneficial insects of forage crops.
14. Name two harmful insects of forage crops.
15. List three ways weeds compete with forage crops.
16. List three losses caused by weeds in forage crops.
17. Match the general categories of weeds to the correct description.
18. List three methods of weed control.
19. Select characteristics of high quality hay.

20. List three factors to consider in cutting alfalfa hay.

21. List four methods of processing hay.

22. List two factors to consider in buying and selling alfalfa hay.

23. Make fertilizer recommendations for alfalfa.

FORAGE PRODUCTION

AG 320 - E

SUGGESTED ACTIVITIES

I. Suggested activities for instructor

A. Order materials to supplement unit.

1. Literature

a. *Alfalfa Science and Technology*, (1972), American Society of Agronomy, Monograph #15, Madison, Wisconsin.

b. *Forage*, instructional unit; available from Agri-Farm Publications, Inc., 1019 Market St., Gowrie, Iowa 50543; approximate cost $13.80; order no. 208; class activity packet on forage production, approximate cost $4.75; order no. 1109; forage production guide available, approximate cost $3.90; order no. 2104.

c. *Forages: The Science of Grassland Agriculture*, (1985), 4th edition, M.E. Heath, R.F. Barnes, and D.S. Metcalf, Iowa State University Press, Ames, Iowa; price - $35.00.

d. *Hay and Forage Harvesting*, 3rd edition, 1987; available from John Deere Distribution Service Center, Service Publication, Dept 333, 1400-13th Street East Moline, Illinois 61244; textbook order number FMO-14103B; instructor's guide order number FMO-14502T; workbook order number FMO-14602W; slide set order number FMO-14203S.

e. *Principles of Field Crop Production*, (1976), Martin, J.H., Leonard, W.H., and Stamp, D.L., Macmillan Publishing Co., Inc., New York.

2. Filmstrips, slideshows, etc.

a. *Diseases of Alfalfa*, 42-frame filmstrip and script; available from Ohio Agriculture Education Curriculum Materials Center, Ohio State University, Columbus, Ohio 43210; approximate cost $6.40; order no. 113X.

b. *Diseases of Clover*, 40-frame filmstrip and script; available from Ohio Agriculture Education Curriculum Materials Center, Ohio State University, Columbus, Ohio 43210; approximate cost $6.10; order No. 114X.

c. *Stem Nematodes on Alfalfa*, Program #177; 6 minutes, VHS or Beta format; discusses history, symptomology and treatment; available from Agricultural Communications Center; 10 Ag Science Bldg., Moscow, Idaho 83843-4196, (208-885-6436); purchase cost $25; rental cost $10 for 14 days.

d. The following Current Information Series (CIS) publications are available from your local University of Idaho County Extension Office or from Agricultural Communications Center, Ag Publications Building, University of Idaho, Moscow, Idaho 83843-4196, (208-885-7982).

CIS	167	Doublecropping Dry Peas and Forage in Southern Idaho $.25
CIS	231	Idaho Insect Control Recommendations for Alfalfa Seed Production $.35
CIS	348	Buying and Selling Alfalfa Hay, Corn Silage, Barley $.25
CIS	447	Northern Idaho Fertilizer Guide: Alfalfa $.25
CIS	539	Setting a Price for Alfalfa Feeds $.35
CIS	635	Alfalfa Variety Performance and Use in Idaho $.45
CIS	736	Joseph and Nezpurs Idaho Fescue: Forage Grasses for the Intermountain Northwest $.45
CIS	827	Idaho Fertilizer Guide: Irrigated Alfalfa in Southern Idaho $.25
CIS	842	Factors Affecting Alfalfa Hay Quality $.25
PNW	223	Alfalfa Hay--Quality and Testing $.25
PNW	244	Selecting Alfalfa Varieties for the Pacific Northwest $.75
EXP	547	Idaho Forage Handbook $2.00
EXT	612	Producing Maximum Alfalfa Hay Yields and Quality Under Irrigation $.50
EXP	638	Winter Pea/Winter Cereal Mixtures as Potential Forage Crops in Northern Idaho $1.00
EXT	678	Late-planted Annual Summer Forages $.50
EXT	679	Variety Performances of Forage Crops in Northern Idaho $.50

B. Make transparencies and necessary copies of materials.

C. Provide students with objective sheet and discuss.

D. Provide students with information and assignment sheets and discuss.

E. Do a community survey on alfalfa production and publish the results in local paper.

F. Invite local alfalfa specialist to speak on alfalfa production.

G. Arrange for a field trip to view harvesting and handling of alfalfa.

H. Make arrangements with a seed company for class to visit local test plots and variety trials.

I. Collect and use dried plant material of major grasses and legumes; also collect and display seeds of forages.

J. Review and give test.

K. Reteach and retest if necessary.

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Leading Alfalfa Producing States
2. TM 2--Alfalfa Cut for Hay
3. TM 3--Common Forage Crops
4. TM 4--Parts of an Alfalfa Plant
5. TM 5--Factors to Consider in Selecting an Alfalfa Variety
6. TM 6--Potential Yield Levels of Irrigated Alfalfa in Southern Idaho
7. TM 7--Factors to Consider in Planting
8. TM 8--Characteristics of High Quality Alfalfa Hay
9. TM 9--Effects of Advancing Maturity on the Feed Value, Yield and Digestibility of Alfalfa Hay
10. TM 10--Factors to Consider in Cutting Hay
11. TM 11--Methods of Processing Hay
12. TM 12--Factors to Consider in Buying and Selling Alfalfa Hay
13. TM 13--Gains in Weight of Steers Affected by the Maturity of Alfalfa Fed

14. TM 14--Effects of Stage of Maturity of Green-chopped Alfalfa-brome Forage on Digestibility, Forage Intake and Milk Production

E. Assignment sheet

1. AS 1--Make Fertilizer Recommendations for Alfalfa

F. Answers to assignment sheet

G. Test

H. Answers to test

III. Unit references

A. *Alfalfa Analyst*, Certified Seed Council, Inc., Woodland, California.

B. Delorit, R.J., et al., *Crop Production*, 4th edition, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

C. Ensign, R.D., et al., *Idaho Forage Crop Handbook*, University of Idaho, CIS No. 547, Moscow, Idaho, 1975.

D. Ensign, R.D., et al., *Alfalfa Variety Performance and Use in Idaho*, University of Idaho, CIS No. 635, Moscow, Idaho, 1982.

E. Graham, J.H., et al., *Compendium of Alfalfa Diseases*, American Phytopathological Society, St. Paul, Minnesota, 1979.

F. Hannaway, D.B. and Adams, H.P., *Alfalfa Hay Quality and Testing*, University of Idaho PNW 223, Moscow, Idaho, 1982.

G. Hannaway, D.B., *Selecting Alfalfa Varieties for the Pacific Northwest*, University of Idaho PNW 244, Moscow, Idaho, 1984.

H. Painter, C.G., et al., *Idaho Fertilizer Guide--Irrigated Alfalfa*, University of Idaho, CIS No. 375 and 447, Moscow, Idaho, 1978.

I. Roylance, H.B. and Kolar, J.J., *Producing Maximum Yields on Irrigated Alfalfa Hay*, University of Idaho, CIS No. 635, Moscow, Idaho, 1982.

J. Ryerson, D.K., et al., *Producing Maximum Alfalfa Hay Yields and Quality Under Irrigation*, University of Idaho Bulletin No. 612, Moscow, Idaho, 1982.

FORAGE PRODUCTION

AG 320 - E

INFORMATION SHEET

I. Terms and definitions

A. Forage--Vegetative material in a fresh, dried or ensiled state which is fed to livestock

B. Crown--The part of the plant usually at or just below ground level between the root and the shoot

C. Crowning--Plowing at a shallow depth in the fall to partially kill the plants in a tough hay sod in preparation for normal plowing and working in the spring

D. Regrowth--Crown bud regrowth

E. Resistance--Percentage of plants that resist disease

F. 1/10 bloom--One plant in ten in bloom

G. Ensile--A process wherein fresh or slightly wilted forage is placed in air-tight storage and allowed to ferment and produce acids which then preserve it

H. Silage--Forage chopped and stored at 60 to 70 percent moisture and allowed to ferment, producing an acid condition that preserves it

I. Symbiotic nitrogen fixation--Nitrogen fixation by bacteria that live in the roots of leguminous plants

J. Inoculation--The application of symbiotic nitrogen-fixing bacteria to the seed of legumes or to the soil in which such legumes are to be grown

K. Green manure crop--A crop, usually a nitrogen-fixing legume, grown and plowed down while still green to add organic matter and nitrogen to the soil

L. Bloat--Puffing up or swelling due to the collection of gas in the rumen of the animal

M. Carotene--Provitamin A; it is found in the leaves and other green parts of plants, and when eaten is changed to vitamin A

II. Leading forage producing states (Transparencies 1, 2)

A. All hay production

1. California

2. Minnesota

3. Iowa

4. Nebraska

5. Texas

6. Kansas

B. Alfalfa hay

1. California

2. Iowa

3. Minnesota

4. Wisconsin

5. Nebraska

6. Idaho

III. Economic importance of forage production to Idaho (1988)

A. Alfalfa hay

1. 920,000 acres harvested

2. 3.8 tons per acre average yield

3. 3,496,000 tons total production

4. $271,942,500 total value

B. All hay

1. 1,140,000 acres harvested

2. 3.4 tons per acre average yield

3. 3,881,000 tons total production

4. $298,837,000 total value

IV. Common forage crops (Transparency 3)

A. Legumes

1. Alfalfa

(Note: Many varieties are available to the alfalfa producer. The variety used will depend on the local disease and insect problems, and on the adaptability of that variety to the area. Consult your local county extension agent or seed specialist to determine which variety will best fit your needs.)

2. Red clover

3. Birdsfoot trefoil

B. Grasses (non-legumes)

1. Smooth brome grass

2. Orchard grass

3. Tall fescue

4. Intermediate wheatgrass

V. Parts of an alfalfa plant (Transparency 4)

A. Leaves

B. Stems

C. Nodules

D. Roots

VI. Factors to consider in selecting an alfalfa variety (Transparency 5)

A. Disease resistance

(Note: A variety is considered resistant if over 30% of plants survive under known disease or insect infestation.)

B. Insect resistance

C. Adaptability to area

(Note: This would include factors such as winter hardiness, limited moisture, etc.)

D. Regrowth after hay harvest

E. Palatability

F. Yield over 5 year period

(Note: The selection of an alfalfa variety has become very confusing to many hay growers. Many new varieties have been released by private companies as well as state universities and the USDA. The new variety releases have been advantageous for the hay grower. Most varieties are high yielding, fast recovery, disease and insect resistant plants. They are capable of 10% to 20% increased yield over old varieties, depending on the disease and insect problems of local growing conditions. Lists are available rating the different varieties on the percent resistance bred into them, or by letter rating.

This letter standard is set up by the Plant Variety Protection Board. The variety will be letter rated as:

S (susceptible)--1% to 5% resistant
LR (low resistance)--6% to 15% resistant
MR (moderate resistance)--16% to 30% resistant
R (resistant)--31% to 50% resistant
HR (high resistance)--more than 50% resistant

A grower can use these lists to compare varieties and aid in making their final decision when they know pest and disease problems for their area.)

VII. Characteristics of a desirable seedbed

A. Firm and well packed

B. Deep, well drained loam

C. Fairly level

D. Free of large clods

E. Adequate available moisture

F. Free of weeds

VIII. Factors to consider in planting (Transparencies 6, 7)

A. Depth of planting

1. Clay soil--1/4 to 1/2 inch

2. Loam soils--1/4 to 1/2 inch

3. Sandy soils--1/4 to 3/4 inch

(Note: A seeding depth of over 3/4 inch will result in very high mortality or very weak seedlings.)

B. Row spacing--6 or 7 inches

(Note: Alfalfa is usually seeded with a drill equipped with depth regulators. Drills distribute the seed more uniformly and assure proper soil coverage to increase the possibility of successful stand establishment. Six or seven inches is the normal spacing for seeders on a drill. Just prior to sowing, inoculate legumes with proper rhizobia.)

C. Time of seeding--Will vary depending upon elevation. Plant as early in the spring as possible, consistent with seedbed preparation and frost hazard

(Note: In southwest Idaho irrigated areas with a long growing season, forage crops may be successfully seeded as late as August 1 to August 15. This allows the seedling to become well established before fall freeze-up and results in minimum winter-killing as compared to later seeding. Late fall seeding is recommended where average rainfall is less than 12 inches annually. The seeding should be made late enough in the fall so that the seeds do not germinate until the following spring.)

D. Rate of seeding

1. Without a companion crop--12 to 15 pounds per acre

(Note: A good, thick stand is important for rapid establishment and production of fine-stemmed, weed-free, high quality alfalfa hay. Alfalfa planted without a companion crop normally results in the best stands of hay. Seeding rates of 12 to 15 pounds per acre will provide about 65 to 70 seeds per square foot. Generally only 30% to 40% of seedlings will survive from seed count. For good quality and production, the starting stand count should be around 18-20 plants per square foot.)

2. With a companion crop--15 to 18 pounds per acre alfalfa plus 40 to 50 percent of normal seeding rate of the grain

(Note: Many growers prefer to seed alfalfa with a companion grain crop or with peas. Alfalfa seeded with a small grain crop sometimes results in thin or spotty stands due primarily to crop competition or lodging.)

IX. Advantages of a companion crop

A Reduction of erosion

B. Reduction of weed competition

C. Provides a source of income during the year the forage crop is becoming established

X. Disadvantages of a companion crop

A. Competition between alfalfa and companion crop for water, nutrients and light

(Note: Companion crops should never be used in areas where a moisture shortage is likely to develop early in the season or on non-irrigated farmland.)

B. Reduced forage yields

C. Sometimes results in thin or spotty stands

XI. Companion crops

A. Peas

(Note: Peas are the best companion crop. Peas mature early and have less competitive effect on forage seedlings than any of the cereals.)

B. Barley

C. Oats

D. Spring wheat

(Note: When cereal companion crops are used, the seeding rate should be reduced by one-half. Manage companion crop to promote legume seeding.)

XII. Fertilizer needs of alfalfa

(Note: Alfalfa hay removes large quantities of nutrients from the soil. Before planting alfalfa, have the soil tested and, if the soil test indicates fertilizer is needed, apply when preparing the seedbed. Phosphorus and potassium can also be applied on established stands of alfalfa. Fall fertilizer applications are recommended for best results.)

A. Nitrogen--None required because alfalfa has nitrogen-fixing bacteria (rhizobium) that convert atmospheric nitrogen to a plant available form

B. Phosphorus--Very important to alfalfa production. Work into top 6 inches of seedbed 2 weeks before seeding

C. Potassium

(Note: Fertilizer guides are available from the University of Idaho that correlates with soil test results. Base fertilizer applications on soil test results. For assistance, contact your local county extension agent or crop management specialist.)

XIII. Forage diseases

A. Phytophthora root rot

1. Symptoms--Yellowish-brown rotted areas on the roots that may extend to the crown, killing the plant; the rotted areas turn black later

(Note: When tap root has rotted off, it is very likely that phytophthora is the cause.)

2. Causal agent--Soil-borne fungi, poorly drained soil

3. Methods of control

a. Plant resistant varieties

b. Crop rotation

B. Bacterial wilt

1. Symptoms--Yellowish-brown discoloration in the woody cylinder of the tap root. Plants become stunted with many yellow shoots having small, cupped leaves

2. Causal agent--Bacteria that survives in dead alfalfa tissue in the soil

3. Method of control

a. Plant resistant varieties

b. Crop rotation

C. Verticillium wilt

1. Symptoms--Wilting of upper leaves at prebud to floral stage; may affect only part of plant, such as the stem on one side of the crown (this is a common characteristic of verticillium not common to other wilts); leaves curl along midrib and eventually die; yellowish to brown discoloration present in the woody cylinder of the tap root

2. Causal agent--Fungi

3. Methods of control

a. Plant resistant varieties

b. Crop rotation

D. Other important diseases

1. Spring black stem

2. Common leaf spot

3. Downey mildew

XIV. Beneficial insects of forage crops

A. Lady beetles

1. Adult--Black-spotted, bright orange beetles; larger lady beetles are about 1/4 to 1/3 inch long and prey on aphids, mealybugs, scale insects and spider mites. The tiny black lady beetle is about 1/6 the length of the larger lady beetles and preys on spider mites

2. Larva--Dragon-like; a full-grown larva will be about 2/5 to 3/5 inch long, elongated in form and usually covered with spines; many are brightly colored with dark spots

B. Damsel bugs

1. Adult--Slender, 3/8 to 1/2 inch insects with piercing-sucking mouthparts. Their tan-to-gray bodies are narrowed at the front and have somewhat enlarged front legs for grasping their prey. They feed on lygus bugs, aphids, leafhoppers, spider mites and small caterpillars

2. Nymph--Very similar to adult except that the smaller ones don't have wing pads

C. Green lacewings

1. Adult--Slender green body; long, thin antennae; large membranous wings with lace-like veins; feed on nectar and honeydew

2. Larva--Look like alligators with long, sickle-shaped jaws; impale aphids, other small insects, eggs and spider mites on their mandibles and suck them dry

D. Syrphid flies, flower flies or hover flies

1. Adult--Resembles a bee or wasp as it hovers around and alights on flowers; 1/4 to 3/5 inch long; feeds on nectar, pollen and honeydew

2. Larva--1/4 to 1/2 inch long, spindle-shaped; brown or green, wrinkled maggots; use their mouth hooks to seize and hold aphids while sucking their body fluids out

XV. Harmful insects of forage crops

A. Alfalfa stem nematodes

1. Description--Small parasitic round worms about 1/64 to 1/8 inch long; they live in the soil and usually move into the plant through the roots

2. Damage--Live in plant tissue and cause direct damage to vascular system; thickened stem bases and reduced growth result

3. Methods of control

a. Plant resistant varieties

b. Crop rotation

B. Pea aphid

1. Description--Large, bright green aphid

2. Damage--Sucks plant juices causing the plants to wilt

3. Methods of control

a. Plant resistant varieties

b. Natural enemies

c. Chemical control

C. Spotted alfalfa aphid

1. Description--This tiny aphid is light yellowish-green or straw colored with rows of dark spots on its back

2. Damage--Sucks the juices from both the leaves and the stalks of the plant and, at the same time, injects a toxic substance that causes the leaves to curl, turn yellow and drop off

3. Methods of control

a. Natural enemies, such as the lady beetle, damsel bugs and lacewing flies

b. Plant resistant varieties

c. Chemical control

D. Alfalfa weevil

1. Description--Newly emerged adult is grayish in color with a triangularly shaped brownish stripe down the back. As they get older, they become darker brown

2. Damage--Feeding on alfalfa by larval and adult forms

3. Methods of control

a. Natural enemies

b. Use good cultural practices

c. Chemical control

XVI. Weed competition with forage crops

A. Competition for water

B. Competition for plant nutrients

C. Competition for light

(Note: Forage crops and weeds have the same basic requirements for normal growth and development. In a mixed community of crops and weeds, the more aggressive species will dominate.)

XVII. Losses caused by weeds

A. Decreased yield

B. Decreased crop quality

1. Reduced total digestible nutrients

2. Reduced total digestible protein

3. Reduced palatability

C. Cost of control activities

XVIII. General categories of weeds

A. Annual--Completes life cycle within a period of one year

B. Perennial--Lives for three years or more, and can reproduce sexually and asexually by means of rhizomes and stolons

C. Broadleaf--Plants with shorter, wider leaves that usually have pinnate or netted veination; dicots

D. Grass--Plants with longer, narrower leaves with parallel veination; monocots

XIX. Methods of weed control

A. Cultural

B. Mechanical

C. Chemical

XX. Characteristics of high-quality alfalfa hay (Transparencies 8, 9)

A. Leafiness

(Note: High quality hay contains about 50 percent leaves. These leaves provide 50 to 75 percent of the digestible matter, 70 percent of the protein and 90 percent of the carotene found in alfalfa hay. Any leaf loss reduces the nutritive value in hay.)

B. Harvested at correct stage of maturity

(Note: As alfalfa gets closer to full maturity, the less the amount of total digestible nutrients. Nutrients, especially protein and phosphorus, are at their highest level at bud state of the plant. The best time for harvesting is at first bloom. Do not wait until 1/2 bloom.)

C. Natural green color

(Note: Bright green hay indicates high levels of carotene. Bright, prolonged sunlight will destroy this valuable provitamin on mowed hay.)

D. Free of foreign material

(Note: Weeds and other foreign material result in decreased palatability and feeding value.)

E. Correct moisture content

(Note: For baled hay, the moisture for storage should be 15 to 20 percent. Hay of higher moisture content should not be stored. In addition to the danger of molding the hay, there is a possibility of spontaneous combustion resulting in a costly fire.)

XXI. Factors to consider in cutting alfalfa hay (Transparency 10)

A. Cut at correct stage of maturity

(Note: Recommended stage of maturity for cutting of alfalfa hay is when one plant in ten has primary bloom, or not more than 1/2 or 3/4 crown bud regrowth.)

B. Put into windrows

(Note: Fewer leaves are lost when the hay is put into windrows. Since the leaves contain more nutrients than the stems, it is important to save as many of them as possible. Windrows should be wide, flat and fluffy to facilitate faster drying. A swather will cut, condition and put hay into windrows in one operation.)

C. Use hay conditioner on swather

(Note: Proper setting of conditioner will leave wide, flat and fluffy windrows to facilitate faster drying of hay than high, tight windrows. Tests have shown that the use of a hay conditioner will reduce hay drying time by about one full day.)

D. Turn windrows over when necessary

(Note: Turning windrows at 30 percent moisture will speed up drying and removal of hay by a least 24 hours. This will reduce the chance of rain damage. Also the faster the hay can dry and be removed, the less damage to regrowth of following crop. If hay is rained on when it is still in the windrow, it may be necessary to turn it over with a rake to prevent spoilage. Rake two windrows into one so that fewer passes with baler will be required and to reduce soil compaction.)

E. Last crop should be cut 4 to 5 weeks prior to first killing frost

(Note: In some areas it is best to leave the crop until the first killing frost and then cut to prevent regrowth. The time lapse between the last hay cutting and the first killing frost must allow enough regrowth to occur to replenish the root reserves for winter hardiness and early spring growth. The residue after killing frost may be grazed or removed for hay.)

XXII. Methods of processing hay (Transparency 11)

A. Baling

(Note: Baling is a general term and may refer to two-string, three-string or one-ton bales. Most bales to be used on the home farm are two-string bales or the one-ton round bales if handling equipment is available. Most bales for export out of state are three-string.)

B. Chopping

(Note: Where alfalfa is to be used on the farm where produced, chopping of the cured hay in the field may be practical. Advantage of chopped hay is less waste since stock will consume both leaves and stems. Since chopped hay packs tightly, it must have a low moisture content of 10 to 14 percent at time of storage.)

C. Pelleting and wafering

(Note: These processes make the hay into a compact and convenient form for handling and feeding. Pellets require less storage and fit in today's continuous-flow feeding systems.)

D. Alfalfa meal

E. Haylage

F. Silage

XXIII. Factors to consider in buying and selling alfalfa hay (Transparencies 12, 13, 14)

(Note: Alfalfa supplies a major share of feed nutrients for the dairy and livestock industry of Idaho. Since the concentration of nutrients is quite variable in most feeds, value is also variable. Differences in nutrient content mean dollars and cents to the livestock or dairy producer.)

A. Maturity at which hay was harvested

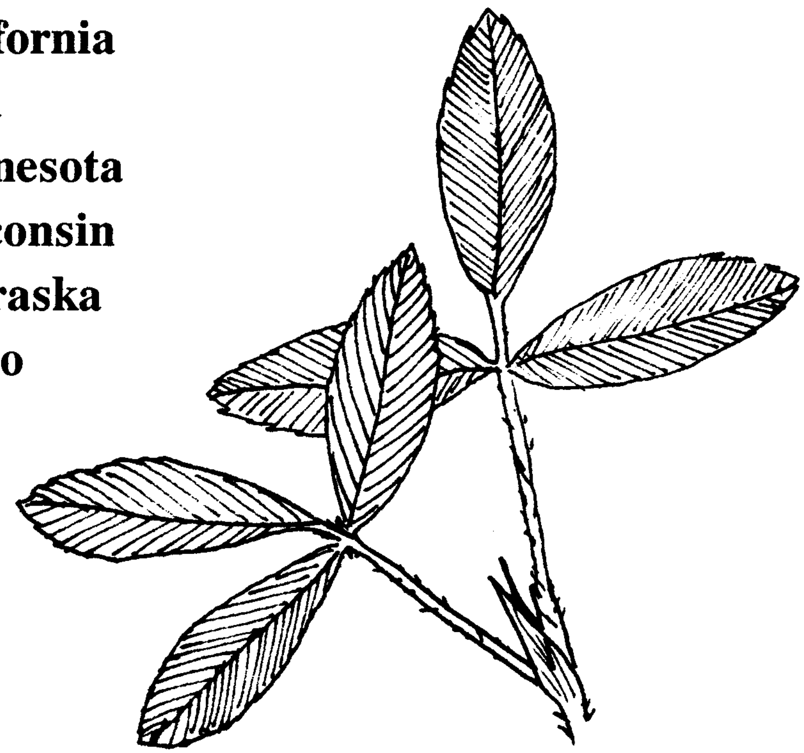
B. Crude protein

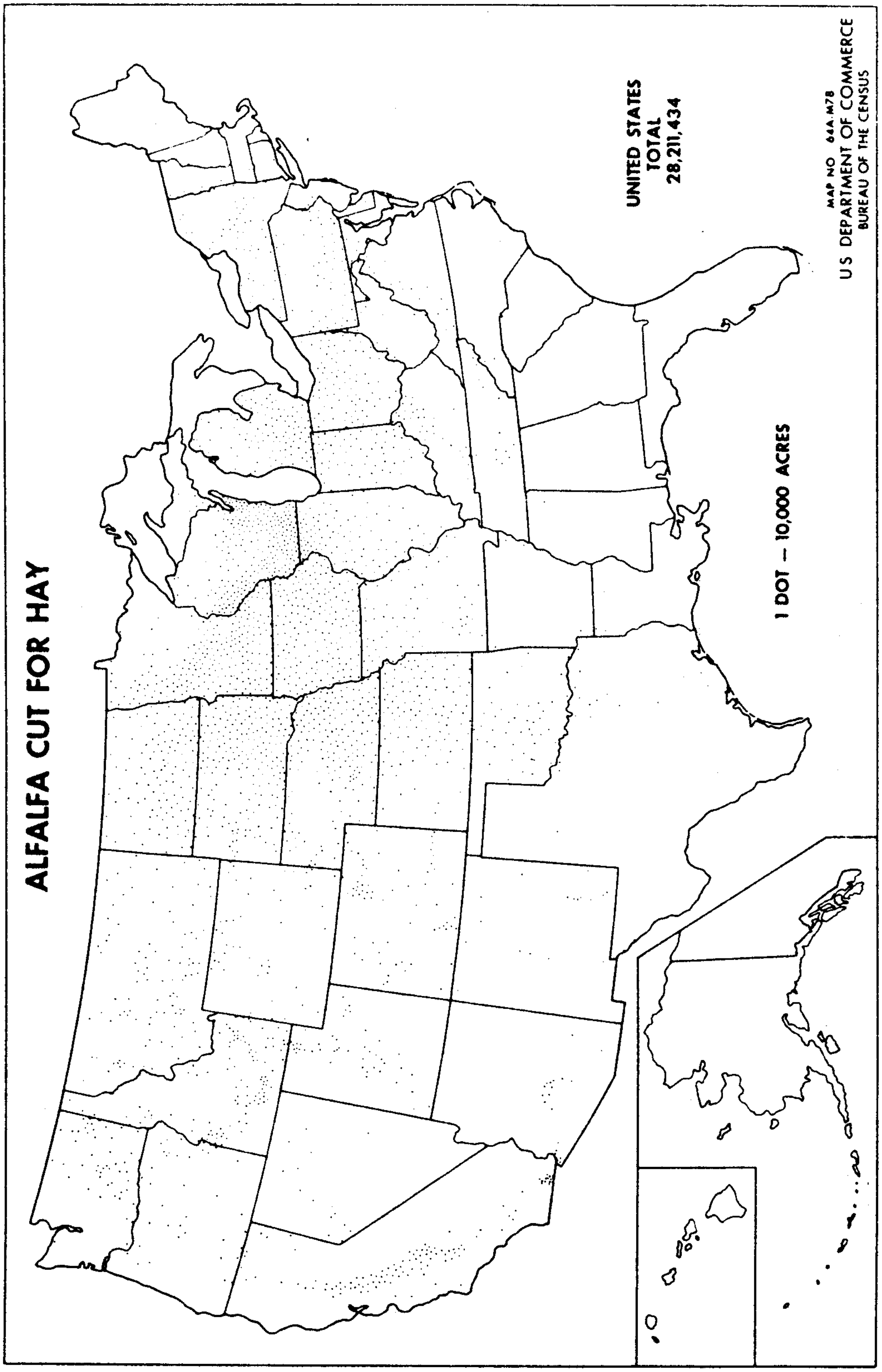
C. Moisture or dry matter

(Note: Using a combination of crude protein and dry matter, average selling price can be adjusted to reflect the nutrient and feeding value of the hay. Refer to University of Idaho CIS #539, Setting a Price For Alfalfa Feeds, for further information or contact your local county extension agent.)

Leading Alfalfa Producing States

1. California
2. Iowa
3. Minnesota
4. Wisconsin
5. Nebraska
6. Idaho




ALFALFA CUT FOR HAY
UNITED STATES
TOTAL
28,211,434
1 DOT — 10,000 ACRES
MAP NO 64A-M78
U S DEPARTMENT OF COMMERCE
BUREAU OF THE CENSUS

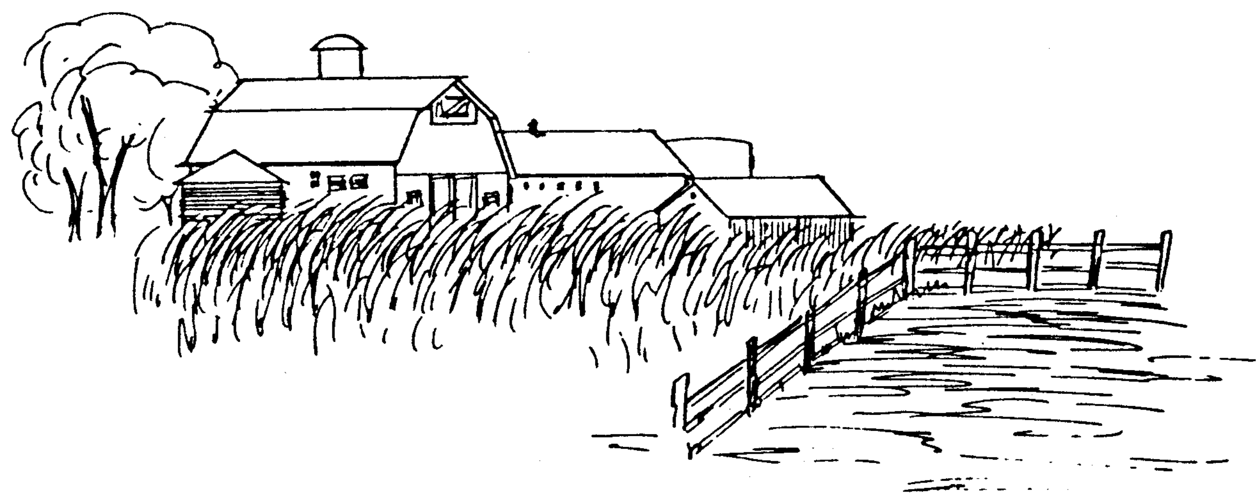
Common Forage Crops

Legume

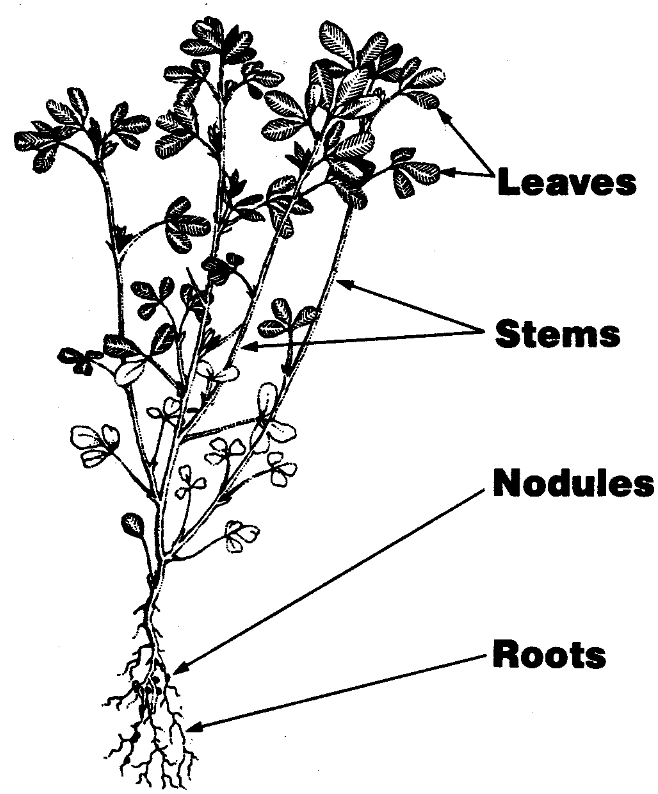
1. Alfalfa
2. Red Clover
3. Birdsfoot Frefoil

Non-Legume

1. Smooth Brome Grass
2. Orchard Grass
3. Tall Fescue
4. Intermediate Wheatgrass

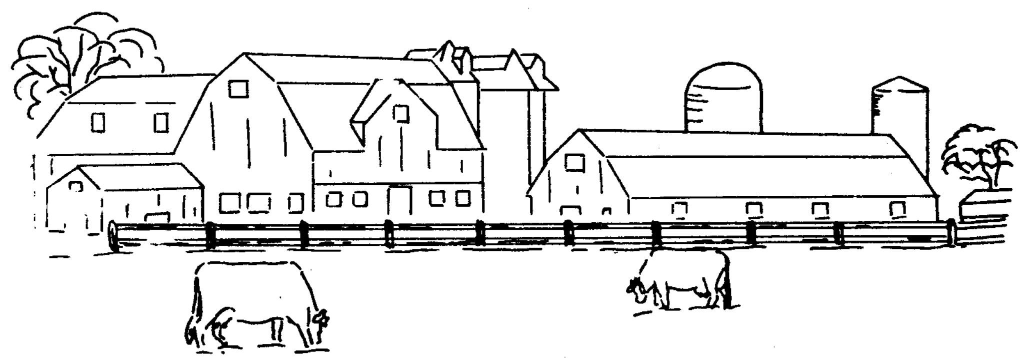


Parts of an Alfalfa Plant

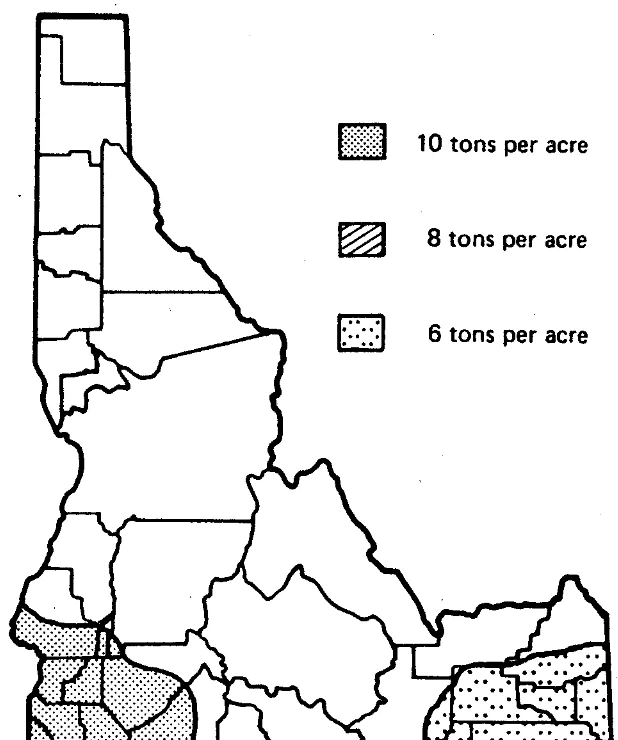


Factors to Consider in Selecting an Alfalfa Variety

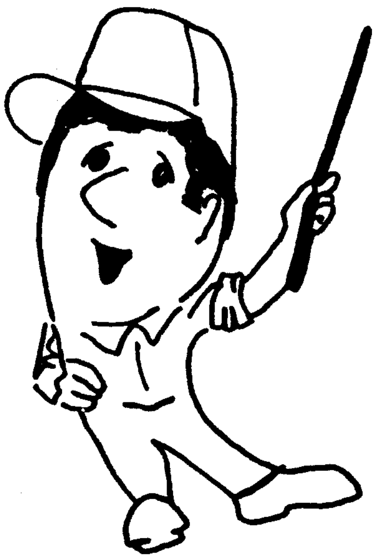
1. Disease Resistance
2. Insect Resistance
3. Adaptability to area
4. Regrowth after harvest
5. Palatability
6. Yield over 5 year period



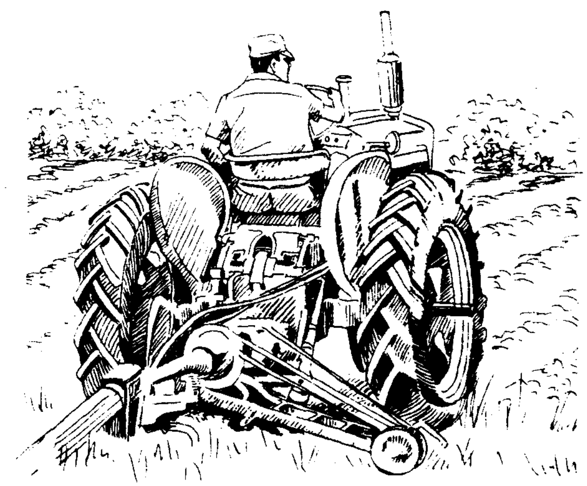
Potential Yield Levels of Irrigated Alfalfa in Southern Idaho



Factors to Consider in Planting

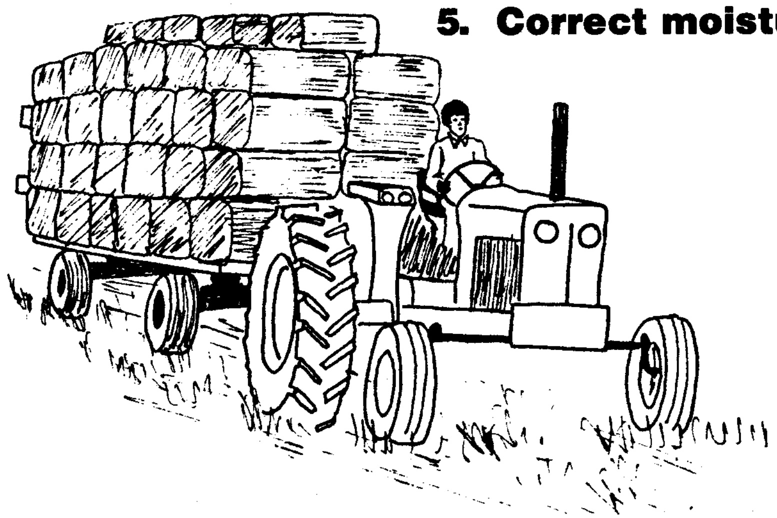


1. Depth of planting
2. Rowspacing
3. Time of seeding
4. Rate of seeding

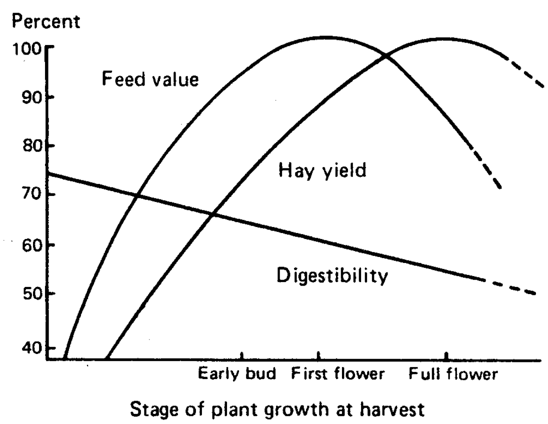


Characteristics of High Quality Alfalfa Hay

1. **Leafiness**
2. **Harvested at correct stage of maturity**
3. **Natural green color**
4. **Free of foreign material**
5. **Correct moisture content**



Effects of Advancing Maturity on the Feed Value, Yield and Digestibility of Alfalfa Hay



FACTORS TO CONSIDER IN CUTTING ALFALFA HAY

Cut at correct stage of maturity

Put into windrows

Use hay conditioner on swather

Turn windrows over when necessary

Last crop cut 4-5 weeks before first killing frost

METHODS OF PROCESSING HAY

Baling

Chopping

Pelleting and wafering

Alfalfa meal

Haylage

Silage

FACTORS TO CONSIDER IN BUYING AND SELLING ALFALFA HAY

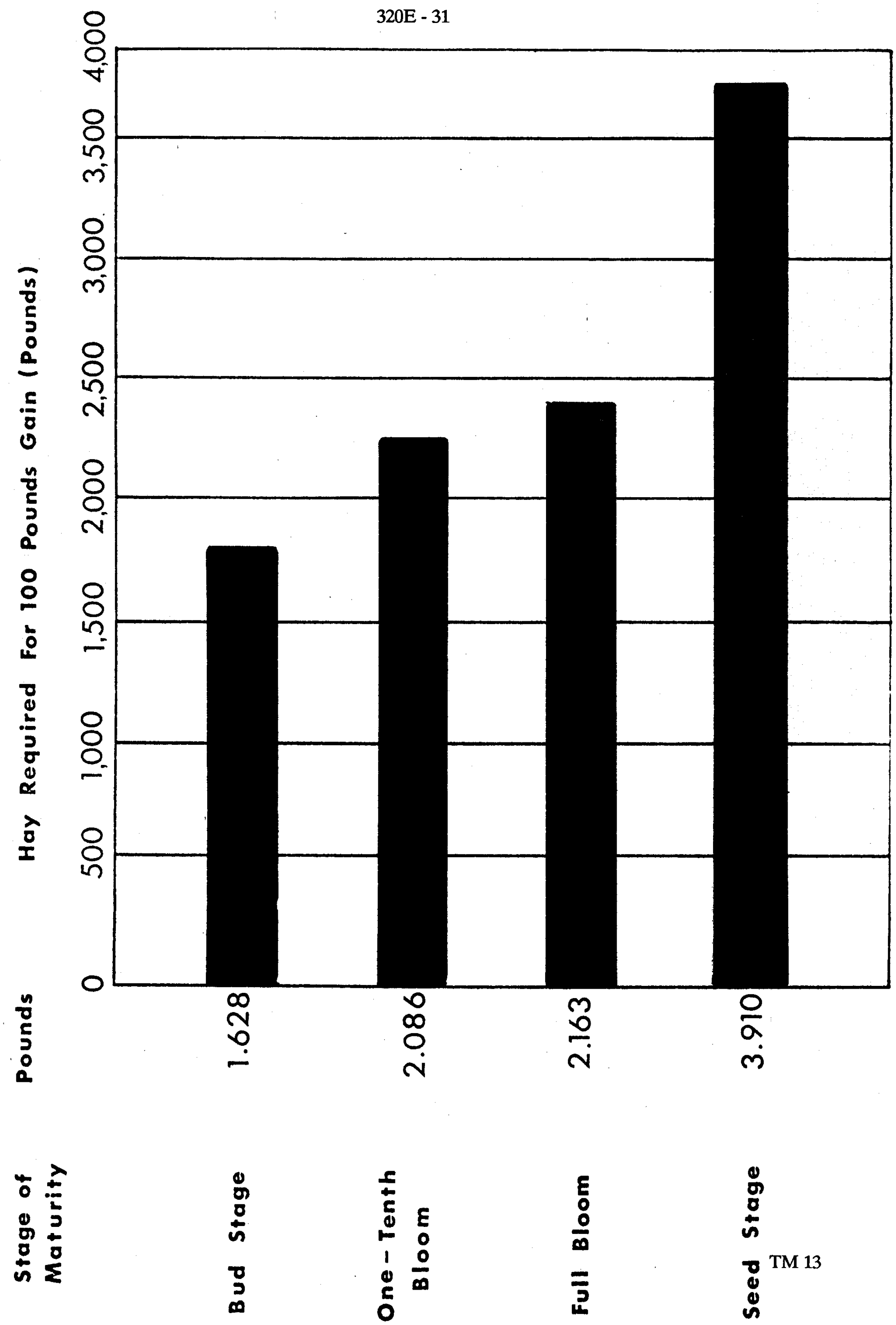
Maturity at which hay was harvested

Crude protein

Moisture or dry matter

320E - 31

Gains in Weight of Steers Affected by the Maturity of the Alfalfa Fed.



TM 13

Effects of Stage of Maturity of Green-Chopped Alfalfa-Brome Forage on Digestibility, Forage Intake and Milk Production.[1]

Stage of Maturity	Harvest Date	Dry Matter Digestibility	Dry Matter Intake	Digestible Dry Matter Intake	Fecal Dry Matter	Milk Production	Amount of Grain Needed
		%	lbs/day[2]	lbs/day[2]	lbs/day[2]	lbs/day	lbs/day[3]
Alfalfa							
prebud	5/17	66.8	34.0	23.0	11.1	42.5	4.0
bud	5/24	65.0	33.2	21.6	11.6	39.5	5.7
early bloom	5/31	63.1	32.0	20.2	11.8	31.4	8.4
midbloom	6/7	61.3	30.6	18.8	11.8	31.4	10.9
full bloom	6/14	59.4	29.2	17.4	11.8	26.5	13.5
late bloom	6/21	57.5	27.8	16.0	11.8	23.4	15.7
mature	6/28	55.8	26.3	14.7	11.6	19.5	18.2

[1] Fed free-choice with 3 to 5 lbs. concentrate.
[2] Pounds per day per 1,000 pounds body weight.
[3] Amount of grain needed per 1,000 pound cow per day to have maintained the level of milk production on 5/17.

FORAGE PRODUCTION

AG 320 - E

ASSIGNMENT SHEET #1--MAKE FERTILIZER RECOMMENDATIONS FOR ALFALFA

Name ______________________________________ Score________________________________

Using the information provided on the soil test report for Hey Maker, and the University of Idaho CIS #827--Idaho Fertilizer Guide for Irrigated Alfalfa, recommend the amount of each nutrient that will need to be applied to achieve an average yield. Refer to the fertilizer guide for more complete directions.

Part I See next page

Soil Test Request and Report Form

Form #88

DO NOT WRITE IN THIS SPACE
Lab no.
Fee
Status: Paid Bill Other
Check no.

Analytical Services Laboratory
College of Agriculture
Moscow, ID 83843-4196
(208) 885-6201

University of Idaho

Mailing Name Hey Maker
Address Ada County

Phone:

Date:

FIELD INFORMATION			
Irrigation: ☐ Sprinkler ☐ Furrow ☐ None			
Rotation	Crop	Fertilizer applied lb/acre	Yield
Next crop	Alfalfa		
Previous crop	Alfalfa		
Grown in 19( )			
Grown in 19( )			

County:

Grower:

Sample Identification:

☑ CHECK TEST REQUIRED: Please make checks payable to **Bursar, University of Idaho.**

☒ Standard Fertility Test* ($10.00)
*Includes drying and grinding ($1.50), pH, P, K and O.M.

___ Bicarbonate P & K ___ Acetate P & K

☐	pH (soil reaction)	$ 1	7.1
☐	Available P (ppm P)	$ 3	5.0
☐	Available K (ppm K)	$ 3	84
☐	Organic matter (%)	$ 3	3.5
	Other Tests:		
☒	Sulfate-S (ppm S)	$ 3	4.0
☐	Boron (ppm B)	$ 5	
☐	Total Salts (E.C.) (mmhos/cm)	$ 2	
☐	Gypsum Requirement	$20	
☐	Lime Requirement	$ 4	
☐	Cation Exchange Capacity (meq/100g)	$ 7	
☐	Zinc (ppm Zn)	$ 4	
☐	Copper (ppm Cu)	$ 4	
☐	Manganese (ppm Mn)	$ 4	
☐	Iron (ppm Fe)	$ 4	

Depth (feet)	Nitrate N (ppm)	Ammonium N (ppm)	Available Moisture (inches)
0-1	☐	☐	☐
1-2	☐	☐	☐
2-3	☐	☐	☐
3-4	☐	☐	☐
4-5	☐	☐	☐
5-6	☐	☐	☐
6-7	☐	☐	☐
Total			

$3 per test ppm × 4 = lb/acre

Cations:	Extractable	Soluble
Calcium	☐	☐
Magnesium	☐	☐
Sodium	☐	☐
Potassium	☐	☐

$3 per test SAR

Contact the Analytical Services Laboratory for other special analyses.

FERTILITY GUIDE

Pounds Per Acre						
N	P_2O_5	K_2O				

Remarks:

If you wish further details or have questions concerning the soil analysis, please contact your University of Idaho County Extension Agent.

White — Grower copy • Yellow — Fertilizer Dealer copy • Pink — Ag Agent copy • Goldenrod — Laboratory copy

Part II

A. Why is nitrogen fertilizer generally not needed for alfalfa?

B. In what situation would it be advisable to apply nitrogen fertilizer?

C. What nutrient is seldom deficient in areas irrigated with water from the Snake River?

D. Alfalfa fields in southern Idaho frequently become yellow during growth of the second and third crop. What would you recommend in this situation?

E. What other factors could affect the ability of alfalfa to get nutrients from the soil (other than level of nutrients in the soil)?

University of Idaho
College of Agriculture
Cooperative Extension System
Agricultural Experiment Station

Current Information Series No. 827

Idaho Fertilizer Guide

Irrigated Alfalfa In Southern Idaho

Raymond G. Gavlak, Extension Soils Specialist

The following fertilizer guidelines are based on relationships established between University of Idaho soil tests and crop yield response. The fertilizer rates suggested are based on research results and are designed to produce above-average yields if other factors are not limiting production. Thus, the fertilizer guide assumes use of good crop management practices.

The suggested fertilizer rates will be accurate for your field provided (1) the soil samples represent the area to be fertilized and (2) the crop history information supplied is complete and accurate.

Nitrogen

Nitrogen (N) fertilizer is generally not needed for alfalfa since a healthy alfalfa stand is capable of fixing adequate levels of N. Responses to applied N usually indicate the alfalfa stand is not effectively nodulated due to lack of proper seed inoculation at planting, or that the stand is aging.

Soils containing 20 to 30 pounds (4 to 7.5 ppm) of nitrate-nitrogen (NO_3-N) in the top 12 inches have sufficient N to establish a stand of alfalfa seeded alone. Adding fertilizer N at establishment reduces nodule number and nodule activity.

Establishing alfalfa with a companion crop is not recommended because the alfalfa stand typically is reduced by the excessive competition from the companion plantings. When growers plant alfalfa with a companion crop, both crops compete for the N. Under these conditions, N rates of 30 to 40 pounds per acre are suggested to establish alfalfa stands.

Phosphorus

Alfalfa responds well to applied phosphorus (P). The need for P fertilization can be determined by a soil test. Phosphorus materials should be broadcast and incorporated into the seedbed before planting.

For best results, P fertilizers should be applied on established stands in the fall. Rates of P relative to soil test levels are given in Table 1. The recommended application should be sufficient for 2 years of production.

Table 1. Phosphorus fertilizer rates based on a soil test.

Soil test* (0 to 12 inch)	Apply (P_2O_5)
(ppm)	(lb/acre)
0	160
3	120
7	60
over 10	0

*P test by $NaHCO_3$ extraction.

Potassium

Alfalfa has a high potassium (K) requirement. Recommended K fertilization levels are determined by soil test (Table 2). Broadcast and incorporate K at establishment or apply in the fall or early spring on established stands.

Table 2. Potassium fertilizer needs based on a soil test.

Soil test* (0 to 12 inch)	Apply (K_2O)
(ppm)	(lb/acre)
0	240
56	160
112	80
150	0

*K test by $NaHCO_3$ extraction.

Sulfur

Mountain valleys and foothill areas that receive higher amounts of precipitation and/or that are irrigated with low sulfur-containing water are likely areas for sulfur (S) deficiency. Areas irrigated with water from the Snake River or any water containing the sulfate (SO_4) form of sulfur should have an adequate amount of S.

Alfalfa and other legumes require more S than grasses. Plant tissue testing is an excellent tool for detecting S-deficient alfalfa. Samples should be analyzed for total N and total S. These values are used to calculate the nitrogen/sulfur ratio, which should be less than 15. When the ratio is greater than 15, an S deficiency is suspected.

Soils testing less than 8 ppm SO_4-S for 0- to 12-inch soil depth should receive 40 pounds S per acre. This rate of application should provide adequate sulfur for 2 years of production. Many southern Idaho soils contain accumulated S below the 12-inch depth. Although the 0- to 12-inch soil zone may be low in S (8 ppm), the soil below 12 inches may supply enough S for alfalfa production. Thus, testing the soil at both 0- to 12- and 12- to 24-inch depths is advised for a good S recommendation.

Fertilizer S sources include gypsum ($CaSO_4$) and elemental sulfur. S is also included in some N, P and K fertilizer materials. Elemental S must be biologically converted to the SO_4 form to be used by the plant. The rate of conversion depends on soil temperature, soil water content and particle size of the elemental S applied. To correct an S deficiency the year of application, use a fertilizer containing SO_4 as the readily available S source. Elemental S can be used to provide long term S release.

Micronutrients

Zinc (Zn) deficiencies on alfalfa have not been observed in Idaho. Crops such as beans, corn, potatoes and onions would normally exhibit Zn deficiency before alfalfa. Zinc applied to any of those crops would have sufficient residual for alfalfa.

Boron

Alfalfa is sensitive to low soil boron (B). B deficiencies have been observed in southern Idaho, but they are not widespread. Deficiencies normally occur on acidic soils (pH less than 7.0) and droughty (gravelly and sandy) soils. If the soil tests less than 0.25 ppm B, apply 1 to 3 pounds per acre of B. Do not use higher rates because B in excessive amounts is toxic to plants.

General Comments

1. Complete information on cultural practices necessary for alfalfa production is contained in University of Idaho Current Information Series 144, *Producing Maximum Yields of Irrigated Alfalfa Hay.*
2. Irrigation, weeds and insects can influence the effectiveness of a fertilizer application.
3. Alfalfa fields in southern Idaho frequently become yellow during the regrowth of the second and third crop. These fields have not responded to applications of fertilizer to correct this temporary yellowing condition.
4. Alfalfa can become a cash crop in the rotation by the application of needed management inputs such as water, fertilizer and pesticides and by timely harvesting. Alfalfa quality is enhanced by cutting at the early bud stage and more frequently during the growing season. This practice will reduce stand life, however.
5. Alfalfa hay should be analyzed to determine P content. Phosphorus is important for animal nutrition and can greatly influence animal performance and animal health. Fertilization can increase P content of forage.
6. Applications of S have been shown to reduce alfalfa selenium (Se) concentrations on soils low in available Se. Levels of Se above 0.1 ppm in the dry forage are considered adequate to prevent white muscle disease and other disorders related to limited Se forage.

Issued in furtherance of cooperative extension work in agriculture and home economics, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, LeRoy D. Luft, Director of Cooperative Extension System, University of Idaho, Moscow, Idaho 83843. We offer educational programs, activities and materials without regard to race, color, religion, national origin, sex, age or disability, in accordance with state and federal laws.

1M, 7-88, 250 6-91 (reprint)

25 cents per copy

FORAGE PRODUCTION

AG 320 - E

ANSWERS TO ASSIGNMENT SHEET

Assignment Sheet #1

Part I

Soil Fertility Guide

Pounds Per Acre						
N	P_2O_5	K_2O	P	K	Sulfur	
—	90	120	40	100	40	

Part II

A. Alfalfa can use atmospheric nitrogen with the help of rhizobia bacteria in modules on roots

B. When seeding with companion crop

C. Sulfur

D. Condition is temporary; alfalfa will not respond to fertilizer application; no action taken

E. Evaluated to satisfaction of instructor

FORAGE PRODUCTION

AG 320 - E

UNIT TEST

Name ______________________________________ Score________________________________

1. Match the terms associated with forage production to the correct definitions. Write the correct number in the blank.

_____a.	The part of a plant usually at or just below ground level between the root and the shoot	1. Forage
		2. Crown
_____b.	Nitrogen fixation by bacteria that live in the roots of leguminous plants	3. Crowning
_____c.	A process wherein fresh or slightly wilted forage is placed in air-tight storage and allowed to ferment and produce acids which then preserve it	4. Regrowth
		5. Resistance
_____d.	Provitamin A; it is found in the leaves and other green parts of plants, and when eaten is changed to vitamin A	6. 1/10 bloom
		7. Silage
_____e.	Vegetative material in a fresh, dried or ensiled state which is fed to livestock	8. Ensile
		9. Inoculation
_____f.	Crown bud regrowth	10. Green manure crop
_____g.	A crop, usually a nitrogen-fixing legume, grown and plowed down while still green to add organic matter and nitrogen to the soil	11. Bloat
		12. Carotene
_____h.	Percentage of plants that resist disease	13. Symbiotic nitrogen fixation
_____i.	The application of symbiotic nitrogen-fixing bacteria to the seed of legumes or to the soil in which such legumes are to be grown	
_____j.	Puffing up or swelling due to the collection of gas in the rumen of the animal	
_____k.	Forage chopped and stored at 60 to 70 percent moisture and allowed to ferment, producing an acid condition which preserves it	
_____l.	Plowing at a shallow depth in the fall to partially kill the plants in a tough hay sod in preparation for normal plowing and working in the spring	
_____m.	One plant in ten in bloom	

2. Name the top three alfalfa producing states.

   a. ______________________________

   b. ______________________________

   c. ______________________________

3. Discuss the economic importance of forage production to Idaho.

   ____

   ____

   ____

   ____

   ____

   ____

   ____

   ____

   ____

4. Name two legume and two non-legume forage crops.

   Legume

   a. ______________________________

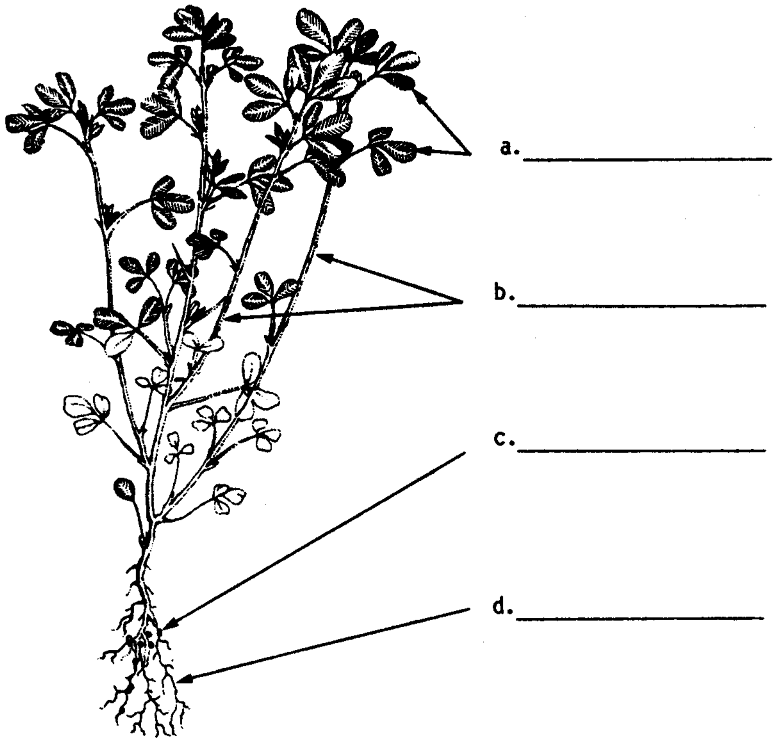
   b. ______________________________

   Non-legume

   a. ______________________________

   b. ______________________________

5. Identify the parts of an alfalfa plant. Write the correct name in the blank.



6. Select from the following list factors to consider in selecting an alfalfa variety. Write an "X" in the blank before each correct answer.

_____a. Palatability

_____b. Yield over 5 year period

_____c. Depth of planting

_____d. Disease resistance

_____e. Winter hardiness

_____f. Regrowth

_____g. Rate of seeding

_____h. Adaptability to area

7. Select from the following list characteristics of a desirable seedbed. Write an "X" in the blank before each correct answer.

_____a. Adequate available moisture

_____b. Minimum field slope of 25%

_____c. Large clod size acceptable

_____d. Free of weeds

_____e. Firm and well packed

_____f. Deep, well drained loam

8. Select from the following list factors to consider in planting. Write an "X" in the blank before each correct answer.

_____a. Do not plant more than 3/4 inch deep on sandy soil

_____b. Plant as early in the spring as possible

_____c. Inoculate legumes with proper rhizobia bacteria

_____d. Regrowth

_____e. Do not plant more than 1/2 inch deep on clay or loam

_____f. Palatability

_____g. Rate of seeding

_____h. Row spacing and method of seeding

9. List two advantages of a companion crop.

a. ____

b. ____

10. List two disadvantages of a companion crop.

a. ____

b. ____

11. List three companion crops.

a. ____

b. ____

c. ____

12. Name two forage diseases.

a. ____

b. ____

13. Name two beneficial insects of forage crops.

a. ____

b. ____

14. Name two harmful insects of forage crops.

a. ______________________________

b. ______________________________

15. List three ways weeds compete with forage crops.

a. ______________________________

b. ______________________________

c. ______________________________

16. List three losses caused by weeds in forage crops.

a. ______________________________

b. ______________________________

c. ______________________________

17. Match the general categories of weeds to the correct description. Write the correct number in the blank.

_____a.	Completes life cycle within a period of one year	1.	Annual
_____b.	Plants with longer, narrower leaves with parallel veination; monocots	2.	Perennial
_____c.	Lives for three years or more, and can reproduce sexually and asexually by means of rhizomes and stolons	3.	Broadleaf
_____d.	Plants with shorter, wider leaves that usually have pinnate or netted veination; dicots	4.	Grass

18. List three methods of weed control.

a. ______________________________

b. ______________________________

c. ______________________________

19. Select from the following list characteristics of high quality hay. Write an "X" in the blank before each correct answer.

_____a. High in leafiness

_____b. Harvested at first bloom

_____c. Bright green color

_____d. Freedom of weeds

_____e. 15 to 20 percent moisture content

_____f. Harvested at full bloom

20. List three factors to consider in cutting alfalfa hay.

a. ____

____

b. ____

____

c. ____

____

21. List four methods of processing hay.

a. ____

b. ____

c. ____

d. ____

22. List two factors to consider in buying and selling alfalfa hay.

a. ____

b. ____

FORAGE PRODUCTION

AG 320 - E

ANSWERS TO TEST

1.

a.	2	e.	1	i.	9	m.	6
b.	13	f.	4	j.	11		
c.	8	g.	10	k.	7		
d.	12	h.	5	l.	3		

2. California; Iowa; Minnesota

3. Answer could include the following information:

   Alfalfa hay: 920,000 acres harvested; 3.8 tons per acre average yield; 3,496,000 tons total production; $271,942,500 total value
   All hay: 1,140,000 acres harvested; 3.4 tons per acre average yield; 3,881,000 tons total production; $298,837,000 total value

4. Answer should include two of the following legume crops: Alfalfa; Red clover; Birdsfoot trefoil
   Answer should include two of the following non-legume crops: Smooth brome grass; Orchard grass; Tall fescue; Intermediate wheatgrass

5.

a.	Leaves	c.	Nodules
b.	Stems	d.	Roots

6. a, b, d, e, f, h

7. a, d, e, f

8. a, b, c, e, g, h

9. Answer should include two of the following:

   Reduction of erosion; Reduction of weed competition; Provides a source of income during the year the forage crop is becoming established

10. Answer should include two of the following:

    Competition between alfalfa and companion crop for water, nutrients, light; Reduced forage yields; Sometimes results in thin or spotty stands

11. Answer should include three of the following: Peas; Barley; Oats; Spring wheat

12. Answer should include two of the following:

    Phytophthora root rot; Bacterial wilt; Verticillium wilt; Spring black stem; Common leaf spot; Downey mildew

13. Answer should include two of the following:

    Lady beetles; Damsel bugs; Green lacewings; Syrphid flies, flower flies or hover flies

14. Answer should include two of the following:

    Alfalfa stem nematodes; Pea aphid; Spotted alfalfa aphid; Alfalfa weevil

15. Competition for water; Competition for plant nutrients; Competition for light

16. Decreased yield; Decreased crop quality (reduced total digestible nutrients, reduced total digestible protein, reduced palatability); Cost of control activities

17. a. 1 b. 4 c. 2 d. 3

18. Cultural; Mechanical; Chemical

19. a, b, c, d, e

20. Answer should include three of the following:

    Cut at correct stage of maturity; Put into windrows; Use hay conditioner on swather; Turn windrows over when necessary; Last crop should be cut 4-5 weeks prior to first killing frost

21. Answer should include four of the following:

    Baling; Chopping; Pelleting and wafering; Alfalfa meal; Haylage; Silage

22. Answer should include two of the following:

    Maturity at which hay was harvested; Crude protein; Dry matter

PASTURE MANAGEMENT

AG 320 - F

UNIT OBJECTIVE

After completion of this unit, students should be able to discuss pasture management techniques involved with plant selection, fertilization, weed and brush control, and methods used to increase production of forage. This knowledge will be demonstrated by completion of the unit test and assignment sheet with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with pasture management to the correct definitions.
2. Name three kinds of pastures.
3. Select from a list factors to consider in selection of pasture species.
4. List three suitable grasses and legumes for pastures.
5. Select from a list advantages of a grass-legume mixture.
6. List three common grass-legume mixtures for Idaho.
7. Discuss seedbed preparation for pasture establishment.
8. List four factors to consider in planting.
9. Select fertilizer needs of pastures.
10. Match methods of weed and brush control to the correct description.
11. List two advantages of renovating pasture.
12. Select methods used to increase forage production.
13. Match the grazing system for irrigated pastures to the correct description.
14. Discuss advantages of rotation grazing.
15. List three practices that reduce bloat hazard.
16. Develop a plan to establish a pasture.

PASTURE MANAGEMENT

AG 320 - F

SUGGESTED ACTIVITIES

I. Suggested activities for instructor

A. Order materials to supplement unit.

1. Literature

a. The following Current Information Series (CIS) publications on forage crops and pasture are available from Ag Communications Center, Ag Publications Bldg., University of Idaho, Moscow, Idaho 83843-4196, (208-885-7982); or contact your local county extension agent.

CIS 853	Northern Idaho Fertilizer Guide: Grass Pastures $.25
CIS 851	Northern Idaho Fertilizer Guide: Legume and Legume-Grass Mixture Pastures $.25
PNW 210	Pasture Management for Control of Tansy Ragwort $.25

b. McVickar, Malcom H., *Approved Practices in Pasture Management*, available from The Interstate Printers and Publishers, Inc., Danville, Illinois.

c. Agricultural Experiment Station Bulletins; order list of publications from Bulletin Mailing Office, Oregon State University, Corvallis, Oregon 97331.

B. Make transparencies and necessary copies of materials.

C. Provide students with objective sheet and discuss.

D. Provide students with information and assignment sheets and discuss.

E. Arrange field trip to survey pastureland and recommend improvement practices.

F. Have student’s design and construct improved pasture plant board for class and local fair.

G. Review and give test.

H. Reteach and retest if necessary

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Kinds of Pastures

2. TM 2--Pasture Species Selection

3. TM 3--Advantages of Grass-Legume Mixtures

4. TM 4--Grazing Systems for Irrigated Pastures

E. Assignment sheet

1. AS 1--Develop a Plan to Establish a Pasture

F. Test

G. Answers to test

III. Unit references

A. Delorit, R.J., et al., *Crop Production*, 4th edition, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

B. Ensign, R.D., et al., *Idaho Forage Crop Handbook*, University of Idaho, CIS No. 547, Moscow, Idaho, 1975.

C. Ensign, R.D., *Rejuvenating Old Pastures*, University of Idaho, CIS No. 409, Moscow, Idaho, 1977.

D. Heath, M.E., Barnes, R.F., and Metcalf, D.S., *Forages: The Science of Grassland Agriculture*, 4th edition, Iowa State University Press, Ames, Iowa, 1985.

E. McVickar, Malcom H., *Approved Practices in Pasture Management*, 3rd edition, The Interstate Printers and Publishers, Danville, Illinois, 1974.

F. Painter, C.G., et al., *Idaho Fertilizer Guide: Irrigate Pastures, Southern Idaho*, University of Idaho, CIS No. 392, Moscow, Idaho, 1977.

PASTURE MANAGEMENT

AG 320 - F

INFORMATION SHEET

I. Terms and definitions

A. Improved pasture--Fenced area of domesticated forages, usually improved, on which animals are grazed

B. Native pasture--A forage area covered by native plants and grazed by livestock

C. Rotation grazing--The grazing of four or more pasture units in a rotation allowing enough time for each pasture unit to recover before reuse

D. Continuous grazing--The grazing of a specific pasture throughout the year

E. Annual--A plant which germinates and completes its life cycle in one year

F. Perennial--A plant that lives for three years or more and can reproduce sexually and asexually by means of rhizomes and stolons

G. Erosion--Loss of soil by the actions of tillage, wind and/or water

H. Renovating--Practice of loosening the soil to allow freer movement of water and air and to control weeds

I. Native grass--Grass species indigenous to an area, not introduced

II. Kinds of pastures (Transparency 1)

A. Native pastures

(Note: Grasslands of this type consist of native types of forage plants. Drier areas have more shrubs and fewer grasses. In general, the grazing capacity is much lower than that of pastures in humid areas. In the U.S., grazing land of this type is referred to as rangeland.)

B. Long-term pastures

(Note: These pastures consist of introduced perennial grasses and legumes, self-seeding annuals or both. Normally not plowed for five years or more.)

C. Rotation pastures

(Note: These pastures are used for grazing in regular order with cultivated and harvested crops. Usually the period of grazing extends from one to three years.)

D. Annual pastures

(Note: These pastures are seeded to annual forage plants.)

E. Temporary pastures

(Note: Fields used for grazing when other pastures become unproductive. They may be annual pastures or they may represent the aftermath of hay fields or small grain stubble.)

III. Factors to consider in selection of pasture species (Transparency 2)

A. Use intended--Cattle, sheep, horses

B. Hardiness

C. Adaptability

D. Compatibility of species mix

E. Nutritional qualities

F. Palatability

G. Soil building capabilities

H. Life span

I. Establishment ease

J. Drought tolerance or moisture requirement

IV. Major forage species

Table 1—Legumes

Species	Growth Habit	Palatability	Optimum Moisture Requirement
1. Alfalfa	Tap to rhizomatous	Medium	16-25+
2. Alsike clover	Stoloniferous	High	25+
3. White clover	Stoloniferous	High	18-25+
4. Red clover	Non-spreading	Medium	20-25+
5. Sainfoin	Non-spreading	High	14-22+
6. Strawberry clover	Stoloniferous	High	25+
7. Sweet clover	Non-spreading	Low	15-20+
8. Birdsfoot trefoil	Non-spreading	High	20-25+

Table 2--Grasses

	Species	Growth Habit	Palatability	Optimum Moisture Requirement
1.	Kentucky bluegrass	Rhizomatous	High	18-25+
2.	Smooth brome	Rhizomatous	High	16-22+
3.	Crested wheatgrass	Bunch	Medium	10-16
4.	Siberian wheatgrass	Bunch	Medium	8-14
5.	Inter. wheatgrass	Sod	High	14-22+
6.	Orchard grass	Bunch	Med. High	20-25+
7.	Reed canary grass	Rhizomatous	Med. High	25+
8.	Tall fescue	Bunch	Medium	18-22+
9.	Tall wheatgrass	Bunch	Low	15-22

V. Advantages of grass-legume mixtures (Transparency 3)

A. Control soil erosion

B. Improve soil fertility

C. Reduce invasion by weeds

D. Less bloat hazard than straight legume

E. Produce more and higher quality forage than straight grass

(Note: Feeding trials have shown that grass-legume mixtures are equally as nutritious and are as productive of livestock products as are legumes seeded alone. Forage yields of grass-legume mixtures under irrigation are generally equal to those of the legume seeded alone.)

F. Improve palatability

VI. Grass-legume mixtures for Idaho

A. Alfalfa and orchard grass

B. Alfalfa and smooth brome grass

C. Alfalfa and tall fescue

D. Birdsfoot trefoil and orchard grass

E. Birdsfoot trefoil and reed canary grass

F. White clover and Kentucky bluegrass

G. Sainfoin and orchard grass

H. Alsike clover and meadow foxtail

(Note: Refer to Idaho Forage Crop Handbook for more information on adaptability of mixtures to soil type, moisture requirements and seeding rates or contact your local county extension agent for mixtures adapted to your local area.)

VII. Seedbed preparation

A. Remove trees and/or shrubs

B. Plow soil if weeds are a problem

C. Use disc if soil is loose and not infested with weeds

D. Use harrow or drag and level land

E. Use roller to firm soil

(Note: A firm, weed-free seedbed is of primary importance in the successful establishment of small-seeded grasses and legumes. A firm seedbed holds moisture near the surface, helps control depth of seeding and provides ready anchorage for the tiny seedling roots. The soil surrounding the seeds after seeding should be moist to promote rapid germination, emergence and successful establishment.)

VIII. Factors to consider in planting

A. Use certified seed

B. Inoculate all legume seeds with proper rhizobia just prior to seeding

C. Depth of planting

1. Clayey soils--1/2 inch

2. Loamy soils--1 inch

3. Sandy soils--1 1/2 inch

(Note: When mixtures are sown, the depth of seeding should be regulated to favor the small-seeded species.)

D. Row spacing--6 or 7 inches

(Note: Plant all seeding with a drill equipped with depth regulators. Drills distribute the seed more uniformly and assure proper soil coverage to increase the possibility of successful stand establishment. Many grass seeds are light and chaffy and will not feed through the drill evenly. This can be prevented by mixing the grass seed for each acre with enough rice or pea hulls to make one bushel. This mixture will feed readily through the drill to give uniform distribution of seed.)

E. Time of seeding

1. Spring seeding--Generally recommended for all areas of Idaho

(Note: In southern Idaho irrigated areas with a long growing season, seeding may be done as late as August 15. This allows the seedlings to become well established before fall freeze-up and results in minimum winter-killing.)

2. Late fall seeding--Recommended where average rainfall is less than 12 inches annually

(Note: Sow seed early enough so it will produce a good healthy seedling before soil freezes.)

F. Rate of seeding

(Note: Rate of seeding will vary for straight legume, straight grass or a mixture of the two. Consult the Idaho Forage Crop Handbook for recommended seeding rates or your local county extension agent.)

IX. Fertilizer needs of established pasture

(Note: Should check soil pH before seeding and if low should lime accordingly.)

A. Nitrogen (N)

(Note: Established grass pastures have responded well to nitrogen application up to 150 lbs/acre. As the amount of legume increases in a pasture, the need for nitrogen fertilizer decreases. On pastures containing a high percentage of legumes, nitrogen applications will reduce the quantity of legume in the forage.)

B. Phosphorus (P)

(Note: Intensively managed and high producing pastures respond to phosphorus applications. Phosphorus can best be applied during seedbed preparation. Established pastures may be top-dressed with phosphorus, preferably in the fall.)

C. Potassium (K)

(Note: Potassium should be incorporated during seedbed preparation or broadcast in the fall.)

D. Sulfur (S)

(Note: Sulfur demand is higher for legume plants than grasses. Areas irrigated with Snake River water should not experience a shortage of sulfur.)

X. Methods of weed and brush control

A. Chemical--Removing by applying a selective herbicide

B. Mechanical--Removing by some type of mechanical practice such as mowing, plowing under or burning

XI. Advantages of renovating pasture

A. Reduces competition of other plants

B. Provides for more available nutrients

C. Increases movement of air and water

XII. Methods used to increase forage production

A. Correct soil problems before attempting to establish an improved pasture

(Note: Problems such as land leveling, installation of drainage systems and compacted soils are easier to deal with before the pasture is seeded. Consult your extension agricultural agent or district Soil Conservation Service personnel for soil information for your area.)

B. Control soil pests

(Note: Frequently, old pastures have wireworms, sod webworms and other soil inhabiting pests that are destructive to pasture plants. If you suspect that pests exist in your pasture area, consult your extension agricultural agent for control recommendations.)

C. Select and plant improved pasture species

(Note: The proper species depends upon the kinds of grazing animals, area of the state, soil factors and moisture availability.)

D. Fertilize regularly

E. Control weeds and brush

F. Protect from overgrazing by pasture rotation

(Note: A good rotation grazing system is necessary to maintain young, productive and nutritive vegetation and to maximize carrying capacity over the entire grazing season.)

XIII. Grazing systems for irrigated pastures (Transparency 4)

A. Continuous--The grazing of a specific pasture continuously throughout the year

(Note: Grazing a pasture continuously results in reduced yields, weed invasion and the eventual loss of the more productive forage plants.)

B. Rotational--The grazing of four or more pasture units in a rotation allowing enough time for each pasture unit to recover before reuse

(Note: Compared to continuous grazing, rotation grazing increases the productivity of most forage species and thus increases farm income from forage production.)

C. Strip--Confining animals to a strip area of forage to be consumed in a short period of time; the livestock are moved to a new pasture each day; electric fences are often used

XIV. Advantages of rotation grazing

A. Proper rotation grazing promotes vigorous plant regrowth and uniform forage utilization

B. The forage can be maintained in a relatively young, rapidly growing and nutritious state

C. High-yielding forage species which are susceptible to overgrazing and trampling damage can be successfully maintained

D. One of the best means to efficiently use forage

XV. Reducing bloat hazard

A. Seed a grass-legume mixture

(Note: Keep the legume component in the pasture mix under 50 percent.)

B. Keep grasses and legumes in proper balance with an adequate fertilization program

C. Have salt and water available at all times

D. Do not graze the animals early in the spring when there is a rapid change from cool to warm growing temperatures

(Note: Under these conditions, legumes often make a sudden flush and outgrow the grass.)

E. Do not graze wet foliage

F. Condition animals to fresh green forage

(Note: Put livestock in a few hours at first, and provide dry hay for the livestock to eat.)

G. Watch animals closely for early symptoms

KINDS OF PASTURES

Native pastures

Long-term pastures

Rotation pastures

Annual pastures

Temporary pastures

PASTURE SPECIES SELECTION

Intended use

Hardiness

Adaptability

Compatibility of species mix

Nutritional qualities

Palatability

Soil building capabilities

Life span

Establishment ease

Drought tolerance/moisture requirement

ADVANTAGES OF GRASS-LEGUME MIXTURES

Control soil erosion

Improve soil fertility

Reduce weed invasion

Reduce bloat hazard

Produce more and higher quality forage than straight grass

Improve palatability

GRAZING SYSTEMS FOR IRRIGATED PASTURES

<u>Continuous</u>

The grazing of a specific pasture continuously throughout the year

<u>Rotational</u>

The grazing of four or more pasture units in a rotation allowing enough time for each pasture unit to recover before reuse

<u>Strip</u>

Confining animals to a strip area of forage to be consumed in a short period of time

PASTURE MANAGEMENT

AG 320 - F

ASSIGNMENT SHEET #1--DEVELOP A PLAN TO ESTABLISH A PASTURE

Name ______________________________________ Score________________________________

Develop a plan to establish a pasture in your local area and write a report to explain your plan. You will need to include the following information in your report:

- Previous year's crop on the ground
- Number of acres to be seeded
- Seedbed preparation
- Time of year you plan to seed
- Seed mix you plan to use
- Fertilizer requirements
- Irrigation requirements (if any)
- Intended use
- Insect and weed control

Some information will be based entirely on your own decisions (such as previous year's crop, number of acres, etc), but other information will have to be obtained from facts. Consult your local county extension agent, area farmers and ranchers; your vocational agriculture instructor and literature on pasture management for specific information.

PASTURE MANAGEMENT

AG 320 - F

UNIT TEST

Name ______________________________________ Score________________________________

1. Match terms associated with pasture management to the correct definitions. Write the correct number in the blank.

_____a.	A plant which germinates and completes its life cycle in one year	1.	Improved pasture
_____b.	The grazing of four or more pasture units in a rotation allowing enough time for each pasture unit to recover before reuse	2.	Native pasture
		3.	Rotation grazing
_____c.	Practice of loosening the soil to allow freer movement of water and air to control weeds	4.	Continuous grazing
		5.	Annual
_____d.	A forage area covered by native plants and grazed by livestock	6.	Perennial
_____e.	Grass species indigenous to an area, not introduced	7.	Erosion
_____f.	Fenced area of domesticated forages, usually improved, on which animals are grazed	8.	Renovating
		9.	Native grass
_____g.	Loss of soil by the actions of tillage, wind and/or water		
_____h.	A plant that lives for three years or more and can reproduce sexually and asexually by means of rhizomes and stolons		
_____i.	The grazing of a specific pasture throughout the year		

2. Name three kinds of pastures.

a.____

b. ____

c.____

3. Select from the following list factors to consider in selection of pasture species. Write an "X" in the blank before each correct answer.

_____a. Compatibility of species mix

_____b. Life span of species

_____c. Drought tolerance or moisture requirement

_____d. Nutritional qualities

_____e. Soil erosion control

_____f. Winter hardiness

_____g. Palatability

_____h. Weed invasion

_____i. Intended use of pasture

_____j. Ease of establishment

_____k. Weed invasion

4. List three suitable legumes and grasses for pastures.

Legumes

a.____

b. ____

c.____

Grasses

a.____

b. ____

c.____

5. Select from the following list advantages of grass-legume mixtures. Write an "X" in the blank before each correct answer.

_____a. Improves fertility of the soil

_____b. Produces lower quality forage than straight grass

_____c. Produces more forage than straight grass

_____d. More bloat hazard than straight legume _____e. Better control of soil erosion than straight legume

_____f. Less bloat hazard than straight grass

6. List three common grass-legume mixtures for Idaho.

   a.____

   b. ____

   c.____

7. Discuss seedbed preparation for pasture establishment.

   ____

   ____

   ____

   ____

   ____

   ____

   ____

   ____

   ____

   ____

8. List four factors to consider in planting.

   a.____

   b. ____

   c.____

   d. ____

9. Select from the following list fertilizer needs of pastures. Write an "X" in the blank before each correct answer.

_____a. Magnesium (Mg)

_____b. Calcium (Ca)

_____c. Sulfur (S)

_____d. Potassium (K)

_____e. Phosphorus (P)

_____f. Nitrogen (N)

10. Match the methods of weed and brush control to the correct description. Write the correct number in the blank.

_____a.	Removing by applying a selective herbicide	1. Chemical
_____b.	Removing by using practices such as mowing, plowing under or burning	2. Mechanical

11. List two advantages of renovating pasture.

a.____

b. ____

12. Select from the following list methods used to increase forage production. Write an "X" in the blank before each correct answer.

_____a. Protect pasture from overgrazing

_____b. Plant seeds 3 inches deep

_____c. Select proper pasture species for your conditions

_____d. Regular addition of fertilizers

_____e. Keep ground saturated throughout the summer

_____f. Elimination of competition from weeds and brush

_____g. Using a rotation grazing system

_____h. Correction of soil problems prior to seeding of pasture

13. Match the grazing systems for irrigated pastures to the correct description. Write the correct number in the blank.

_____a.	The grazing of four or more pasture units in a rotation allowing enough time for each pasture units to recover before reuse	1. Continuous 2. Rotational
_____b.	The grazing of a specific pasture continuously throughout the year	3. Strip
_____c.	Confining animals to an area of forage to be consumed in a short period of time; the livestock are moved to a new pasture each day	

14. Discuss advantages of rotation grazing.

15. List three practices that reduce bloat hazard.

a.

b.

c.

PASTURE MANAGEMENT

AG 320 - F

ANSWERS TO TEST

1.

a.	5	d.	2	g.	7
b.	3	e.	9	h.	6
c.	8	f.	1	i.	4

2. Answer should include three of the following:

   Native pastures; Long-term pastures; Rotation pastures; Annual pastures; Temporary pastures

3. a, b, c, d, f, g, i, j

4. Answers should include three of the following for each:

   Legume: Alfalfa; Alsike clover; White clover; Red clover; Sainfoin; Strawberry clover; Sweet clover; Birdsfoot trefoil
   Grasses: Kentucky bluegrass; Smooth brome; Crested wheatgrass; Siberian wheatgrass; Inter. wheatgrass; Orchard grass; Reed canary grass; Tall fescue; Tall wheatgrass

5. a, c, e

6. Answer should include three of the following:

   Alfalfa and orchard grass; Alfalfa and smooth brome grass; Alfalfa and tall fescue; Birdsfoot trefoil and orchard grass; Birdsfoot trefoil and reed canary grass; White clover and Kentucky bluegrass; Sainfoin and orchard grass; Alsike clover and meadow foxtail

7. Answer could include the following information:

   Remove trees and/or shrubs; Plow soil if weeds are a problem; Use disc if soil is loose and not infested with weeds; Use harrow or drag and level land; Use roller to firm soil

8. Answer should include four of the following:

   Use of certified seed; Inoculation of legume seeds with proper rhizobia prior to seeding; Depth of planting; Row spacing; Time of seeding; Rate of seeding

9. c, d, e, f

10. a. 1 b. 2

11. Answer should include two of the following:

    Reduces competition of other plants; Provides for more available nutrients; Increases movement of air and water

12. a, c, d, f, g, h

13. a. 2 b. 1 c. 3

14. Answers should include three of the following:

    Proper rotation grazing promotes vigorous plant regrowth and uniform forage utilization; The forage can be maintained in a relatively young, rapidly growing and nutritious state; High-yielding forage species which are susceptible to overgrazing and trampling damage can be successfully maintained; One of the best means to efficiently use forage

15. Answer should include three of the following:

    Seed a grass-legume mixture; Keep grasses and legumes in proper balance with an adequate fertilization program; Have salt and water available at all times; Do not graze the animals early in the spring when there is a rapid change from cool to warm growing temperatures; Do not graze wet foliage; Condition animals to fresh green forage; Watch animals closely for early symptoms

RANGELAND MANAGEMENT

AG 320 - G

UNIT OBJECTIVE

After completion of this unit, students should be able to match terms with the correct definitions. Students should be able to discuss rangeland management techniques involved with plant selection and grazing of livestock. Students should also be able to make recommendations for improvement of existing rangeland. This knowledge will be demonstrated by completion of the unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with rangeland management to the correct definitions.
2. List three uses of rangeland.
3. Give the percentage of rangeland in the world, United States and Idaho.
4. List four kinds of plants found on range sites.
5. List three classifications of range plants other than by structure.
6. Select characteristics of a good rangeland plant.
7. Classify grasses as very palatable, palatable or less palatable.
8. Select factors affecting forage growth.
9. Match the periods of plant growth on western ranges to the correct definitions.
10. List four factors to consider in planning grazing.
11. Discuss what a grazing plan should include.
12. List three general and two specific objectives of a grazing system.
13. Match grazing systems to the correct descriptions.
14. List three classes of plant response to range disturbance.
15. Match range conditions to the correct descriptions.
16. Select benefits received from range improvement practices.
17. List five range improvement practices.
18. Arrange in order the steps in the range improvement process.
19. List two methods to prevent overgrazing.

20. List three methods of weed and brush control.

21. Discuss the control of rodents.

22. Calculate animal units and amount of forage consumed per month when given the animal unit equivalents for each example.

23. Discuss the determination of stocking rate.

24. List three classes of range utilization.

25. List three agencies involved in rangeland management.

26. List two significant legislative acts to rangeland management.

RANGELAND MANAGEMENT

AG 320 - G

SUGGESTED ACTIVITIES

I. Suggested activities for instructor

A. Order materials to supplement unit.

1. Literature

a. Several publications available from Oregon State University. For a catalog of publications, write to: Bulletin Mailing Office, Industrial Building, Oregon State University, Corvallis, Oregon 97331.

b. The following Current Information Series (CIS) publications are available from Agricultural Communications Center, Ag Publications Building, University of Idaho, Moscow, Idaho 83843-4196, (208-885-7982).

CIS	179	Reseeding Semiarid Rangeland $.25
CIS	736	Joseph and Nezpurs Idaho Fescue: Forage Grasses for the Intermountain Northwest $.45
PNW	200	Rangelands in Dry Years--Drought Effects on Range, Cattle and Management $.25
EXP	512	The Sagebrush Region in Idaho--A Problem in Range Resource Management

B. Make transparencies and necessary copies of materials.

C. Provide students with objective sheet and discuss.

D. Provide students with information sheet and discuss.

E. Do a community survey on rangeland use and publish results in local newspaper.

F. Highlight the areas of rangeland use on a world, U.S. and Idaho map.

G. Conduct a range bowl.

H. Invite a person from BLM or Forest Service to address the class on public lands.

I. Invite an early settler of your area to address the early use of rangeland.

J. Encourage students to read books about the history of the west and its ranges, and to summarize the range and/or livestock conflicts that took place.

K. Invite a Fish and Game expert to address competition between livestock and wildlife on the range, and multiple use resource management.

L. Review and give test.

M. Reteach and retest if necessary

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Uses of Rangeland

2. TM 2--Amount of Rangeland

3. TM 3--Potential Vegetation of Idaho

4. TM 4--Important Range Plant Groups

5. TM 5--Grass Plant

6. TM 6--Winter Annuals

7. TM 7--Summer Annuals

8. TM 8--Biennials

9. TM 9--Perennials

10. TM 10--Palatability of Grasses

11. TM 11--Vegetative Retrogression of Plant Species Based on Their Response to Disturbance Such as Overgrazing

12. TM 12--Mechanical Methods of Control

13. TM 13--Mechanical Methods of Control

14. TM 14--Chemical Control

15. TM 15--Chemical Control

16. TM 16--Animal Unit Equivalents

E. Test

F. Answers to test

III. Unit references

A. Beitia, Marc, Notes from range curriculum taught at Raft River High School, Malta, Idaho.

B. *Crops, Soils and Fertilizers Resource Manual*, Vo-Ed No. 73, University of Idaho, Moscow, Idaho, 1978.

C. Hannebaum, J., *Source Unit in Range and Pasture Management*, Colorado State University, Department of Vo-Ed, Agriculture Education Division, 1975.

D. *Improving Native Rangeland: Unit II*, State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, Stillwater, Oklahoma.

E. *Resource Unit on Range Management for Core Curriculum*, Montana State University, Agricultural and Industrial Education, Bozeman, Montana, 1976.

F. Sharp, L.A. and Sanders, K.D., *Rangeland Resources of Idaho*, Idaho Rangeland Comm. and College of FWR, University of Idaho, Moscow, Idaho, 1978.

G. Stevens, Larry W., Notes from range curriculum taught at Grace High School, Grace, Idaho.

RANGELAND MANAGEMENT

AG 320 - G

INFORMATION SHEET

I. Terms and definitions

A. Range--Land not suited for cultivation, which supports a cover of vegetation suitable for grazing by animals

B. Native plant--Plant originating in North America

C. Introduced plant--Plant brought from countries outside the United States

D. Climax--The thrifty productive grasses that comprise a high percentage of the grass cover of a range in top condition; these decrease under heavy use

E. Grass--Any plant of the family Gramineae; characteristic of long narrow leaves with parallel veination

F. Grass-like--Resembling grasses; usually used for sedges and rushes

G. Forb--A plant with a solid, non-woody stem, usually broadleaf with netted veination

H. Shrub--A woody perennial plant with a solid woody stem which is characteristic of growth rings

I. Palatability--The degree of an animal's desire to graze or not to graze a certain plant

J. Decreasers--Plant that decreases on a range when exposed to heavy grazing pressures

K. Increasers--Plant that increases on a range when decreasers are reduced

L. Invader--Plant which comes into a range after both increasers and decreasers have been reduced

M. Forage value--Rating of a plant as a feed for cattle or sheep; a species will be classified as high, medium or low

N. Warm-season plant--Plant which grows during the summer and early fall

O. Cool-season plant--Plant which grows during the fall, winter or spring

P. Range condition--The current productivity of a range relative to what that range is naturally capable of producing

Q. Range trend--The direction of change in range condition

(Note: If the change is toward the climax, the range is improving and the trend is up. If the change is away from the climax, the range is deteriorating and the trend is down.)

R. Range utilization--Amount of forage removed from a range area by grazing animals

S. Animal unit--One mature cow or the equivalent based upon average daily forage consumption of 12 kg dry matter per day

T. Animal unit month (AUM)--The amount of feed or forage required by an animal unit for one month

U. Range management--The care and use of rangeland for multiple uses including the highest continuous yield of animal products without endangering soil and water resources

V. Range improvement--Special treatments, developments and structures used to improve range forage resources or to facilitate their use by grazing animals

W. Stocking rate--Number of animal units that are grazed in a certain area for a certain period of time

X. Grazing plan--A plan for grazing rangeland based upon the range condition and types of vegetation

II. Uses of rangeland (Transparency 1)

A. Livestock production

1. Cattle grazing

2. Sheep grazing

B. Watershed

C. Wildlife

D. Recreation

E. Energy reserves

1. Coal

2. Oil

3. Natural gas

III. Amount of rangeland (Transparencies 2, 3)

A. Worldwide

1. Approximately 47% of the earth's surface can be classified as rangeland

(Note: Figures quote 30% of earth's surface as rangeland, but forest and desert rangelands are not included in this figure.)

B. United States

1. Approximately 47% of the U.S. is classified as rangeland, not including forest and desert

(Note: Of the 1.9 billion acres in the U.S., 885 million are classified as rangeland.)

C. Idaho

1. Approximately 85% of the land in Idaho is rangeland

(Note: About one-half of this land is forested.)

IV. Kinds of plants found on range sites (Transparencies 4, 5)

A. Grasses

B. Grass-like

C. Forbs

D. Shrubs

V. Classification of range plants (other than by structure) (Transparencies 6, 7, 8, 9)

A. Life span

1. Annual

2. Biennial

3. Perennial

B. Origin

1. Native

2. Introduced

C. Growth season

1. Cool season

2. Warm season

VI. Characteristics of a good rangeland plant

A. Hardiness

B. Good nutritional qualities

C. Good palatability

D. Soil building/holding

E. Drought tolerant

F. Easy to establish

VII. Palatability of grasses (Transparency 10)

(Note: Palatability will vary depending on associated plant species and type of grazing animal.)

A. Very palatable

1. Bluebunch wheatgrass

2. Idaho fescue

3. Orchard grass

B. Palatable

1. Crested wheatgrass

2. Kentucky bluegrass

3. Junegrass

C. Less palatable

1. Cheatgrass

2. Medusahead

3. Three awn

VIII. Factors affecting forage growth

A. Rainfall

(Note: Moisture is the most limiting resource in the development of rangelands.)

B. Sunlight

C. Temperature

D. Nutrients in the soil

E. Texture of soil

F. Structure of soil

G. Topography

IX. Periods of plant growth on western ranges

A. Period 1--Initial growth, usually in spring. Soils are damp and cold. Growth is slow and leaves contain much moisture. New leaves are high in crude protein, minerals and energy, but cattle cannot usually get enough new growth to satisfy their intake needs. Plant growth is less than animal demand unless stocking pressures are very low. This period is before traditional range readiness

B. Period 2--Plant growth is just about even with animal demand. This is usually a short time at most. Nutritional values are just about adequate to meet requirements

C. Period 3--This is the flush period where animal demand is usually less, sometimes greatly so, than the forage supply. Nutrition is high; animals gain well during the entire period but less well as the end arrives

D. Period 4--Dormant period. This will certainly be the dry season and may be during the wet season, also. There may or may not be a late summer-fall green-up which is a short time repeat of Period 1, but not of Period 2 and 3. Period 4 will be the longest period of the year; during this period, nutritional values may limit animal performance

X. Factors to consider in planning grazing

A. Intensity of use--How many animals there are for a given area

B. Frequency of use--How often grazing is done

C. Season of use--When grazing occurs in a plant's life history

D. Selectivity of use--What plants are being eaten

XI. A grazing plan should include

A. The time when the range is ready to graze (depending upon plant growth)

B. The season during which the range can be used for the greatest benefit from the vegetation and offer the greatest protection of improvement of the range

(Note: Move livestock in relation to plant growth stage and forage utilization, not by calendar. Be sure enough forage is available in the next pasture or another move will be imminent.)

XII. Objectives of a grazing system

A. General

1. Increase forage production

2. Increase wildlife

3. Minimize soil erosion

4. Minimize recreational conflicts

B. Specific

1. Vegetation

a. Maintenance or improvement of range condition

b. Restore vigor to plants

c. Allow for reproduction of plants (vegetative and sexual)

2. Animal

a. Provide more nutritional forage

b. Maintain or increase current levels of production

XIII. Grazing systems

A. Deferred--A range is not grazed until seed maturity is assured, or a comparable growth stage

B. Rested--A range is not grazed for the entire year

C. Ungrazed--Range receiving a period of no grazing which is not rested or deferred

D. Continuous--The grazing of a range continuously throughout the year

E. Repeated seasonal--Grazing the range the same time each year

F. Rotational--Moving livestock from one area of range to another on a scheduled basis

XIV. Classes of plant response to range disturbance (Transparency 11)

A. Decreaser

(Note: This is a plant that is reduced in numbers or composition as a result of heavy grazing.)

B. Increaser

(Note: This is a plant that increases in percentage of composition during the first part of heavy grazing as the range condition is on the decline. Continued heavy grazing will cause these plants to decrease in composition.)

C. Invader

(Note: This is a plant not present under an ideal climax condition or only present in small amounts. These plants increase in composition on extremely heavy grazed range or one that is deteriorating.)

XV. Range condition

(Note: This corresponds to the Soil Conservation Service rating system.)

A. Excellent--76 to 100 percent of the vegetation is a mixture of highly palatable and desirable plants

B. Good--51 to 75 percent of the original vegetation is a mixture of highly palatable and desirable perennial plants

C. Fair--26 to 50 percent of the original vegetation is a mixture of highly palatable and desirable perennial plants

D. Poor--Less than 25 percent of all vegetation consists of highly palatable and desirable plants

XVI. Benefits received from range improvement practices

A. Increased quantity of forage

B. Increased quality of forage

C. Increased animal production

(Note: Increased animal production would include both domestic livestock and wildlife.)

D. Control of livestock poisoning by poisonous plants

E. Reduced fire hazard

F. Increased water yields on watershed

G. Controlling erosion by stabilizing erosive soils

H. Reduce conflicts between multiple uses of range resources

(Note: Controlled burning can be a useful improvement tool in special situations. Annual burning is not recommended. The application of fertilizer has definitely shown an increased tonnage, but there is a question as to whether it is economical.)

XVII. Range improvement practices

A. Adequate and well placed water supplies

B. Fenced to control grazing

C. Salt licks located at each watering hole

D. Management of native forage

E. Seeding of range

F. Practice weed and brush control

G. Rodent and insect control

H. Burning

I. Range fertilization

J. Develop and implement grazing plan

XVIII. Steps in range improvement process

A. Identify cause of poor performance by range

1. Overgrazing--Livestock, wildlife or both

2. Fire

3. Insects

4. Drought

5. Shrub invasion not related to past or current animal use

B. Select range improvement practices best suited for the situation

C. Implement selected range improvement practices

D. Maintain proper range management practices and evaluate effect of improvement practices

(Note: Overgrazing will destroy the root supply, decrease the food supply available for new growth the following year, pack the ground and reduce water intake.)

XIX. Prevention of overgrazing

A. Rotate pastures

B. Graze lightly during seed production seasons

C. Regulate animal units

(Note: When cattle graze, the first parts of the plant they remove are the stem and the bud. This causes lateral branching which produces new growth. It is recommended that 50 percent of a plant by weight be removed and 50 percent left because heavily grazed plants lose vigor and die. Using herbicides is the most selective and most economical method, while mechanical clearing is the most expensive method and must be used on land where erosion is not a problem.)

XX. Weed and brush control (Transparencies 12, 13, 14, 15)

A. Mechanical (Transparencies 12, 13)

1. Root plowing

2. Cutting brush

3. Bulldozing

4. Chaining and cabling

5. Mowing and shredding

6. Girdling

7. Heavy-duty brush cutters

B. Burning

(Note: Burning alone will not control undesirable woody plants. Practices such as seeding to grass, rotation of grazing ranges and careful grazing practices will help prevent the return of undesirable shrubs. Generally, the burning of rangeland is considered ineffective due to a lack of sufficient ground cover to burn both large and small plants. Fire along with a combination of mechanical control methods is considered a more positive means of controlling woody plants than when using fire alone.)

C. Chemical (Transparencies 14, 15)

1. Aerial spraying

2. Basal trunk spraying

3. Ground application--Granules, pellets, balls

4. Stump treatment

XXI. Control of rodents

A. Trapping

B. Poisoning

XXII. Animal unit--Equivalent to a 1000 pound cow and calf which will consume approximately 26 pounds of dry forage per day (Transparency 16)

(Note: The forage required for one animal unit for one month is an animal unit month (AUM). Stocking rate figures are expressed as animal unit months per acre.)

Animal Unit Equivalents

1 cow	=	1.0 A.U.
1 yearling	=	0.6 A.U.
1 bull	=	1.3 A.U.
1 horse	=	1.5 A.U.
5 ewes	=	1.0 A.U.
5 deer	=	1.0 A.U.
10 antelope	=	1.0 A.U.
1 elk	=	0.8 A.U.
160 ground squirrels	=	1.0 A.U.

XXIII. Determining stocking rate

A. Determine the number of usable acres in the pasture by subtracting the rocky, wooded and other unusable acres from the total acres. This results in the total usable acres

B. Find the animal unit stocking rate for the range by multiplying the animal unit month figure by the number of usable acres

C. Find the stocking rate for a growing season by dividing the length of the grazing season in months into the total animal unit months stocking rate

(Note: Another method of determining the stocking rate is to graze the animals on the pasture and observe the effect upon the vegetation, and make animal number adjustments according to the reaction of the vegetation. This method requires more experience and time, but is the most accurate. Stocking rates will vary from pasture to pasture.)

XXIV. Classes of range utilization

A. Heavy use

B. Moderate use

C. Light use

(Note: It is important to know range utilization so that the range vegetation can be used efficiently without damaging the productivity of the range.)

XXV. Agencies involved in rangeland management

A. Bureau of Land Management

B. U.S. Forest Service

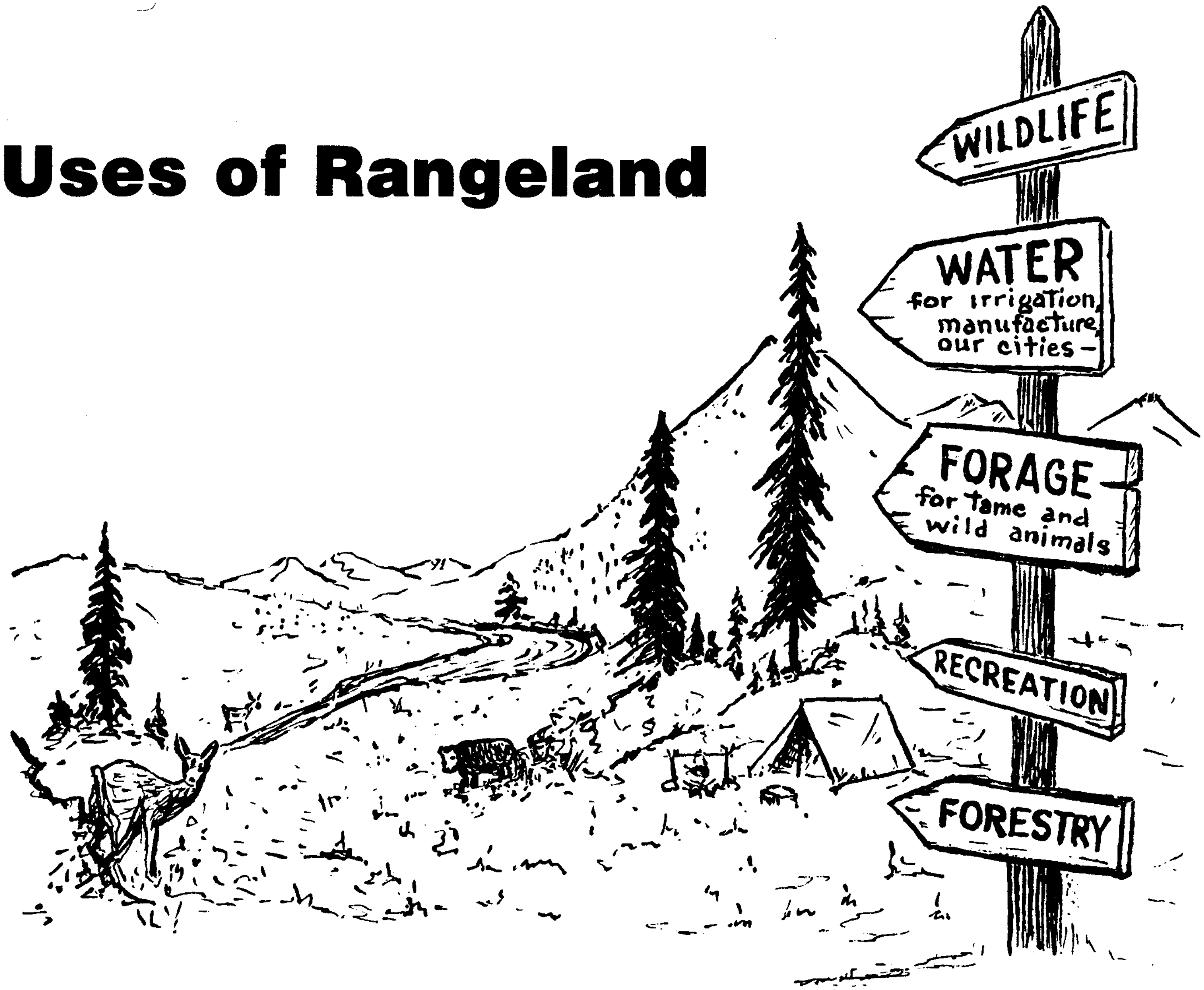
C. Agricultural Stabilization and Conservation Service

- D. Soil Conservation Service
- E. Cooperative Extension Service
- F. State Department of Lands
- G. Bureau of Indian Affairs

XXVI. Significant legislative acts to rangeland management

- A. Homestead Act--1862
- B. Timber Culture Act--1873
- C. Forest Reserve Act--1901
- D. Enlarged Homestead Act--1916
- E. Stock Grazing Homestead Act--1916
- F. Soil Erosion Service--1933
- G. Taylor Grazing Act--1934
- H. Halogeton Control Act--1952
- I. Forest and Rangeland Renewable Resources Planning Act--1974
- J. Federal Lands Policy and Management Act--1976
- K. Desert Land Act--1977
- L. Grazing Fee Study--1977 and 1985
- M. Public Rangelands Improvement Act--1978

Uses of Rangeland

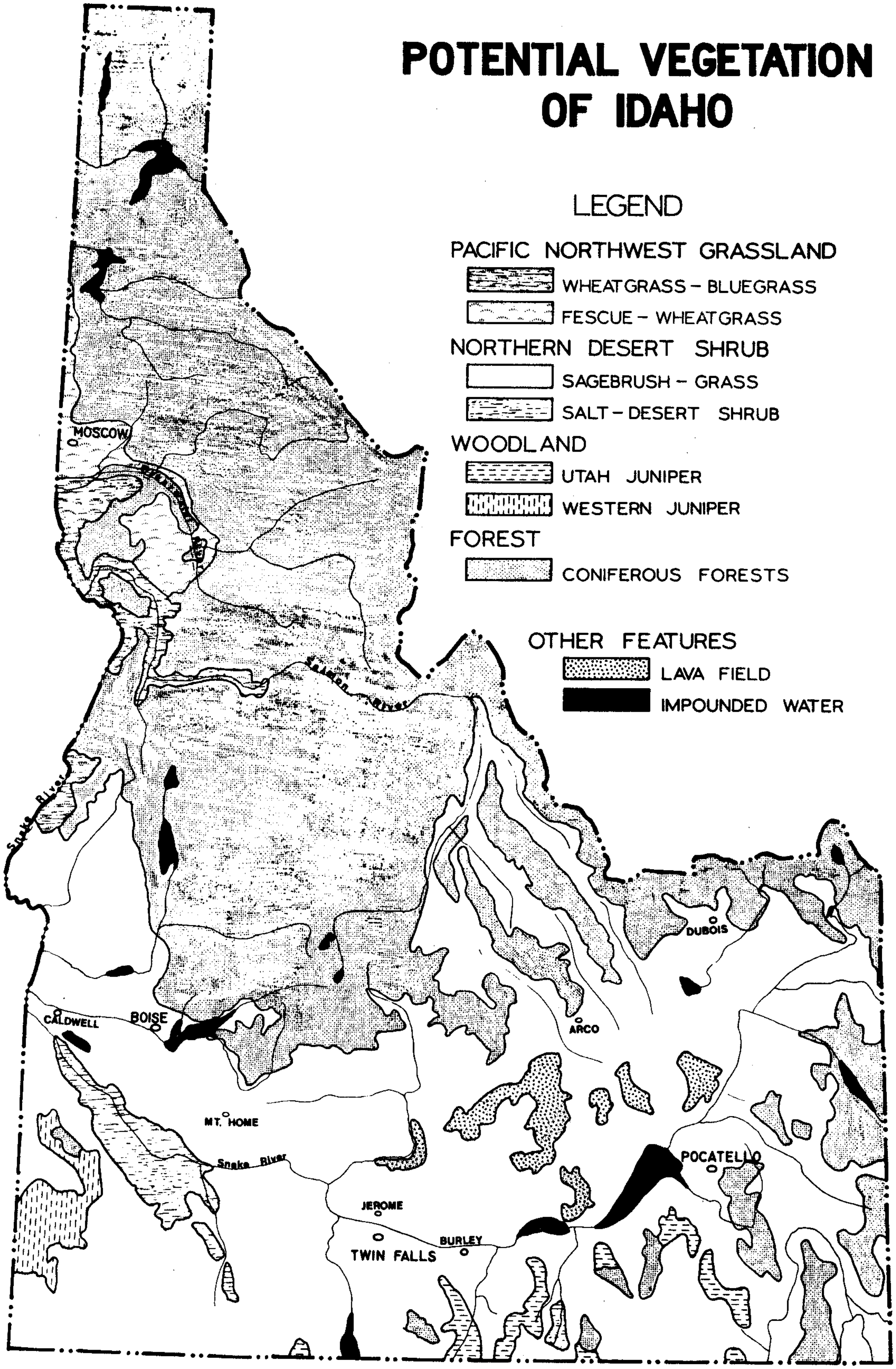


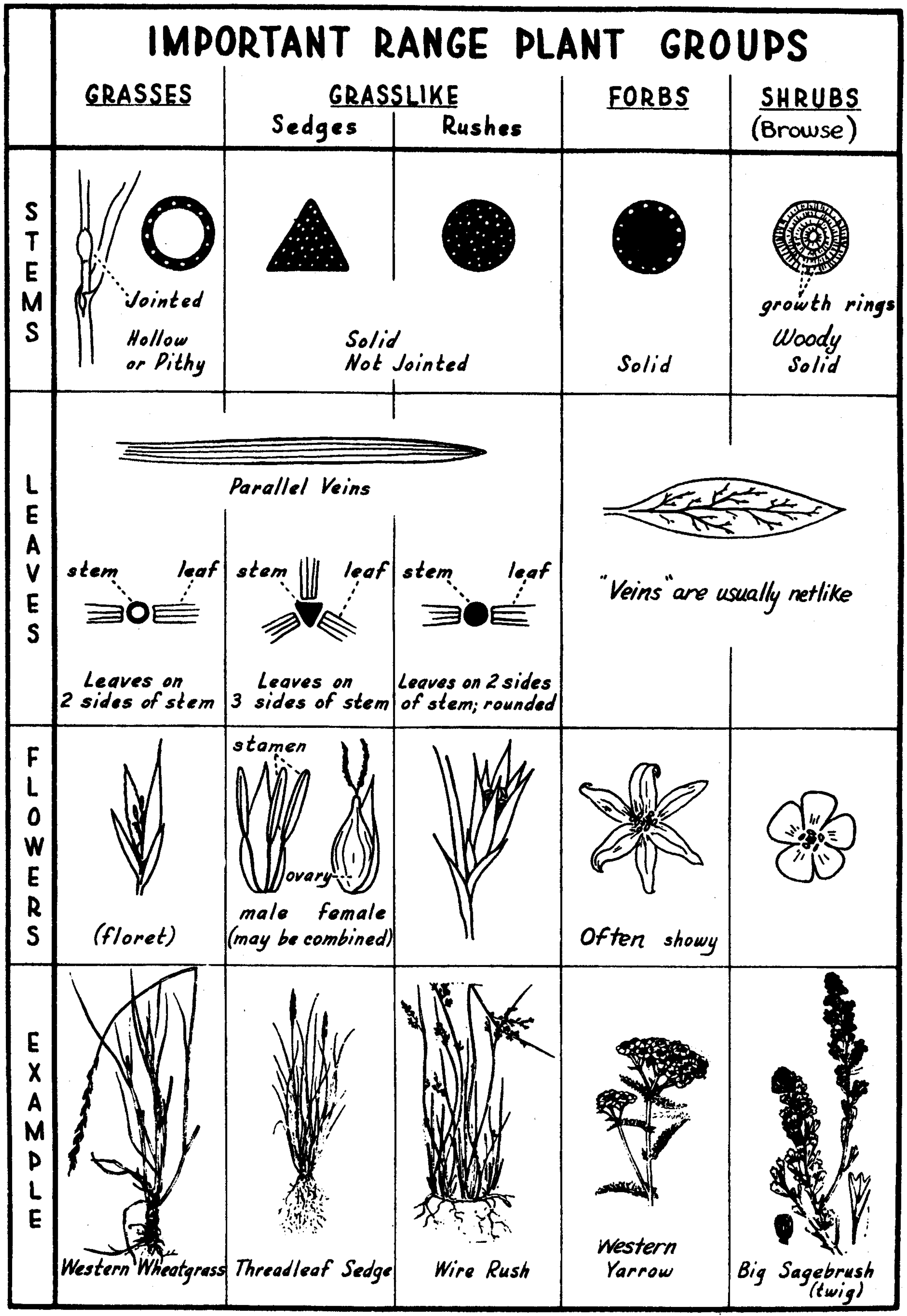
AMOUNT OF RANGELAND

Worldwide 47%

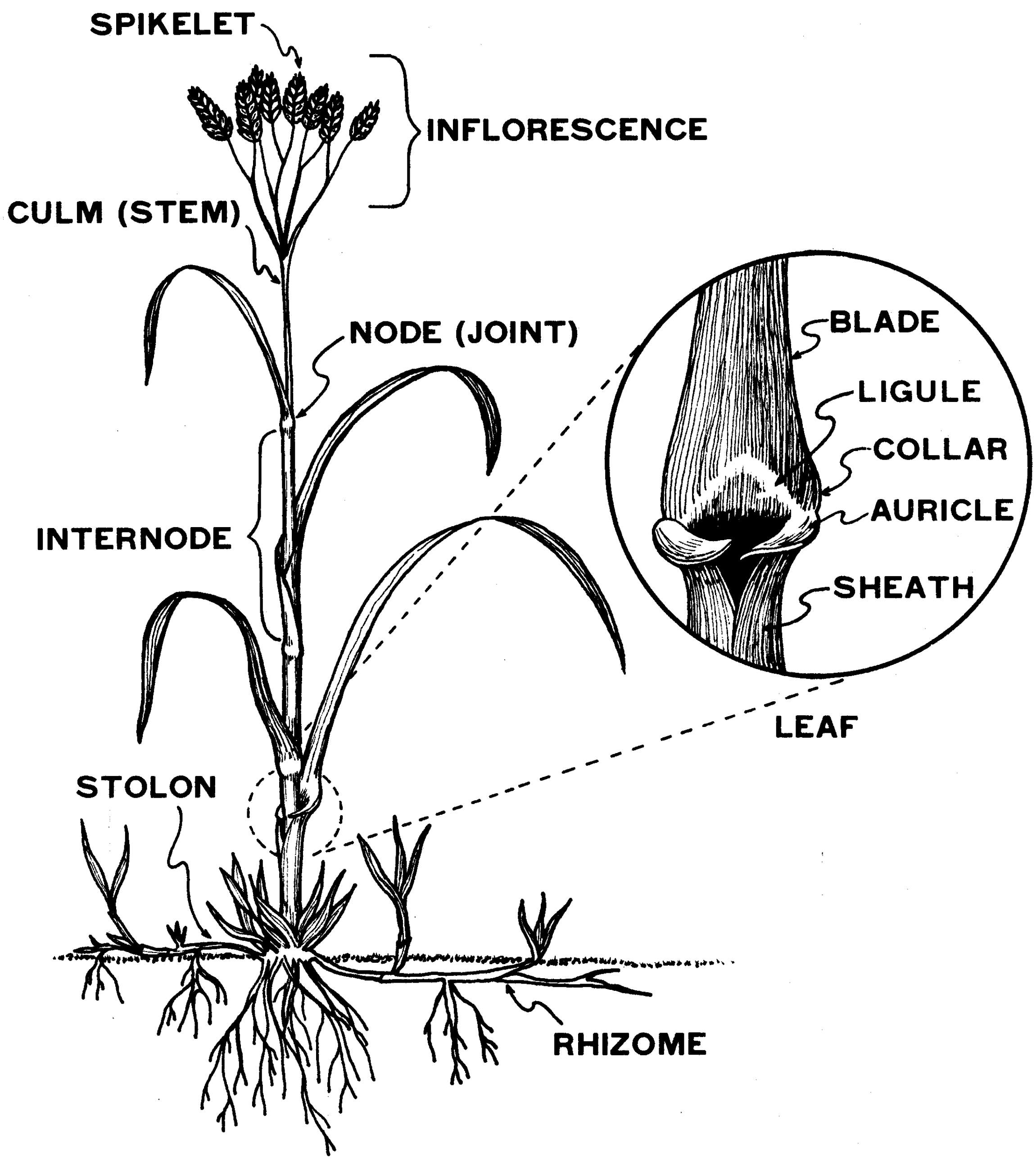
United States 47%

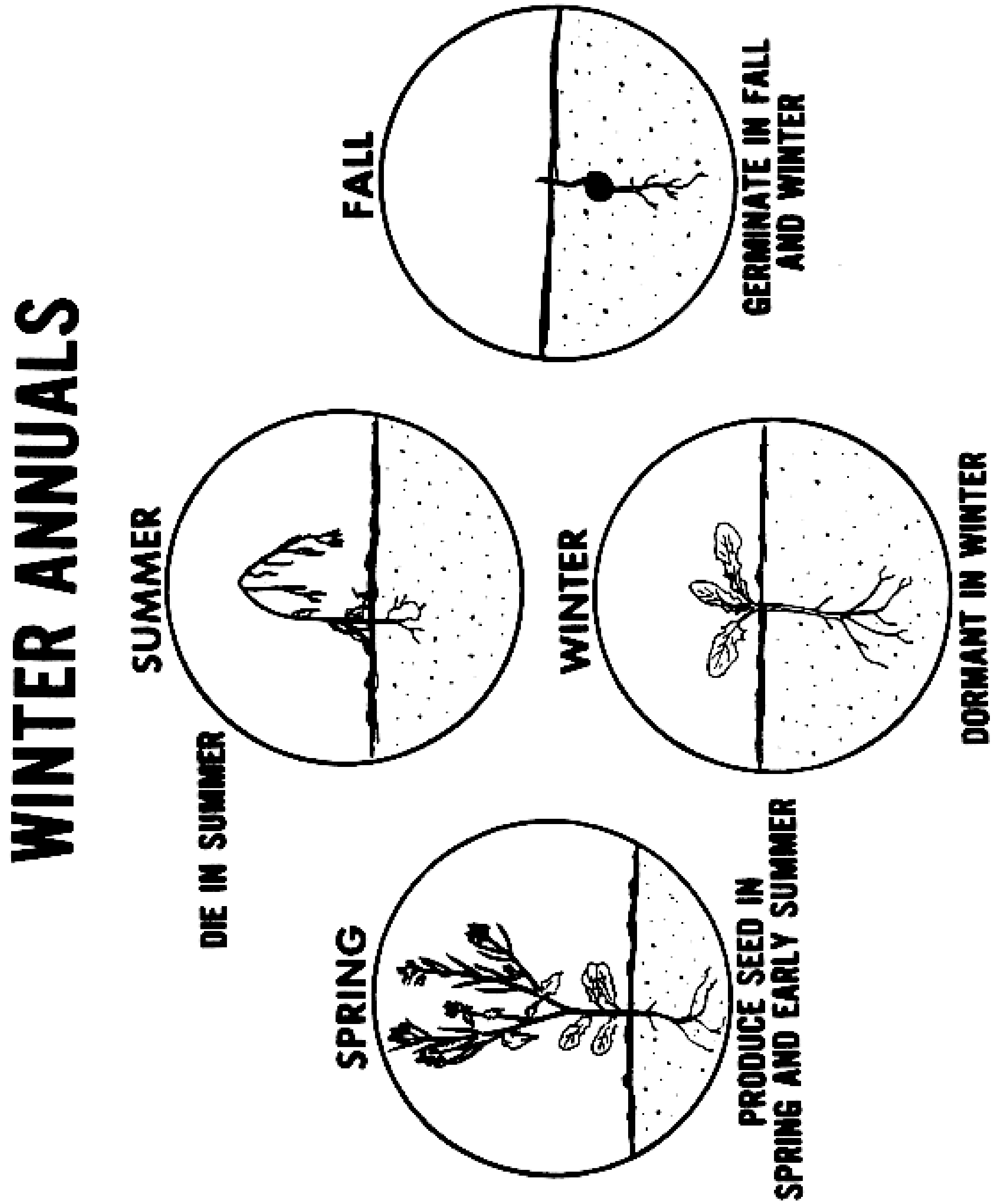
Idaho 85%

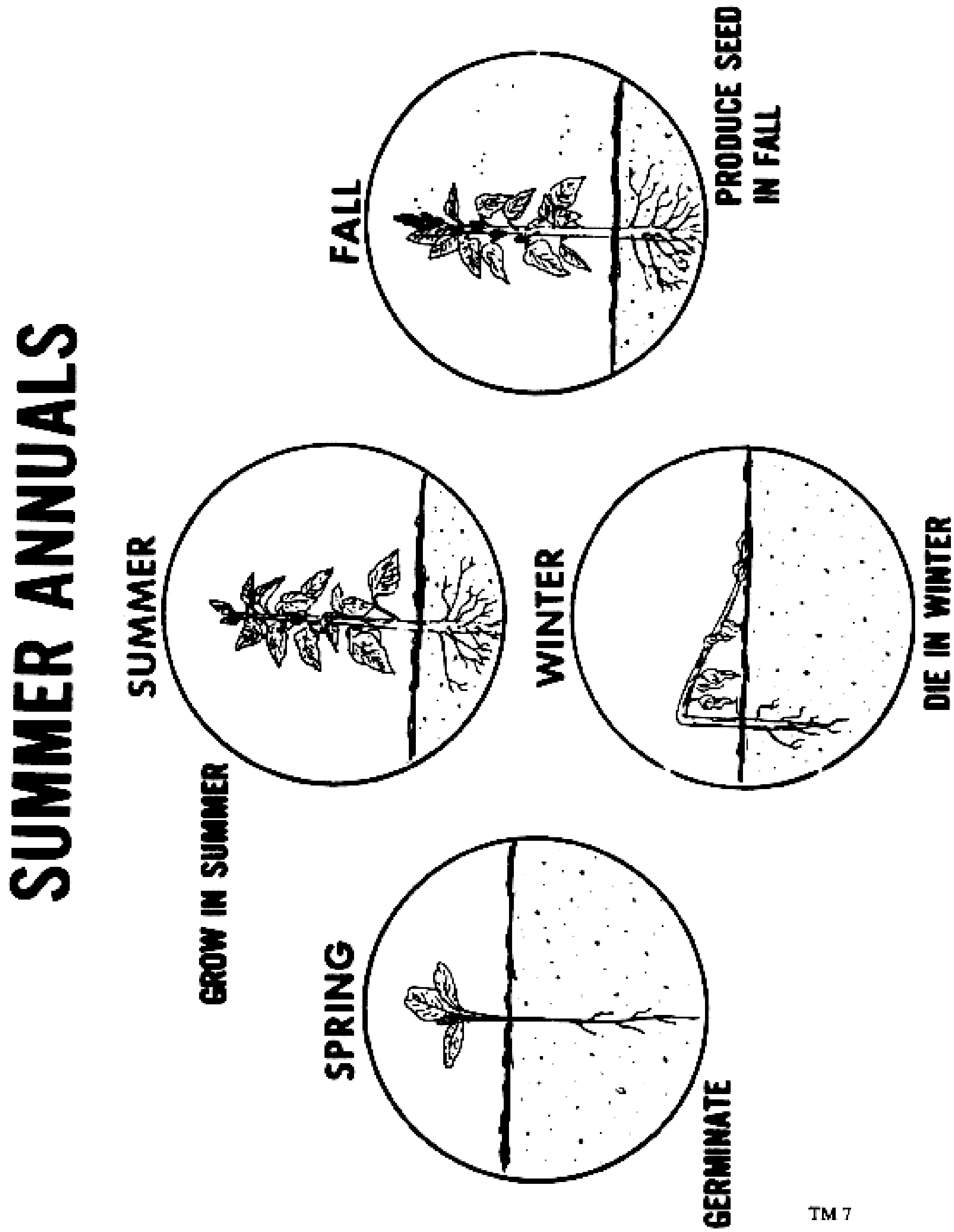

POTENTIAL VEGETATION
OF IDAHO
LEGEND
PACIFIC NORTHWEST GRASSLAND
WHEATGRASS – BLUEGRASS
FESCUE – WHEATGRASS
NORTHERN DESERT SHRUB
SAGEBRUSH – GRASS
SALT – DESERT SHRUB
WOODLAND
UTAH JUNIPER
WESTERN JUNIPER
FOREST
CONIFEROUS FORESTS
OTHER FEATURES
LAVA FIELD
IMPOUNDED WATER
MOSCOW
Salmon River
Snake River
DUBOIS
ARCO
CALDWELL
BOISE
MT. HOME
Snake River
POCATELLO
JEROME
BURLEY
TWIN FALLS


IMPORTANT RANGE PLANT GROUPS
GRASSES
GRASSLIKE
Sedges
Rushes
FORBS
SHRUBS
(Browse)
STEMS
Jointed
Hollow or Pithy
Solid Not Jointed
Solid
growth rings
Woody Solid
LEAVES
Parallel Veins
stem
leaf
Leaves on 2 sides of stem
Leaves on 3 sides of stem
Leaves on 2 sides of stem; rounded
"Veins" are usually netlike
FLOWERS
(floret)
stamen
ovary
male female
(may be combined)
Often showy
EXAMPLE
Western Wheatgrass
Threadleaf Sedge
Wire Rush
Western Yarrow
Big Sagebrush (twig)

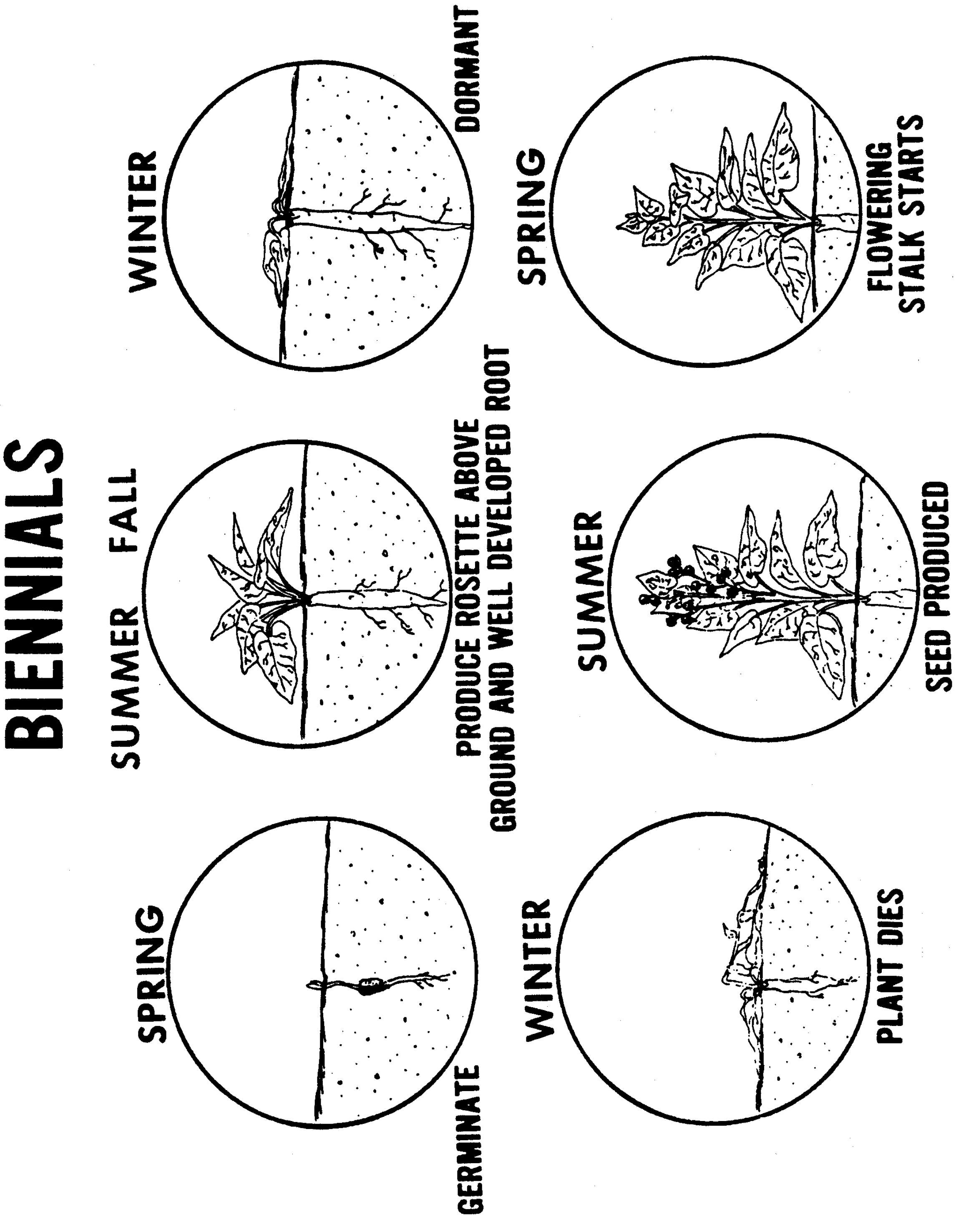
GRASS PLANT

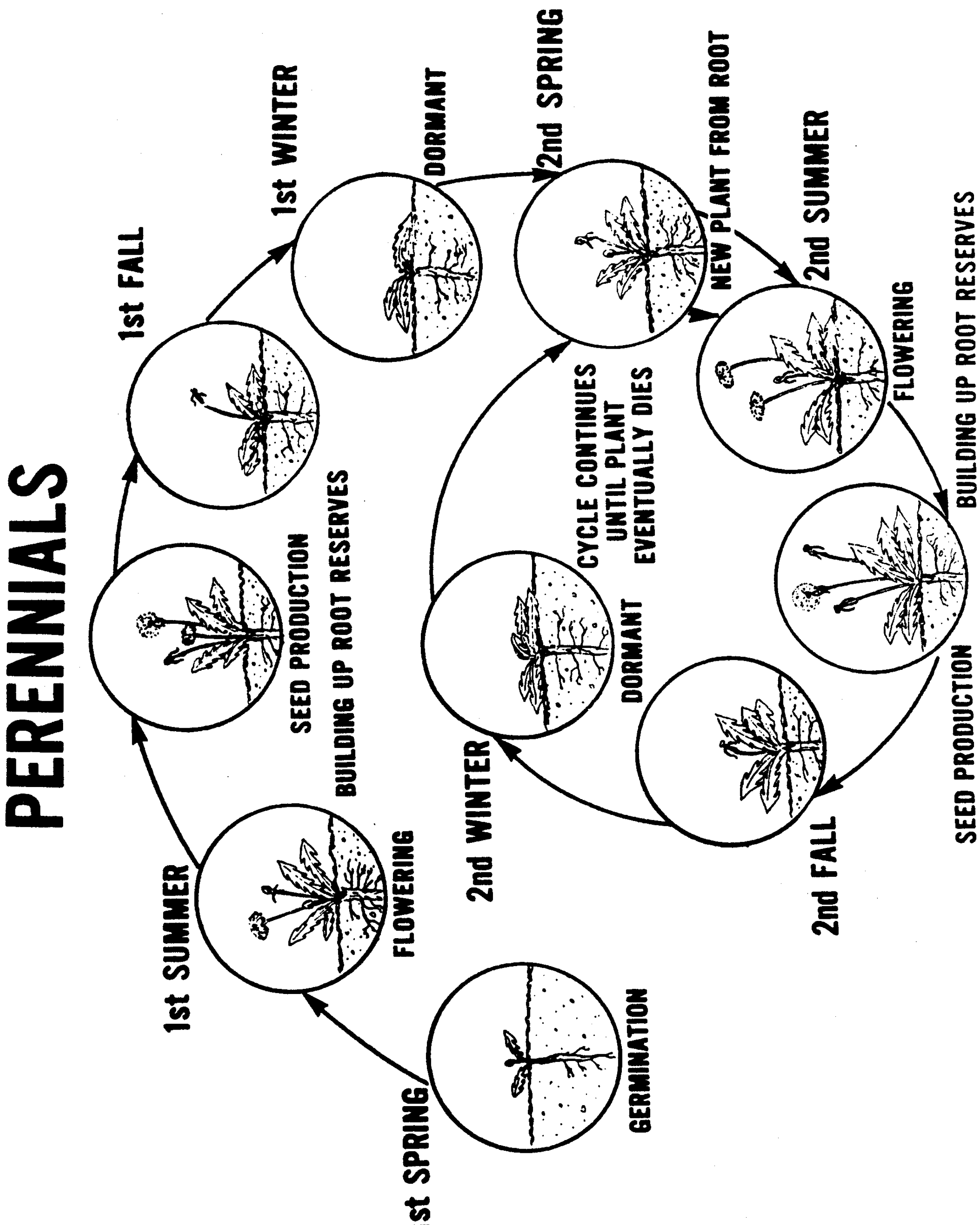

SPIKELET
INFLORESCENCE
CULM (STEM)
NODE (JOINT)
INTERNODE
BLADE
LIGULE
COLLAR
AURICLE
SHEATH
LEAF
STOLON
RHIZOME


WINTER ANNUALS
FALL
GERMINATE IN FALL AND WINTER
WINTER
DORMANT IN WINTER
SPRING
PRODUCE SEED IN SPRING AND EARLY SUMMER
SUMMER
DIE IN SUMMER


SUMMER ANNUALS
SPRING
GERMINATE
SUMMER
GROW IN SUMMER
FALL
PRODUCE SEED
IN FALL
WINTER
DIE IN WINTER

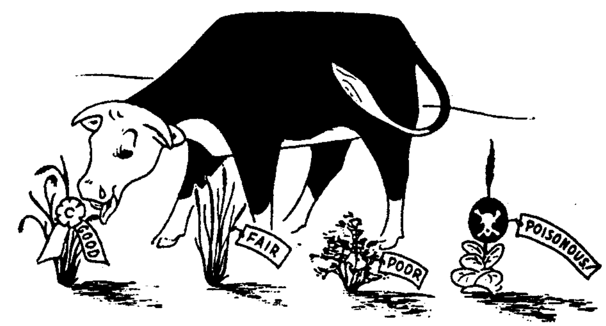
TM 7


BIENNIALS
SPRING
GERMINATE
SUMMER FALL
PRODUCE ROSETTE ABOVE
GROUND AND WELL DEVELOPED ROOT
WINTER
DORMANT
WINTER
PLANT DIES
SUMMER
SEED PRODUCED
SPRING
FLOWERING
STALK STARTS

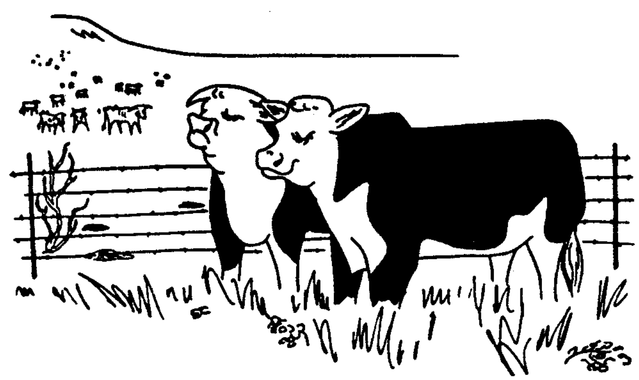

PERENNIALS
1st SPRING
GERMINATION
1st SUMMER
FLOWERING
SEED PRODUCTION
BUILDING UP ROOT RESERVES
1st FALL
1st WINTER
DORMANT
2nd SPRING
NEW PLANT FROM ROOT
2nd SUMMER
FLOWERING
BUILDING UP ROOT RESERVES
SEED PRODUCTION
2nd FALL
2nd WINTER
DORMANT
CYCLE CONTINUES
UNTIL PLANT
EVENTUALLY DIES

Palatability of Grasses

Very palatable
- Bluebunch wheatgrass
- Idaho fescue
- Orchard grass

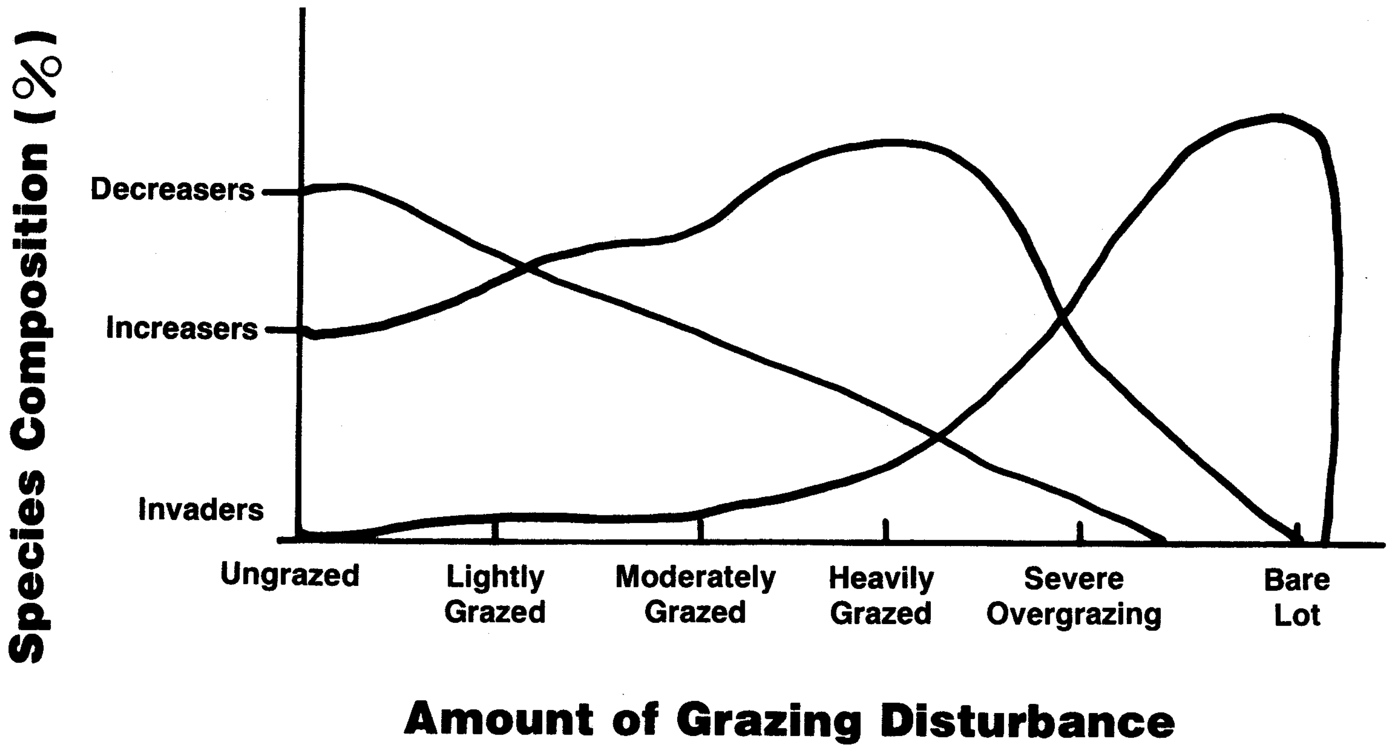


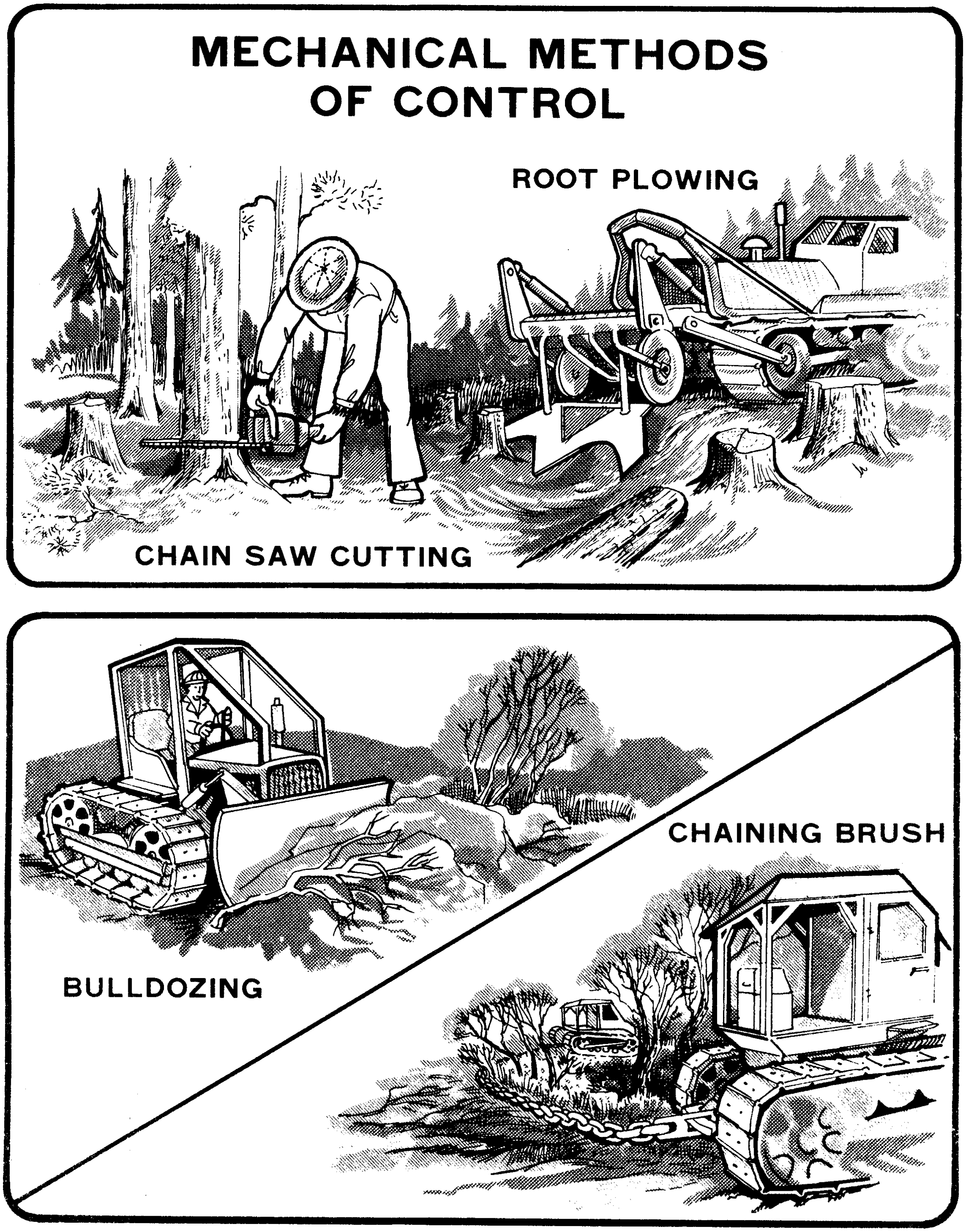
Palatable
- Crested wheatgrass
- Kentucky bluegrass
- Junegrass

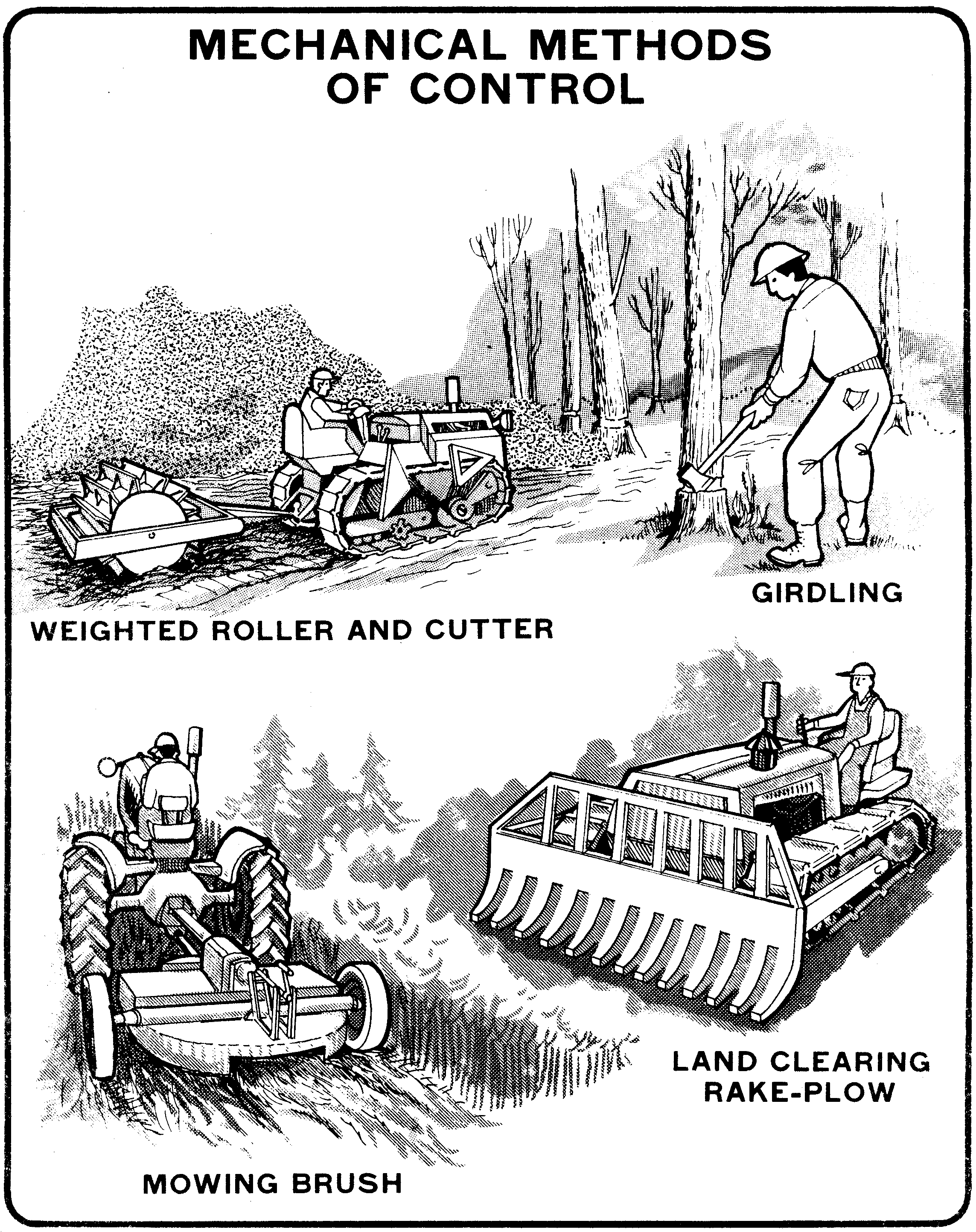


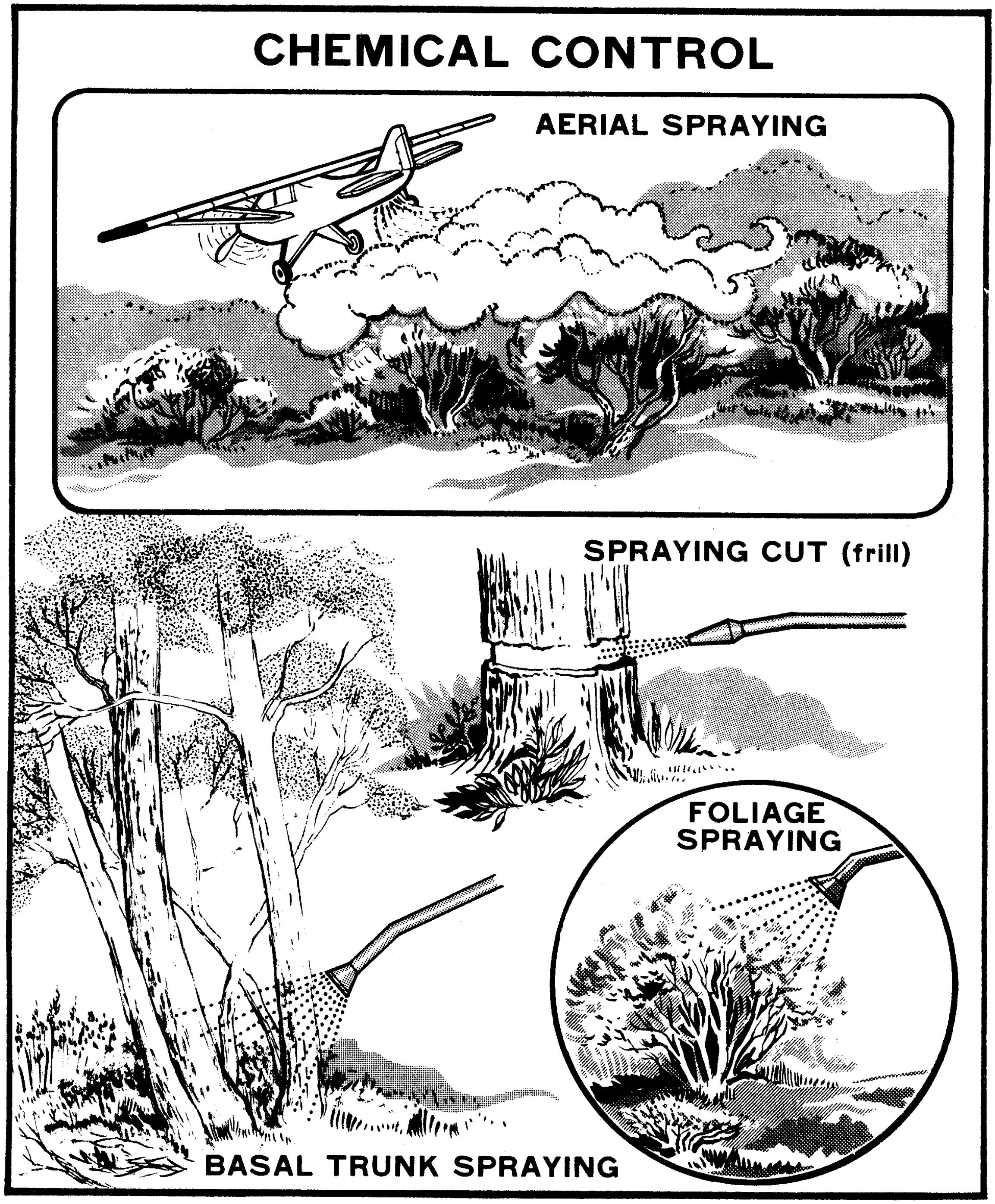
Less Palatable
- Cheatgrass
- Medusahead
- Three awn

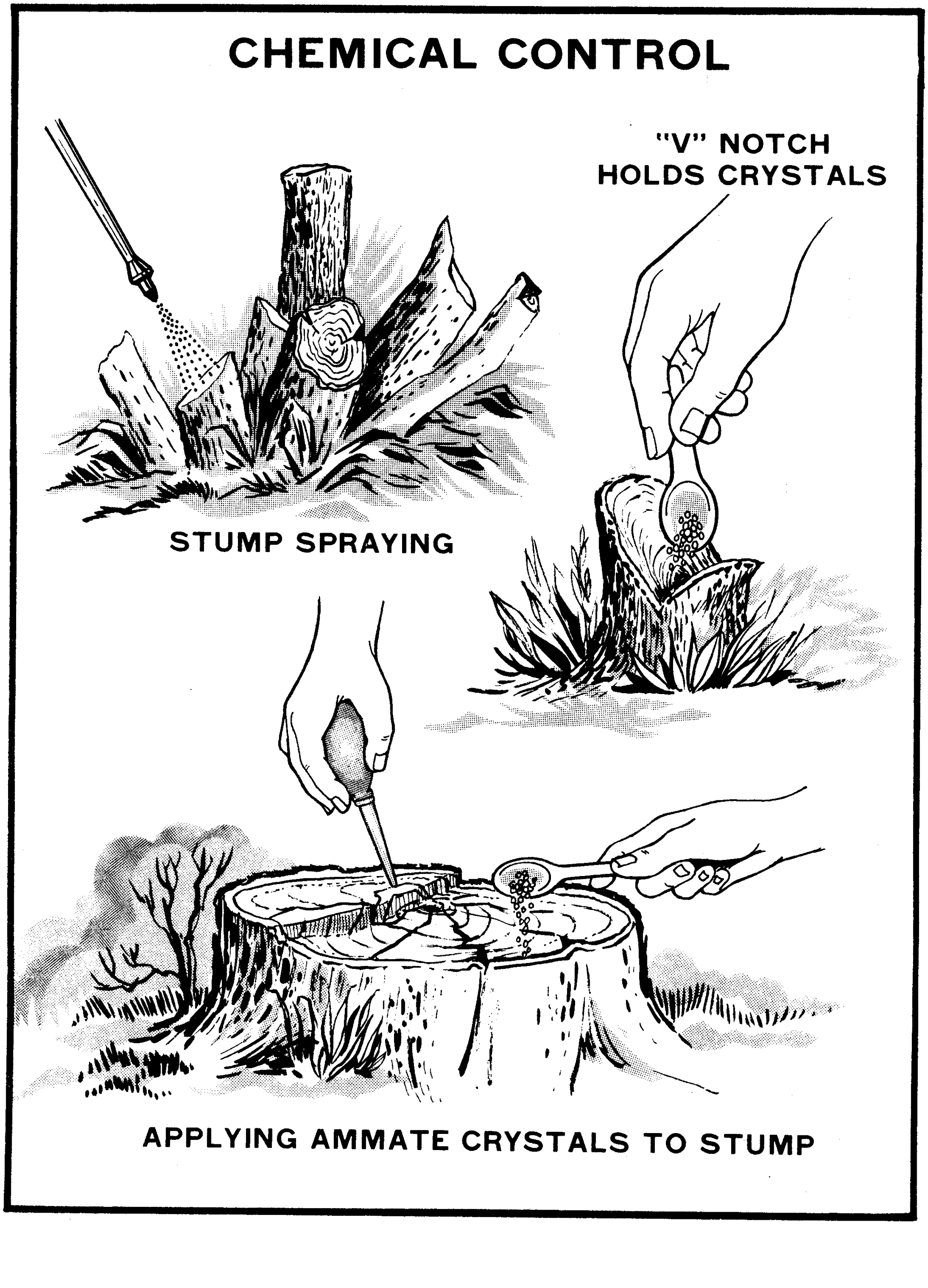
Vegetative Retrogression of Plants Species Based on Their Response to Disturbance Such as Overgrazing




MECHANICAL METHODS
OF CONTROL
ROOT PLOWING
CHAIN SAW CUTTING
CHAINING BRUSH
BULLDOZING

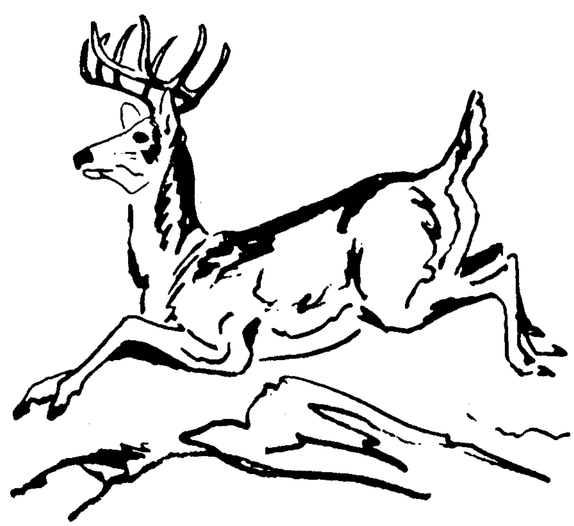

MECHANICAL METHODS
OF CONTROL
GIRDLING
WEIGHTED ROLLER AND CUTTER
LAND CLEARING
RAKE-PLOW
MOWING BRUSH


CHEMICAL CONTROL
AERIAL SPRAYING
SPRAYING CUT (frill)
FOLIAGE SPRAYING
BASAL TRUNK SPRAYING


CHEMICAL CONTROL
"V" NOTCH
HOLDS CRYSTALS
STUMP SPRAYING
APPLYING AMMATE CRYSTALS TO STUMP

Animal Unit Equivalent

1 cow	1.0 A.U.
1 yearling	0.6 A.U.
1 bull	1.3 A.U.
1 horse	1.5 A.U.
5 ewes	1.0 A.U.
5 deer	1.0 A.U.
10 antelope	1.0 A.U.
1 elk	0.8 A.U.
160 ground squirrels	1.0 A.U.



RANGELAND MANAGEMENT

AG 320 - G

UNIT TEST

Name ______________________________________ Score________________________________

1. Match terms associated with rangeland management to the correct definitions. Write the correct numbers in the blanks.

_____a.	Amount of forage removed from a range area by grazing animals	1.	Range
		2.	Native plant
_____b.	Resembling grasses; usually used for sedges and rushes	3.	Introduced plant
_____c.	Plant originating in North America	4.	Climax
_____d.	Plant which comes into a range after both increasers and decreasers have been reduced	5.	Grass
		6.	Grass-like
_____e.	Plant which grows during the fall, winter or spring	7.	Forb
_____f.	The amount of feed or forage required by an animal unit for one month	8.	Shrub
_____g.	A plan for grazing rangeland based upon the range condition and types of vegetation	9.	Palatability
		10.	Decreasers
_____h.	Land not suited for cultivation, which supports a cover of vegetation suitable for grazing by animals	11.	Increasers
		12.	Invader
_____i.	The degree of an animal's desire to graze or not to graze a certain plant	13.	Forage value
_____j.	Special treatments, developments and structures used to improve range forage resources or to facilitate their use by grazing animals	14.	Warm season plant
		15.	Cool season plant
_____k.	The direction of change in range condition	16.	Range condition
_____l.	The thrifty productive grasses that comprise a high percentage of the grass cover of a range in top condition	17.	Range trend
		18.	Range utilization
_____m.	Plant that increases on a range when decreasers are reduced	19.	Animal unit
		20.	Animal unit month
_____n.	A plant with a solid, non-woody stem, usually broadleaf with netted veination	21.	Range management

_____o.	The current productivity of a range relative to what that range is naturally capable of producing		22.	Range improvement
_____p.	The care and use of rangeland for multiple uses including the highest continuous yield of animal products without endangering soil and water resources		23.	Stocking rate
_____q.	Number of animal units that are grazed in a certain area for a certain period of time		24.	Grazing plan
_____r.	One mature cow or equivalent based upon the average daily forage consumption of 12 kg dry matter per day			
_____s.	Plant which grows during the summer and early fall			
_____t.	Any plant of the family Gramineae; characteristic of long narrow leaves with parallel veination			
_____u.	Rating of a plant as a feed for cattle or sheep			
_____v.	A woody perennial plant with a solid woody stem which is characteristic of growth rings			
_____w.	Plant brought from countries outside the United States			
_____x.	Plant that decreases on a range when exposed to heavy grazing pressures			

2. List three uses of rangeland.

   a.____

   b. ____

   c.____

3. Give the percentage of rangeland in the:

   a. World _______________

   b. United States _______________

   c. Idaho _______________

4. List four kinds of plants found on range sites.

   a.____

   b. ____

   c.____

   d. ____

5. List three classifications of range plants other than by structure.

   a.____

   b. ____

   c.____

6. Select from the following list characteristics of a good rangeland plant. Write an "X" in the blank before each correct answer.

   _____a. Drought tolerant

   _____b. Tall

   _____c. Good palatability

   _____d. Good nutritional qualities

   _____e. Hardiness

   _____f. Easy to establish

   _____g. Short growth season

   _____h. Soil building/holding

7. Classify the following grasses as very palatable (A), palatable (B), or less palatable (C). Write the correct letter in the blank before each statement.

   _____a. Medusahead

   _____b. Idaho fescue

   _____c. Kentucky bluegrass

   _____d. Cheatgrass

   _____e. Crested wheatgrass

   _____f. Bluebunch wheatgrass

8. Select from the following list factors affecting forage growth. Write an "X" in the blank before each correct answer.

_____a. Temperature

_____b. Texture of soil

_____c. Rainfall

_____d. Structure of soil

_____e. Minerals in the air

_____f. Sunlight

_____g. Oxygen content in soil

_____h. Nutrients in the soil

_____i. Topography

9. Match the periods of plant growth on western ranges to the correct definitions. Write the correct number in the blank.

_____a. The flush period where animal demand is usually less than the forage supply; nutrition is high; animals gain well during the entire period

_____b. Dormant period; the longest period of the year; during this period, nutritional values may limit animal performance

_____c. Initial growth, usually in spring; growth is slow; cattle cannot usually get enough new growth to satisfy their intake needs; plant growth is less than animal demand; this period is before traditional range readiness

_____d. Plant growth is just about even with animal demand; usually a short time; nutritional values are just about adequate to meet requirements

1. Period 1
2. Period 2
3. Period 3
4. Period 4

10. List four factors to consider in planning grazing.

a.____

b. ____

c.____

d. ____

11. Discuss what a grazing plan should include.

____

____

____

____

____

12. List three general and two specific objectives of a grazing system.

General

a.____

b. ____

c.____

Specific

a.____

b. ____

13. Match grazing systems to the correct descriptions. Write the correct number in the blank.

_____a.	Range receiving a period of no grazing which is not rested or deferred	1. Deferred
		2. Rested
_____b.	Moving livestock from one area of range to another on a scheduled basis	3. Ungrazed
_____c.	A range is not grazed for an entire year	4. Continuous
_____d.	A range is not grazed until seed maturity is assured, or a comparable growth stage	5. Repeated seasonal
		6. Rotational
_____e.	Grazing the range the same time each year	
_____f.	The grazing of a range continuously throughout the year	

14. List three classes of plant response to range disturbance.

a.____

b. ____

c.____

15. Match range conditions to the correct descriptions. Write the correct number in the blank.

_____a.	76 to 100 percent of the vegetation is a mixture of highly palatable and desirable plants	1. Excellent 2. Good
_____b.	26 to 50 percent of the original vegetation is a mixture of highly palatable and desirable perennial plants	3. Fair 4. Poor
_____c.	51 to 75 percent of the original vegetation is a mixture of highly palatable and desirable perennial plants	
_____d.	Less than 25 percent of all vegetation consists of highly palatable and desirable plants	

16. Select from the following list benefits received from range improvement practices. Write an "X" in the blank before each correct answer.

_____a. Erosion control

_____b. Increased fire hazard

_____c. Increased quantity of forage

_____d. Decreased quantity of forage

_____e. Increased quality of forage

_____f. Decreased wildlife production

17. List five range improvement practices.

a.____

b. ____

c.____

d. ____

e.____

18. Arrange in order the steps in the range improvement process. Write a "1" before the first step, a "2" before the second step, and so on.

_____a. Maintain proper range management practices and evaluate effect of improvement practices

_____b. Implement selected range improvement practices

_____c. Select range improvement practices best suited for the situation

_____d. Identify cause of poor performance by range

19. List two methods to prevent overgrazing.

a.____

b. ____

20. List three methods of weed and brush control.

a.____

b. ____

c.____

21. Discuss the control of rodents.

____

____

22. Calculate the animal unit equivalent, and the amount of forage consumed per month for the following examples.
(Note: One animal unit will consume 26 pounds of dry forage per day.)

a. 45 beef cows (1 beef cow = 1.0 A.U.)

b. 1000 ewes (5 ewes = 1.0 A.U.)

c. 25 deer (5 deer = 1.0 A.U.)

d. 15 elk (1 elk = 0.8 A.U.)

e. 10 horses (1 horse = 1.5 A.U.)

23. Discuss the determination of stocking rate.

____

____

____

____

____

____

____

____

24. List three classes of range utilization.

a.____

b. ____

c.____

25. List three agencies involved in rangeland management.

a.____

b. ____

c.____

26. List two significant legislative acts to rangeland management.

a.____

b. ____

RANGELAND MANAGEMENT

AG 320 - G

ANSWERS TO TEST

1.

a.	18	i.	9	q.	23
b.	6	j.	22	r.	19
c.	2	k.	17	s.	14
d.	12	l.	4	t.	5
e.	15	m.	11	u.	13
f.	20	n.	7	v.	8
g.	24	o.	16	w.	3
h.	1	p.	21	x.	10

2. Answer should include three of the following:

   Livestock production (cattle & sheep grazing); Watershed; Wildlife; Recreation; Energy reserves (coal, oil, natural gas)

3. a. 47% b. 47% c. 85%

4. Grasses; Grass-like; Life span; Origin; Growth season; Forbs; Shrubs

6. a, c, d, e, f, h

7.

a.	C	d.	C
b.	A	e.	B
c.	B	f.	A

8. a, b, c, d, f, h, i

9. a. 3 b. 4 c. 1 d. 2

10. Intensity of use; Frequency of use; Season of use; Selectivity of use

11. Answer should include the following information:

    The time when the range is ready to graze (depending upon plant growth); The season during which the range can be used for the greatest benefit from the vegetation and offer the greatest protection of improvement of the range; (Note: Move livestock in relation to plant growth stage and forage utilization, not by calendar. Be sure enough forage is available in the next pasture or another move will be imminent.)

12. Answer should include three of the following:

    General: Increase forage production; Increase wildlife; Minimize soil erosion; Minimize recreational conflicts

Answer should include two of the following:

Specific: Vegetation--Maintenance or improvement of range condition; Restore vigor to plants; Allow for reproduction of plants (vegetative and sexual); Animal--Provide more nutritional forage; Maintain or increase current levels of production

13. a. 3 d. 1
 b. 6 e. 5
 c. 2 f. 4

14. Decreaser; Increaser; Invader

15. a. 1 b. 3 c. 2 d. 4

16. a, c, e

17. Answer should include five of the following:

 Adequate and well placed water supplies; Fenced to control grazing; Salt licks located at each watering hole; Management of native forage; Seeding of range; Practice weed and brush control; Rodent and insect control; Burning; Range fertilization; Develop and implement grazing plan

18. a. 4 b. 3 c. 2 d. 1

19. Answer should include two of the following:

 Rotate pastures; Graze lightly during seed production seasons; Regulate animal units

20. Mechanical; Burning; Chemical

21. Trapping; Poisoning

22. a. 45.0 animal units; 35,100 lbs or 17.55 tons
 b. 200 animal units; 156,000 lbs or 78 tons
 c. 5 animal units; 3900 lbs or 1.95 tons
 d. 12 animal units; 9360 lbs or 4.68 tons
 e. 15 animal units; 11,700 lbs or 5.85 tons

23. Answer should include the following information:

 Determine the number of usable acres in the pasture by subtracting the rocky, wooded and other unusable acres from the total acres. This results in the total usable acres; Find the animal unit stocking rate for the range by multiplying the animal unit month figure by the number of usable acres; Find the stocking rate for a growing season by dividing the length of the grazing season in months into the total animal unit months stocking rate; (Note: Another method of determining the stocking rate is to graze the animals on the pasture and observe the effect upon the vegetation, and make animal number adjustments according to the reaction of the vegetation. This method requires more experience and time, but is the most accurate. Stocking rates will vary from pasture to pasture.)

24. Heavy use; Moderate use; Light use

25. Answer should include three of the following:

    Bureau of Land Management; U.S. Forest Service; Agricultural Stabilization and Conservation Service; Soil Conservation Service; Cooperative Extension Service; State Department of Lands; Bureau of Indian Affairs

26. Answer should include two of the following:

    Homestead Act--1862; Timber Culture Act--1873; Forest Reserve Act--1901; Enlarged Homestead Act--1916; Stock Grazing Homestead Act--1916; Soil Erosion Service--1933; Taylor Grazing Act--1934; Halogeton Control Act--1952; Forest and Rangeland Renewable Resources Planning Act--1974; Federal Lands Policy and Management Act--1976; Desert Land Act--1977; Grazing Fee Study--1977 and 1985; Public Rangelands Improvement Act--1978

SUGAR BEET PRODUCTION

AG 320 - H

UNIT OBJECTIVE

After completion of this unit, students should be able to describe the vegetative cycle of the sugar beet and characteristics of a good seedbed. Students should also be able to discuss seedbed preparation, planting, weed problems, insect problems and harvesting. This knowledge will be demonstrated by completion of the assignment sheet and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Describe the vegetative cycle of the sugar beet.
2. List and describe the three regions of the mature beet body.
3. Describe the arrangement and growth of the sugar beet leaves.
4. Select correct statements concerning the sugar beet flower and seed development.
5. Describe the characteristics of a good seedbed.
6. List three primary goals of early seedbed preparation.
7. Select correct practices of early seedbed preparation.
8. Discuss the purpose of the final stages of seedbed preparation.
9. Discuss the practices of the final stages of seedbed preparation.
10. Discuss planting dates, spacing and rate.
11. List two sugar beet seed varieties.
12. List three problems caused by weeds.
13. List two methods of weed control in sugar beets.
14. List two sugar beet diseases.
15. List five insect pests of sugar beets.
16. Discuss the damage caused by sugar beet nematodes.
17. Discuss the function of the sugar beet harvester.
18. Identify the optimum harvest period for sugar beets.
19. Identify three causes of damage to roots while harvesting and handling sugar beets.

20. Select the top sugar beet producing states.

21. Discuss the economic importance of sugar beet production in Idaho.

22. List and discuss the three major factors affecting profitability of sugar beet production.

23. Make fertilizer recommendations for sugar beets.

SUGAR BEET PRODUCTION

AG 320 - H

SUGGESTED ACTIVITIES

I. Suggested activities for instructor

A. Order materials to supplement unit.

1. Literature

a. The following Current Information Series (CIS) publications are available from Agricultural Communications Center, Ag Publications Building, University of Idaho, Moscow, Idaho 83843-4196, (208-885-7982).

CIS	271	Idaho Fertilizer Guide: Sugar beets $.25
CIS	410	Sugar beet Injury--A Significant Factor in Loss of Sucrose $.35
CIS	747	Predicting the Change in Value of Sugar beets for Different Harvest Dates $.35
CIS	836	Improvement of Sugar Beet Seedling Emergence by Seed Priming $.25
CIS	845	The Sugar Beet Crown Borer in Idaho $.25
CIS	854	1987 Sugar beet Production Costs on Idaho and Eastern Oregon Farms $.35
EXP	533	Storage Studies on Sugar Beets in Southeastern Idaho $.50

b. Publications available from Washington State University. For a catalog of publications write to: Bulletin Department, Cooperative Extension, Cooper Publications Building, Washington State University, Pullman, Washington 99164.

c. Publications available from Oregon State University. For a catalog of publications write to: Bulletin Mailing Office, Industrial Building, Oregon State University, Corvallis, Oregon 97331.

2. Filmstrips, slideshows, etc.

   a. *Low-Damage Sugar beet Harvester*, Program # 126; 8 1/2 minutes, VHS or Beta format; explains the operation and advantages of an experimental sugar beet harvester; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196, (208-885-6436); purchase cost $25; rental cost $25 for 10 days.

   b. *Curly Top of Sugar beets*, Program # 168; 13 minutes, VHS or Beta format; describes history, symptomology and treatment; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196, (208-885-6436); purchase cost $25; rental cost $25 for 10 days.

   c. *Cyst Nematode of Sugar beets*, Program # 161; 8 minutes, VHS or Beta format; describes history, symptomology and treatment; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196, (208-885-6436); purchase cost $25; rental cost $25 for 10 days.

   d. *Powdery Mildew of Sugar beets*, Program # 165; 7 minutes, VHS or Beta format; describes history, symptomology and treatment; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196, (208-885-6436); purchase cost $25; rental cost $25 for 10 days.

B. Make transparencies and necessary copies of materials.

C. Provide students with objective sheet and discuss.

D. Provide students with information sheet and discuss.

E. Review and give test.

F. Reteach and retest if necessary.

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--The Sugar beet

2. TM 2--Weed Problems in Sugar beets

3. TM 3--Weed Control in Sugar beets

4. TM 4--Insect Pests of Sugar beets

E. Assignment sheet

1. AS 1--Make Fertilizer Recommendations for Sugar beet Production

F. Answers to assignment sheet

G. Test

H. Answers to test

III. Unit references

A. Baird, Craig R., et al., *The Sugar beet Crown Borer in Idaho*, University of Idaho Current Information Series No. 845., Moscow, Idaho, 1989.

B. Fenwick, H.S., *Cercospora Leaf Spot of Sugar Beets*, University of Idaho Current Information Series No. 301, Moscow, Idaho, 1975.

C. Johnson, Russell T., et al., *Advances in Sugar beet Production: Principles and Practices*, The Iowa State University Press, Ames, Iowa, 1971.

D. Martin, John H., et al., *Principles of Field Crop Production*, 3rd edition, Macmillan Publishing Co., Inc., New York, 1976.

E. Peterson, C.L., *Sugar beet Injury - A Significant Factor in Loss of Sucrose*, University of Idaho Current Information Series No. 410, Moscow, Idaho, 1977.

F. *Sugar beet Grower's Guide Book*, The Amalgamated Sugar Company, Ogden, Utah, 1979.

G. *The Sugar beet*, The Amalgamated Sugar Company, Ogden, Utah, 1979.

SUGAR BEET PRODUCTION

AG 320 - H

INFORMATION SHEET

I. Vegetative development (Transparency 1)

A. Biennial--Completes its vegetative cycle in two years

1. First year--Develops large succulent root, where most of the reserve food is stored

2. Second year--Produces flowers and seeds

B. Mature beet is an elongated pear-shaped body composed of three regions

1. Crown

a. Broadened, cone-shaped apex

b. Bears a tuft of large, succulent leaves and leaf bases

c. Center of crown has lowest sugar content of the entire beet

2. Neck

a. Just below the crown

b. Smooth, thin zone

c. Broadest part of the beet

3. Root

a. Cone-shaped, flattened on two sides

b. Terminates in a slender tap root

c. Usually grooved

d. Growth results from cell division

C. Leaves

1. Arranged on crown in close spiral

2. Growth after unfolding occurs by cell enlargement

II. Flower and seed development

A. Usually sets seed from pollination

B. Rosette of leaves forms during second year, but start getting smaller after about six weeks of growth and then the flower stalk develops

1. The flower stalk grows rapidly and branches considerably

2. The mature inflorescence (seed bush) is composed of large, open spikes arranged in a panicle that bears the flowers and later the seeds

C. The sugar beet fruit is an aggregate (formed by the cohesion of two or more flowers that have grown together at their bases). They form the seed ball (a hard, irregular dry body which usually contains two to five seeds)

D. Mature seed

1. Shiny, lentil-like structure

2. About 3 mm long; 1 1/2 mm thick

3. Outer seed coat

a. Reddish-brown

b. Very brittle

c. Separates easily from seed

III. Characteristics of a good seedbed

A. Firm

B. Fine-structured

C. Area between rows

1. Loose enough to permit air exchange and water percolation

2. Rough enough to resist wind and erosion

3. Smooth enough to permit precise cultivation

IV. Primary goals of early seedbed preparation

A. Manage crop residues

B. Change or improve soil structure to meet needs of sugar beet crop

C. Eliminate growing weeds

V. Early seedbed preparation

A. Plowing

1. Normal depth ranges from 6 to 14 inches, depending on the soil type, soil condition and type of farm equipment used

2. Usually done in fall or spring
3. Usually preceded by fertilizer application

B. Deep tillage--Chiseling

1. Break up hardpan
2. Allow for deep air and water percolation
3. Leave crop residues on soil surface

C. Leveling

VI. Final stages of seedbed preparation

A. Purpose

1. Eliminate weeds
2. Create soil environment conducive to precision planting, rapid germination and emergence

B. Practices

1. Bedding--Shaping soil in ridges; seed planted on top of ridges
2. If bedding is not done

a. Harrow or disc

b. Harrow ahead of planting

VII. Planting

A. Date--As early in the spring as weather and soil conditions permit

B. Spacing--18 to 22 inch rows

C. Rate--One to two pounds per acre (depending on seed type)

VIII. Sugar beet seed varieties

A. WS-88

B. WS-PM9

C. ACH-177

D. Beta 8654

E. HH-39

F. MH-R2

G. L.S.D. .05

IX. Problems caused by weeds (Transparency 2)

A. Compete with sugar beets for space

B. Compete with sugar beets for moisture

C. Compete with sugar beets for fertility

D. Serve as hosts for pests

E. Hinder crop harvesting

X. Weed control in sugar beets (Transparency 3)

A. Plowing and delayed seedbed tillage

B. Manual hoeing and weeding

C. Cultivation

D. Chemical

XI. Sugar beet diseases

A. Powdery mildew

1. Causal agent--Microscopic spores carried by wind

2. Symptoms--Powdery film or mold visible on leaves

3. Control methods--Sulfur applications

B. Curly top

1. Causal agent--Virus disease transmitted by sugar beet leafhopper

2. Symptoms--Rolling, crinkling and dwarfing of leaves; irregularly swollen veins; necrosis develops in the phloem areas of the vascular bundles

3. Control methods--Resistant varieties

C. Cercospora leaf spot

1. Causal agent--Fungus spores spread by becoming airborne

2. Symptoms--First symptoms visible as small, brownish spots with reddish-purple borders; later, the spots enlarge and turn gray; center tissue of old lesions drops out leaving ragged holes

3. Control methods--Crop rotation; weed control; fungicides

XII. Insect pests of sugar beets (Transparency 4)

A. Aphids

B. Cutworms

C. Armyworms

D. Loopers

E. Beet Leafhopper

F. Sugar beet Crown Borer

G. Grasshoppers

H. Lygus Bugs

I. Spider Mites

J. Root Maggot

K. Wireworms

XIII. Sugar beet nematodes

A. Description--Microscopic, eel-shaped animal

B. Damage--Puncture plant cells and suck out the fluid; puncture wound can leave the sugar beet open to fungal or bacterial invasion

C. Control--Long rotations with immune crops (alfalfa, beans, potatoes, small grains and corn); soil fumigation; weed control; refrain from returning tare dirt to fields

XIV. Harvesting and storage

A. Function of beet harvester

1. Harvest roots free of clinging soil

2. Remove foliage at base of lowest leaf scar

B. Optimum harvest period--October 10 to November 5

C. Considerations during harvest

1. Beet storage conditions can result in significant sugar loss when stored for several months (beets lose about 1/2 pound of sugar per ton per day of storage)

2. Well-topped, clean beets lose less sugar in storage

XV. Causes of damage to roots while harvesting and handling

A. Dropping or throwing the roots

B. Striking or scraping the roots with moving machine part

C. Handling beets when cold

XVI. Leading sugar beet producing states (1988)

A. California

B. Minnesota

C. Idaho

D. North Dakota

E. Michigan

F. Nebraska

XVII. Economic importance of sugar beet production in Idaho (1987)

A. 162,000 acres harvested

B. 26.4 tons yield per harvested acre

C. 4,277,000 tons total production

D. Economic value to the state of $165,520,000

XVIII. Factors affecting profitability of sugar beet production

A. Operating or variable costs

1. Seed (certified, registered, common)

2. Fertilizer

3. Soil testing

4. Irrigation (equipment investment, interest on investment, electricity)

5. Interest on operating capital

6. Pest control (herbicides, fungicides, insecticides, soil fumigation)

7. Machinery and equipment operation (land preparation, chemical application, planting, harvesting, machine hire)

8. Fuel

9. Crop insurance

10. Land rent

11. Part-time labor (salary, social security taxes, disability insurance)

B. Fixed costs

1. Land (investment, interest on investment, taxes)

2. Full-time labor (salary, social security taxes, disability insurance)

3. Machinery and equipment (investment, interest on investment, maintenance and repairs, insurance, depreciation)

4. Buildings (investment, interest on investment, maintenance and repairs, insurance, depreciation)

5. Farm liability insurance

C. Marketing

1. Transportation

2. Supply and demand

The Sugarbeet

WEED PROBLEMS IN SUGARBEETS

Compete with sugarbeets for space

Compete with sugarbeets for moisture

Compete with sugarbeets for fertility

Serve as hosts for pests

Hinder crop harvesting

WEED CONTROL IN SUGARBEETS

Plowing

Delayed seedbed tillage

Manual hoeing and weeding

Cultivation

Chemical

INSECT PESTS OF SUGARBEETS

Aphids

Cutworms

Armyworms

Loopers

Beet Leafhopper

Sugarbeet Crown Borer

Grasshoppers

Lygus Bugs

Spider Mites

Root Maggot

Wireworms

SUGAR BEET PRODUCTION

AG 320 - H

ASSIGNMENT SHEET #1--MAKE FERTILIZER RECOMMENDATIONS FOR SUGAR BEETS

Name ______________________________________ Score________________________________

Using the information provided on the soil test report for Sandy Sweettooth, and University of Idaho CIS # 271--Idaho Fertilizer Guide for Sugar beets, recommend the amount of fertilizer that will need to be applied to achieve above average yields (if other factors are not limiting production). Refer to the fertilizer guide for more complete directions.

Part I: See next page

Soil Test Request and Report Form

Form #88

DO NOT WRITE IN THIS SPACE
Lab no. 1A-004-10
Fee $32.00
Status: (Paid) Bill Other
Check no. 04965

Analytical Services Laboratory
College of Agriculture
Moscow, ID 83843-4196
(208) 885-6201

University of Idaho

Mailing Name Sandy Sweettooth
Address Rt #50 Box 3
Daily, ID 12345

Phone: (208) 413-8131
Date: 4-1-90

County: Ada
Grower: Sweettooth
Sample Identification: Large field

FIELD INFORMATION			
Irrigation: ☐ Sprinkler ☒ Furrow ☐ None			
Rotation	Crop	Fertilizer applied lb/acre	Yield
Next crop	Sugar beets	Pot. yield=	26 T/acre
Previous crop	Barley	160	4200#/acre
Grown in 19( )	Corn (Silage)	250	20 T/ac
Grown in 19( )	Sugar beets	300	31 T/ac

☑ CHECK TEST REQUIRED: Please make checks payable to Bursar, University of Idaho.

☒ Standard Fertility Test* ($10.00)
*Includes drying and grinding ($1.50), pH, P, K and O.M.

X Bicarbonate P & K ___ Acetate P & K

☐ pH (soil reaction)	$ 1	7.7
☐ Available P (ppm P)	$ 3	4.5
☐ Available K (ppm K)	$ 3	800 +
☐ Organic matter (%)	$ 3	1.46
Other Tests:		
☒ Sulfate-S (ppm S)	$ 3	6
☐ Boron (ppm B)	$ 5	
☐ Total Salts (E.C.) (mmhos/cm)	$ 2	
☐ Gypsum Requirement	$20	
☐ Lime Requirement	$ 4	
☐ Cation Exchange Capacity (meq/100g)	$ 7	
☒ Zinc (ppm Zn)	$ 4	0.51
☐ Copper (ppm Cu)	$ 4	
☐ Manganese (ppm Mn)	$ 4	
☐ Iron (ppm Fe)	$ 4	

Depth (feet)	Nitrate N (ppm)	Ammonium N (ppm)	Available Moisture (inches)
0-1	☒ 4.0	☒ 1.21	☐
1-2	☒ 3.1	☒ 0.86	☐
2-3	☒ 2.5	☐	☐
3-4	☐	☐	☐
4-5	☐	☐	☐
5-6	☐	☐	☐
6-7	☐	☐	☐
Total			

$3 per test   ppm × 4 = lb/acre

Cations:	Extractable	Soluble
Calcium	☐	☐
Magnesium	☐	☐
Sodium	☐	☐
Potassium	☐	☐

$3 per test   SAR ______

Contact the Analytical Services Laboratory for other special analyses.

FERTILITY GUIDE

Pounds Per Acre						
N	P_2O_5	K_2O				

Remarks: ______

If you wish further details or have questions concerning the soil analysis, please contact your University of Idaho County Extension Agent.

White — Grower copy • Yellow — Fertilizer Dealer copy • Pink — Ag Agent copy • Goldenrod — Laboratory copy

Part II:

A. How many pounds of nitrogen per acre are required to produce 1 ton of sugar beets?

B. List the three ways in which the nitrogen requirements are met.

C. Mineralizable nitrogen is assumed to be approximately __________________ pounds N per acre.

D. At what depths should the soil samples be taken?

E. Is the practice of placing starter fertilizer with the seed recommended? Why or why not?

University of Idaho
College of Agriculture

Cooperative Extension Service
Agricultural Experiment Station

Current Information Series No. 271

Idaho Fertilizer Guide: Sugarbeets

J. J. Gallian, S. E. Petrie, D. T. Westermann and J. N. Carter

These fertilizer guidelines are based on relationships established through research by the University of Idaho, The Amalgamated Sugar Company and the USDA Agricultural Research Service. Results and experience indicate that the guide rates suggested will produce above-average yields if other factors are not limiting production. Thus, the fertilizer guide assumes good management.

The suggested fertilizer rates will be accurate for your field provided: (1) the soil samples represent the area to be fertilized, and (2) the crop history information supplied is complete and accurate. An analysis is only as good as the sample collected (see CIS No. 162, *Soil Sampling*). Low yielding, eroded or scraped areas should be sampled separately and, if necessary, fertilized separately. These fertilizer guide rates and critical levels are subject to change as additional research information becomes available.

Nitrogen (N)

Controlling the amount of N available to the sugarbeet is critical in producing high beet tonnage with high sugar percentage. Nitrogen in excess of the crop's need can reduce sugar percentage and gross income per acre. The N soil test is the only way to accurately estimate N fertilizer needs. About 10 pounds of N per acre are required to produce 1 ton of sugarbeets. This N need is met by N released by mineralization of soil organic matter, by residual N carryover from previously fertilized crops and by addition of fertilizer N. Mineralizable N is assumed to be approximately 150 pounds N per acre.

Nitrogen Soil Test — Accurate soil sampling and analysis in a high value crop like sugarbeets is one of the best investments that can be made and is highly recommended. A soil test measures the residual N carryover from the previous crop and provides the necessary information for accurate fertilizer application.

Nitrate nitrogen (NO_3–N) is mobile in the soil. Soil samples, therefore, should be taken from the 0 to 12-inch and 12- to 24-inch soil depths or the effective root zone. These depths should be sampled and kept separate for analysis.

The N soil test values in Table 1 represent the sum of the extractable NO_3–N and ammonium nitrogen (NH_4–N) in the top 2 feet of soil by 1-foot increments or in the effective root zone. If the effective rooting depth is greater than 24 inches, a third sample should be collected, analyzed separately and the NO_3–N and NH_4–N added to the 0 to 12-inch and 12- to 24-inch values.

If the first foot is low in N (less than 5 ppm) but the sum of the first 2 feet is adequate, 20 to 40 pounds N per acre may be applied to provide N until root growth is sufficient to reach

Table 1. Nitrogen fertilizer rates for sugarbeet yield goals based on soil test N.

	Yield goal (tons/acre)[2]									
Soil test N[1]	18	20	22	24	26	28	30	32	34	36
ppm	N application rate (lb/acre)[3]									
0 to 5	65	85	110	130	155	185	215	245	275	300
6 to 10	35	55	80	100	125	155	180	210	240	270
11 to 15	0	35	55	75	100	125	150	180	210	240
16 to 20	0	0	25	50	75	100	120	150	180	210
21 to 25	0	0	0	25	50	70	95	120	145	170
26 to 30	0	0	0	0	25	45	65	90	115	140
31 to 35	0	0	0	0	0	25	35	50	80	105
36 to 40	0	0	0	0	0	0	20	30	50	75
41 to 45	0	0	0	0	0	0	0	0	25	50
46 to 50	0	0	0	0	0	0	0	0	0	25

[1]Add the ppm soil test NO_3–N and NH_4–N in the 0 to 12-inch sample to that in the 12- to 24-inch sample or effective rooting depth sample to determine soil test N. If effective rooting depth is greater than 24 inches, a third sample should be collected, analyzed separately and the NO_3–N and NH_4–N added to the 0 to 12-inch and 12 to 24-inch values.

[2]Nitrogen rates suggested should produce these yields if stand, planting date, irrigation disease or other factors are not limiting production. Choose a realistic yield goal that is consistent with your past experience and climatic conditions, and fertilize accordingly.

[3]Add 15 pounds N for each ton of grain straw or non-legume residue plowed under up to 50 pounds N per acre. Yields of grain straw or corn stover are normally 3 to 4 tons per acre.

the N in the second foot (about 4 to 5 weeks after emergence). The practice of placing starter fertilizer with the seed is not recommended because it will reduce germination and result in poor stands. Table 1 shows the rates of N to apply based on the yield goals and soil test N.

Phosphorus (P)

Sugarbeets will respond to P fertilizer if soil test levels are low. The soil test is based on extractable P present in the upper 12 inches of the soil. Table 2 shows the rates of P to apply for different soil test levels.

Phosphorus should be plowed down or applied to rough-plowed ground and worked into the seedbed. High rates should not be placed with or immediately below the seed. Side dressing is recommended when late applications are necessary.

Table 2. Phosphorus fertilizer rates based on soil test.

Soil test P[1] (0 to 12 inches)	Application rate[2] (lb/acre)	
(ppm)	(P_2O_5)	(P)
0 to 3.9	240	105
4.0 to 6.9	160	70
7.0 to 9.9	80	35
10.0 to 12.9	40	18
13.0 and above	0	0

[1]Soil extractant for P is $NaHCO_3$.
[2]$P \times 2.29 = P_2O_5$; $P_2O_5 \times 0.44 = P$.

Potassium (K)

Sugarbeets require less K than potatoes or alfalfa but will respond to K fertilization if soil test levels are low. The soil test is based on the extractable K present in the upper 12 inches of the soil. Table 3 shows the rates of K to be applied for different soil test levels. Potassium fertilizer should be incorporated into the seedbed.

Table 3. Potassium fertilizer rate based on soil test.

Soil test K[1] (0 to 12 inches)	Application rate[2] (lb/acre)	
(ppm)	(K_2O)	(K)
0 to 40	240	200
41 to 75	160	135
76 to 95	80	65
over 95	0	0

[1]Soil extractant for K is $NaHCO_3$.
[2]$K \times 1.2 = K_2O$; $K_2O \times 0.83 = K$.

Micronutrients

Zinc (Zn) — Deficiences of Zn are not widespread in sugarbeets. When the soil test for Zn is below 0.6 ppm in the upper 12 inches of the soil, or where land leveling has exposed white, limey subsoil, apply Zn fertilizer at a rate that supplies 10 pounds of Zn per acre or equivalent.

Other Micronutrients — "Shotgun" applications of micronutrient mixtures "for insurance" have not been necessary or economical; therefore, they are not recommended.

Sulfur (S)

Sulfur is generally not deficient in the major sugarbeet-growing region of Idaho where the Snake River is the source of irrigation water. In areas known to be S deficient or where the soil test is less than 8 ppm in the 0 to 12-inch soil sample, apply 30 pounds S per acre.

General Comments

- Irrigation management and weed, insect and disease control significantly influence the efficiency and effectiveness of your fertilizer applications and your ultimate crop yield.
- Nitrogen fertilizers can be fall applied on loam, silt loam and clayey soils. Winter leaching of N from the soil profile can be reduced to a minimum by applying N in the ammonium or urea forms when soil temperature is below 45°F. Greater efficiency may be obtained from preplant application in spring or by side dressing before July 1. Nitrogen applied after July 1 stimulates vegetative growth, lowers sugar percentage and extractability and contributes little to total sugar yield.
- On sandy soils where over-irrigation and leaching of nitrogen are likely, side dressing or applications of nitrogen through irrigation water before July 1 are suggested for at least half of the rate used.
- Fertilizer materials such as P, K and Zn can be effectively fall-applied as they are not readily leached over winter.
- Zinc-sensitive crops such as beans or corn following sugarbeets should receive 10 pounds Zn per acre.
- Uniform plant populations (110 to 130 plants per 100 feet of row) after thinning have produced the highest root yields and sugar percentages.

If you have questions regarding the interpretation of this information, please contact your Extension Agricultural agent or sugar company fieldman.

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SUGAR BEET PRODUCTION

AG 320 - H

ANSWERS TO ASSIGNMENT SHEET

Part I:

Nitrogen	4.0			
	3.1			
	2.5			
	1.21			
	.86			
	11.67	+	100	lbs/acre
			50	max
	15 lbs x 4 =		Residue plowed	
			150 lbs/acre	

Soil Fertility Guide

Pounds Per Acre						
N	P_2O_5	K_2O	P	Zinc	Sulfur	
150	—	—	160	10	30	

Part II:

A. 10

B. 1. Nitrogen released by mineralization of soil organic matter
   2. Residual nitrogen carryover from previously fertilized crops
   3. Addition of nitrogen fertilizer

C. 150

D. From the 0-12-inch and 12-to-24-inch soil depths or the effective root zone.

E. No--reduces germination, results in poor stands.

SUGAR BEET PRODUCTION

AG 320 - H

UNIT TEST

Name ______________________________________ Score________________________________

1. Describe the vegetative cycle of the sugar beet.

____

____

____

____

2. List and describe the three regions of the mature beet body.

a.____

____

b. ____

____

c.____

____

3. Describe the arrangement and growth of the sugar beet leaves.

____

____

____

____

4. Select statements concerning the flower and seed development of sugar beets. Place an "X" in the blank next to the correct statements.

_____a. Usually sets seed from pollination

_____b. Rosette of leaves forms during first year

_____c. The fruit is an aggregate

_____d. The seed ball formed is a soft, plump body containing 8-10 seeds _____e. The mature seed is dull; similar to a wheat seed

_____f. The outer seed coat is reddish-brown and very brittle

_____g. It is difficult to separate the seed coat from the seed

5. Describe the characteristics of a good seedbed.

____

____

____

____

____

____

6. List three primary goals of early seedbed preparation.

a.____

____

b. ____

____

c.____

____

7. Select correct practices of early seedbed preparation. Place an "X" in the blank next to the correct statement.

_____a. Harrowing

_____b. Plowing

_____c. Leveling

_____d. Cultivating

_____e. Chiseling

8. Discuss the purpose of the final stages of seedbed preparation.

____

____

9. Discuss the practices of the final stages of seedbed preparation.

____

____

____

10. Discuss planting dates, spacing and rates.

    a. Date _______________________________________

    b. Spacing ____________________________________

    c. Rate _______________________________________

11. List two sugar beet seed varieties.

    a. _______________________________________

    b. _______________________________________

12. List three problems caused by weeds.

    a. _______________________________________

    b. _______________________________________

    c. _______________________________________

13. List two methods of weed control in sugar beets.

    a. _______________________________________

    b. _______________________________________

14. List two sugar beet diseases.

    a. _______________________________________

    b. _______________________________________

15. List five insect pests of sugar beets.

    a. _______________________________________

    b. _______________________________________

    c. _______________________________________

    d. _______________________________________

    e. _______________________________________

16. Discuss the damage caused by sugar beet nematodes.

____

____

17. Discuss the function of the sugar beet harvester.

____

____

____

18. Identify the optimum harvest period for sugar beets.

____

19. Identify three causes of damage to roots while harvesting and handling sugar beets.

a.____

b. ____

c.____

20. Select the top sugar beet producing states.

_____a. Idaho

_____b. Utah

_____c. California

_____d. Nebraska

_____e. Missouri

_____f. Michigan

_____g. North Dakota

_____h. Minnesota

21. Discuss the economic importance of sugar beet production in Idaho.

22. List and discuss the three major factors affecting profitability of sugar beet production.

a.

b.

c.

SUGAR BEET PRODUCTION

AG 320 - H

ANSWERS TO TEST

1. Biennial--Completes its vegetative cycle in two years: First year--Develops large succulent root, where most of the reserve food is stored; Second year--Produces flowers and seeds

   <u>Crown</u>: Broadened, cone-shaped apex; Bears a tuft of large, succulent leaves and leaf bases; Center of crown has lowest sugar content of the entire beet
   <u>Neck</u>: Just below the crown; Smooth, thin zone; Broadest part of the beet
   <u>Root</u>: Cone-shaped, flattened on two sides; Terminates in a slender tap root; Usually grooved; Growth results from division

3. Arranged on crown in close spiral; Growth after unfolding occurs by cell enlargement

4. a, c, f

5. Firm; Fine-structured; Area between rows: Loose enough to permit air exchange and water percolation; Rough enough to resist wind, erosion; Smooth enough to permit precise cultivation

6. Manage crop residues; Change or improve soil structure to meet needs of sugar beet crop; Eliminate growing weeds

7. b, c, e

8. Eliminate weeds; Create soil environment conducive to precision planting, rapid germination and emergence

9. Bedding--Shaping soil in ridges; Seed planted on top of ridges; If bedding is not done--Harrow or disc; Harrow ahead of planting

10. a. Date--As early in the spring as weather and soil conditions permit
    b. Spacing--18 to 22 inch rows
    c. Rate--1 to 2 pounds per acre (depending on seed type)

11. Answer should include two of the following:

    WS-88; WS-PM9; ACH-177; Beta 8654; HH-39; MH-R2; L.S.D. .05

12. Answer should include three of the following:

    Compete with sugar beets for space; Compete with sugar beets for moisture; Compete with sugar beets for fertility; Serve as hosts for pests; Hinder crop harvesting

13. Answer should include two of the following:

    Plowing and delayed seedbed tillage; Manual hoeing and weeding; Cultivation; Chemical

14. Answer should include two of the following:

    Powdery mildew; Curly top; Cercospora leaf spot

15. Answer should include five of the following:

    Aphids; Cutworms; Armyworms; Loopers; Beet Leafhopper; Sugar beet Crown Borer; Grasshoppers; Lygus Bugs; Spider Mites; Root Maggot; Wireworms

16. Puncture plant cells and suck out the fluid; Puncture wound can leave the sugar beet open to fungal or bacterial invasion

17. Harvest roots free of clinging soil; Remove foliage at base of lowest leaf scar

18. October 10 - November 5

19. Dropping or throwing the roots; Striking or scraping the roots with moving machine part; Handling beets when cold

20. a, c, d, f, g, h

21. Answer could include the following information:

    162,000 acres harvested; 26.4 tons yield per harvested acre; 4,277,000 tons total production; Economic value to the state of $165,520,000

22. Answer could include the following information:

    <u>Operating or variable costs</u>: Seed (certified, registered, common); Fertilizer; Soil testing; Irrigation (equipment investment, interest on investment, electricity); Interest on operating capital; Pest control (herbicides, fungicides, insecticides, soil fumigation); Machinery and equipment operation (land preparation, chemical application, planting, harvesting, machine hire); Fuel; Crop insurance; Land rent; Part-time labor (salary, social security taxes, disability insurance)
    <u>Fixed costs</u>: Land (investment, interest on investment, taxes); Full-time labor (salary, social security taxes, disability insurance); Machinery and equipment (investment, interest on investment, maintenance and repairs, insurance, depreciation); Buildings (investment, interest on investment, maintenance and repairs, insurance, depreciation); Farm liability insurance
    <u>Marketing</u>: Transportation; Supply and demand

DRY PEA AND LENTIL PRODUCTION

AG 320 - I

UNIT OBJECTIVE

After completing this unit, students should be able to describe dry pea and lentil production techniques involved in seedbed preparation, fertilizer requirements, planting, disease and insect control, weed control, harvest and marketing. This knowledge will be demonstrated by completing the assignment sheet and the unit test with a minimum score of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. List three advantages of dry peas and lentils to cereal producers.
2. Describe the major production areas of dry peas and lentils.
3. Indicate the percent of Idaho dry pea and lentil production of the U.S. totals.
4. List five general recommendations for dry pea and lentil production.
5. Select characteristics of a desirable seedbed.
6. List three tillage operations involved in seedbed preparation.
7. Discuss seeding dates for spring peas, lentils and winter peas.
8. List two common varieties of seed for winter peas, spring peas and lentils.
9. Indicate the seeding rates for long-vined and short-vined winter peas that are seeded before September 15 in a good seedbed.
10. Discuss the changes in seeding rates for winter peas when seeding is delayed after September 15, and when seeding into seedbeds that are cloddy or have heavy surface straw residue.
11. Indicate the average seeding rates for spring peas and lentils.
12. Indicate the row spacing for peas and lentils.
13. Discuss why nitrogen fertilizer applications are generally not needed on peas and lentils.
14. List three ways that weeds compete with peas and lentils.
15. List three ways weeds cause losses in peas and lentils.
16. List three weeds in peas and lentils.
17. List two ways that weeds can be controlled in peas and lentils.

18. Name two harmful insects of peas and/or lentils.

19. Name two diseases of peas and lentils.

20. Discuss the harvesting of dry peas and lentils.

21. Indicate the percentage of U.S. dry peas and lentils that are exported, used for seed and marketed for domestic use.

22. Name three countries that are major importers of U.S. dry edible peas.

23. Name three countries that are major importers of U.S. lentils.

24. List and discuss the three factors affecting the profitability of dry pea and lentil production.

DRY PEA AND LENTIL PRODUCTION

AG 320 - I

SUGGESTED ACTIVITIES

I. Suggested activities for instructor

A. Order materials to supplement unit.

1. Literature

The following publications can be purchased from your University of Idaho Cooperative Extension System County Office, or you can order directly from Agricultural Communications Center, Agricultural Publications Building, University of Idaho, Moscow, Idaho 83843-4196, (208-885-7982). List publications by title and number on your order. Make your check payable to the Agricultural Communications Center.

CIS 227 *The Pea Leaf Weevil* $.35

CIS 448 *Northern Idaho Fertilizer Guide for Peas and Lentils* $.25

CIS 475 *Pea Weevil and Its Control* $.35

CIS 497 *Melrose Austrian Winter Pea* $.35

CIS 526 *Spring-Planted Austrian Winter Peas* $.35

CIS 720 *Importance of Quality and Size of Winter Pea Seed* $.35

CIS 738 *Glacier Winter Peas* $.45

CIS 748 *Aphids on Peas and Lentils and Their Control* $.35

CIS 749 *Intercropping Austrian Winter Peas* $.35

EXT 664 *Dry Pea, Lentil and Chickpea Production in Northern Idaho* $1.00

EXT 667 *Transporting and Marketing Idaho's Dry Edible Peas and Lentils* $.50

2. Video

a. *Sclerotinia White Mold of Peas,* Program #163; VHS or Beta format; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196, (208-885-6436); rental cost $10 for 14 days; purchase cost $25.00.

B. Make transparencies and necessary copies of materials.

C. Provide students with objective sheet and discuss.

D. Provide students with information and assignment sheets and discuss.

E. Do a community survey on dry pea and lentil production and publish the results in the local newspaper.

F. Calibrate a drill to seed dry peas and lentils as a class project.

G. Invite a local dry pea and lentil specialist to speak on pea and lentil production.

H. Arrange for a field trip to a local elevator to discuss storage and marketing of dry peas and lentils.

I. Make arrangements with a seed company or extension office for the class to visit local test plots and variety trials.

J. Review and give test.

K. Reteach and test if necessary.

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Idaho and Washington Dry Edible Pea and Lentil Production Areas

2. TM 2--General Production Recommendations

3. TM 3--Pea and Lentil Varieties

4. TM 4--Seeding Rates

5. TM 5--Marketing Flow Chart for Peas and Lentils

E. Assignment sheet

1. AS 1--Make Fertilizer Recommendations for Lentils

F. Answers to assignment sheet

G. Test

H. Answers to test

III. Unit references

A. Auld, D.L., et al., *Glacier Winter Peas*, University of Idaho, Current Information Series No. 738, Moscow, Idaho, 1984.

B. Auld, D.L., et al., *Melrose Austrian Winter Pea*, University of Idaho Current Information Series No. 497, Moscow, Idaho, 1979.

C. Delorit, R.J., et al., *Crop Production,* 5th edition, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

D. *Dry Peas and Lentils: Easy on the Budget and Good for You*, Washington and Idaho Dry Pea and Lentil Commissions and the American Dry Pea and Lentil Association, Moscow, Idaho.

E. Harris, Wesley and Meyer, Neil, *Transporting and Marketing Idaho's Dry Peas and Lentils*, University of Idaho Bulletin No. EXT 667, Moscow, Idaho, 1987.

F. Homan, Hugh W., et al., *Aphids on Peas and Lentils and Their Control*, University of Idaho Current Information Series No. 748, Moscow, Idaho, 1984.

G. McDole, R.E. and Mahler, R.L., *Northern Idaho Fertilizer Guide for Peas and Lentils*, University of Idaho Current Information Series No. 448, Moscow, Idaho, 1984.

H. Murray, G.A., et al., *Dry Pea, Lentil and Chickpea Production in Northern Idaho*, University of Idaho Bulletin No. EXT 664, Moscow, Idaho, 1987.

I. Murray, G.A., et al., *Importance of Quality and Size of Winter Pea Seed*, University of Idaho Current Information Series No. 720, Moscow, Idaho, 1983.

DRY PEA AND LENTIL PRODUCTION

AG 320 - I

INFORMATION SHEET

I. Advantages of dry peas and lentils to cereal producers

   A. Reduced incidence of cereal diseases (legumes are not hosts for cereal pathogens)

   B. Reduced fertilizer costs

      1. Legumes usually do not need addition of nitrogen fertilizer

      2. Legumes generally need smaller amounts of other nutrients than cereals

      3. Winter peas used as a green manure crop can fix 80 to 100 pounds of nitrogen per acre from the atmosphere

   C. Reduced winter annual grass problems in cereals

   D. Reduced cereal surpluses

   E. Increased market flexibility

II. Production areas (Transparency 1)

   A. Nearly 100 percent of U.S. dry edible peas and lentils are produced in Idaho and Washington

      1. Nearly all are grown in a region 150 miles long and 40 miles wide extending from Spokane, Washington to Grangeville, Idaho (known as the Palouse and the Camas Prairie)

      2. On the average, Idaho produces about 40 percent of the U.S. totals

III. General production recommendations (Transparency 2)

   A. Select well-drained fields with soil pH above 5.4

   B. Use drainage control measures in waterlogged fields if long-term economic benefits are realized

   C. In fields with pH below 5.4, add lime to attain a pH between 5.6 and 6.0, if cost-effective

   D. Do not plant in fields with severe weed, disease and insect problems unless appropriate control measures are available and used

   E. Use cultural and pesticide control measures in a timely manner for weeds, diseases and insects

F. Avoid soil compaction during and after seedbed preparation

G. Plant adapted varieties that produce marketable seed

H. Plant high-quality, disease-free seed

I. Plant early at recommended rates and depths

J. Apply adequate fertilizer for optimum yields

IV. Characteristics of desirable seedbed

A. Minimum of straw residue on soil surface

B. Absence of large clods

C. Absence of compaction

D. Fairly level

E. Loose and mellow

F. Adequate moisture

G. Free of weeds

V. Tillage operations involved in seedbed preparation

A. Primary tillage

1. Moldboard plow

a. Time--Spring or fall

b. Depth--6 to 8 inches

c. Moisture needed

2. Ripper (chisel plow)

a. Time--Fall

b. Depth--12 to 14 inches

c. Dry conditions needed

B. Secondary tillage

1. Disk

a. Time--Spring

b. Depth--3 to 4 inches

2. Harrow
    a. Time--Spring
    b. Depth--3 to 4 inches
3. Roller
    a. Time--Spring
    b. Depth--Surface

VI. Seeding dates

A. Spring peas and lentils
1. Seed as early as possible in the spring
2. Soil temperature at seeding depth should be at least $40^{o}F$

B. Winter peas--Seed between September 10 and 15

VII. Pea and lentil varieties (Transparency 3)

A. Winter peas
1. Common
2. Melrose
3. Glacier

B. Spring peas
1. Small Sieve Alaska
2. Tracer
3. Regular Alaska
4. Latah
5. Alaska 81
6. Columbian

C. Lentils
1. Chilean 78
2. Red Chief
3. Emerald

4. Brewer
5. Laird
6. Easton

VIII. Seeding rates and row spacing (Transparency 4)

A. Seeding rates

1. Winter peas
   a. 75 pounds per acre for long-vined Melrose and Common peas
   b. 100-125 pounds per acre for short-vined Glacier peas
   c. Increase one pound per acre for each day the seeding is delayed after September 15
   d. In seedbeds that are cloddy or have heavy straw residue on the surface, seeding rates should be increased
      (1) 90-100 pounds per acre for Melrose or Common peas
      (2) 130-150 pounds per acre for Glacier
2. Spring peas--Average 150 pounds per acre
   a. 125-150 pounds per acre
      (1) Small Sieve Alaska
      (2) Tracer
   b. 150-175 pounds per acre
      (1) Regular Alaska
      (2) Latah
      (3) Alaska 81
      (4) Columbian
3. Lentils--Average 60 - 80 pounds per acre
   a. 60 pounds per acre
      (1) Chilean 78
      (2) Red Chief
      (3) Emerald

(4) Brewer

b. 80 pounds per acre--Laird

B. Row spacing--6 to 7 inches

IX. Fertilization requirements

A. Soil testing

(Note: Use soil test results in conjunction with University of Idaho Fertilizer Guides. Nutrients of concern for soil test include nitrogen, phosphorus, potassium, sulfur and boron. Applications of other nutrients have not been shown to be responsive or economical and are not recommended. Lime applications should be considered on fields with pH 5.2 and below, but it is not known that it will be economical. Nitrogen applications are usually not needed on peas and lentils since they are capable of obtaining or "fixing" a portion of the nitrogen they require from the atmosphere. They also obtain nitrogen from residual nitrogen fertilizers and decomposition of organic matter in the soil.)

X. How weeds compete with peas and lentils

A. Competition for water

B. Competition for plant nutrients

C. Competition for light

XI. Losses caused by weeds

A. Decreased seed yield

B. Decreased seed quality

C. Cost of control activities

XII. Weeds in peas and lentils

A. Wild oats

B. Common lambsquarter

C. Pigweed

D. Mayweed chamomile

E. Nightshades

F. Mustards

XIII. Weed control

A. Chemical

(Note: Many herbicides registered for use on spring peas are ineffective for use in winter peas because the weeds either are not present at time of application or are too large for effective control.)

B. Cultural (before planting)

XIV. Harmful insects of dry pea and lentils

A. Pea leaf weevil (peas only)

1. Damage

a. Adult is a heavy feeder and causes severely scalloped edges on leaves and growing points of peas. The larvae burrow into the root zone where they feed on the nodules

2. Control--If the adult weevil population is large enough to affect growth, spraying is necessary to prevent loss of stand and reduced yields

B. Pea weevil (peas only)

1. Damage--Larvae eat through pods and into the developing pea seed

2. Control--Apply insecticide approximately 6 days after first blooms appear

C. Pea aphids and cowpea aphids

(Note: Pea aphid feeds on peas and lentils; cowpea aphid only feeds on lentils.)

1. Damage--Aphids suck the sap from growing plants, which causes foliage and blossoms to wilt and shrivel. Also transmit a variety of virus diseases

2. Control--Apply insecticide

D. Lygus bugs (usually only in lentils)

1. Damage--Feed on developing pods and seeds and cause chalky spot

2. Control--Apply insecticide

XV. Dry pea and lentil diseases

A. Seed rot

1. Symptoms--Seedlings fail to emerge

2. Causal agent--Soil-borne fungi

3. Control--Fungicide seed treatment

B. Root rot complex

1. Symptoms--Stunted, nonvigorous plants often yellowing from the base upward and reduced pod numbers

2. Causal agent--Soil-borne fungi

3. Methods of control

a. Seed treatment

b. Resistant varieties

c. Avoid soil compaction

C. Ascochyta foot rot

1. Symptoms--Purple spots on surface of leaves often enlarge and turn black or brown. On the stems, lesions can vary from purple to black in color and may be several inches long. Infected stems may die. Pods may become infected

2. Causal agent--Soil-borne fungus

3. Control methods

a. Grow peas on minimum of 3 to 4 year rotations

b. Completely bury all pea refuse during cultivation

c. Resistant varieties

D. Sclerotina white mold

1. Symptoms--Infected leaves and stems turn brown and appear water-soaked. Tissue above lesions wilts and turns brown and eventually dies prematurely in hot weather. A white moldy growth may be evident on plant tissue in later stages

2. Causal agent--Soil-borne fungus

3. Control--Very limited; may help not to use excessive seeding rates. Glacier winter peas show some resistance

XVI. Harvesting dry peas and lentils

A. Occurs primarily in August after the vines and pods have dried

B. Method

1. Combined directly with pea bar attached to front of grain combine

2. If green weeds are a problem, it may be necessary to swath field before combining

(Note: Swathing is very risky since the light, fluffy windrows are easily blown away by wind.)

XVII. Pea and lentil markets (Transparency 5)

A. Exports account for nearly 70 percent of the dry edible peas and lentils marketed

1. U.S. consistently exports dry edible peas to over 90 countries worldwide

a. Over 70 percent of any one year's exports will go to 10 countries including Columbia, Venezuela, Brazil, United Kingdom, Taiwan, Japan and Canada

2. U.S. lentil exports go primarily to 7 countries: Columbia, Venezuela, West Germany, Spain, Italy, Greece and Algeria

B. Approximately 9 percent of the dry edible peas and lentils will go back to the producer for use as seed

C. Domestic use accounts for about 21 percent of the dry peas and lentils produced

XVIII. Factors affecting profitability of dry pea and lentil production

A. Operating or variable costs

1. Seed (certified, registered, common)

2. Fertilizer

3. Soil testing

4. Irrigation (equipment investment, interest on investment, electricity)

5. Interest on operating capital

6. Pest control (herbicides, fungicides, insecticides, soil fumigation)

7. Machinery and equipment operation (land preparation, chemical application, planting, harvesting, machine hire)

8. Fuel

9. Crop insurance

10. Land rent

11. Part-time labor (salary, social security taxes, disability insurance)

B. Fixed costs

1. Land (investment, interest on investment, taxes)

2. Full-time labor (salary, social security taxes, disability insurance)

3. Machinery and equipment (investment, interest on investment, maintenance and repairs, insurance, depreciation)

4. Buildings (investment, interest on investment, maintenance and repairs, insurance, depreciation)

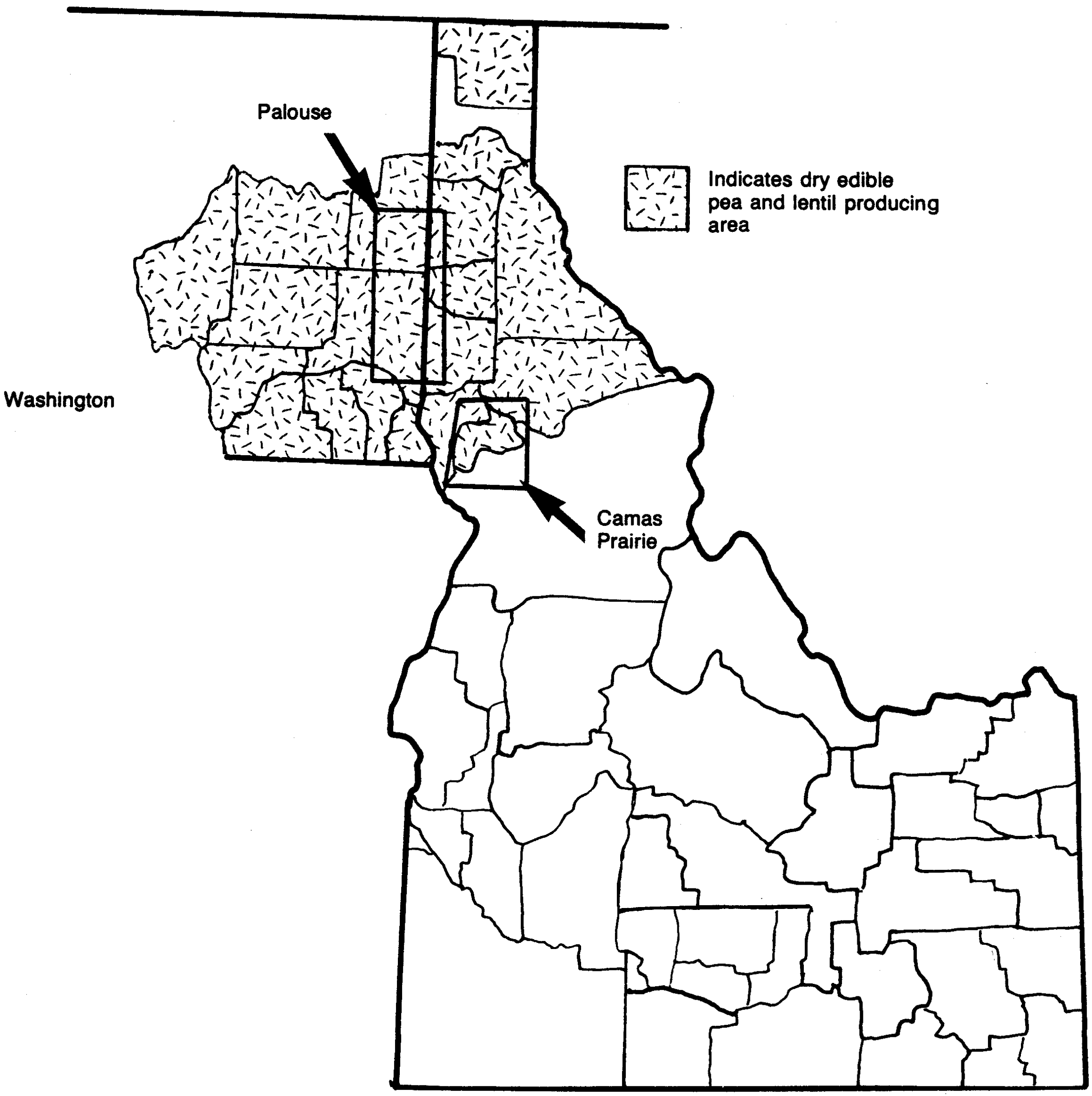
5. Farm liability insurance

C. Marketing

1. Transportation

2. Supply and demand

Idaho & Washington Dry Edible Pea & Lentil Production



GENERAL PRODUCTION RECOMMENDATIONS

Well drained fields

Soil pH above 5.4

Drainage control measures

Lime if cost effective

Evaluate weed, disease and insect problems

Cultural and chemical control measures for weeds, diseases and insects

Avoid soil compaction

Adapted varieties of marketable seed

High quality, disease-free seed

Plant early

Fertilize

PEA AND LENTIL VARIETIES

Winter Peas

Common

Melrose

Glacier

Spring Peas

Small Sieve Alaska	Latah
Tracer	Alaska 81
Regular Alaska	Columbian

Lentils

Chilean 78	Brewer
Red Chief	Laird
Emerald	Easton

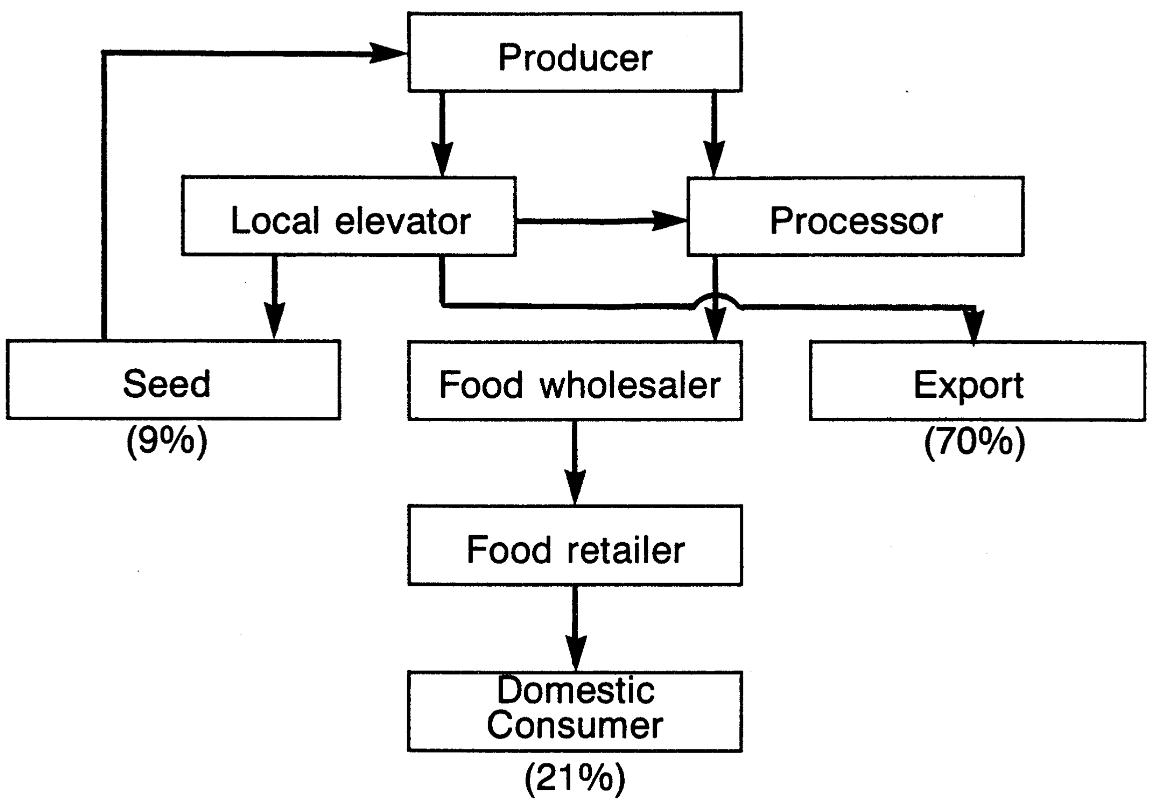
SEEDING RATES

Long-vined winter peas	**75 lbs/acre**
Short-vined winter peas	**100-125 lbs/acre**

(Increase winter pea seeding rates when seeded after September 15, and when seeded into seedbeds that are cloddy or with heavy surface straw residue.)

Spring Peas	**125-175 lbs/acre**
Lentils	**60-80 lbs/acre**

Marketing Flow Chart for Peas & Lentils



DRY PEA AND LENTIL PRODUCTION

AG 320 - I

ASSIGNMENT SHEET #1--MAKE FERTILIZER RECOMMENDATIONS FOR LENTILS

Name ______________________________________ Score________________________________

Using the information provided on the soil test report for Pam Peeling and University of Idaho CIS #448--Northern Idaho Fertilizer Guide for Peas and Lentils, recommend the amount of fertilizer that will need to be applied to achieve above average yields (if other factors are not limiting production). Refer to the fertilizer guide for more complete directions.

Part I See next page

Soil Test Request and Report Form

Form #88

Analytical Services Laboratory
College of Agriculture
Moscow, ID 83843-4196
(208) 885-6201

University of Idaho

DO NOT WRITE IN THIS SPACE
Lab no. I-003-8
Fee $21.00
Status: Paid Bill Other
Check no. 10463

Mailing Name Pam Peeling
Address Rt 2 Box 10
Hail, ID 81818

Phone: (208) 432-9741
Date: 3-15-90

FIELD INFORMATION			
Irrigation: ☐ Sprinkler ☐ Furrow ☐ None			
Rotation	Crop	Fertilizer applied lb/acre	Yield
Next crop	Lentils		
Previous crop	Wheat	200	60 bu/AC
Grown in 19(88)	Barley	300	2000#/AC
Grown in 19(87)	Alfalfa	150	3T/AC

County: Idaho
Grower: Peeling
Sample Identification: Old Place

☑ CHECK TEST REQUIRED: Please make checks payable to Bursar, University of Idaho.

☒ Standard Fertility Test* ($10.00)
*Includes drying and grinding ($1.50), pH, P, K and O.M.

____ Bicarbonate P & K X Acetate P & K

☐ pH (soil reaction)	$ 1	5.5
☐ Available P (ppm P)	$ 3	2.4
☐ Available K (ppm K)	$ 3	131
☐ Organic matter (%)	$ 3	3.16
Other Tests:		
☒ Sulfate-S (ppm S)	$ 3	<2
☒ Boron (ppm B)	$ 5	0.19
☐ Total Salts (E.C.) (mmhos/cm)	$ 2	
☐ Gypsum Requirement	$20	
☐ Lime Requirement	$ 4	
☐ Cation Exchange Capacity (meq/100g)	$ 7	
☐ Zinc (ppm Zn)	$ 4	
☐ Copper (ppm Cu)	$ 4	
☐ Manganese (ppm Mn)	$ 4	
☐ Iron (ppm Fe)	$ 4	

Depth (feet)	Nitrate N (ppm)	Ammonium N (ppm)	Available Moisture (inches)
0-1	☒ 2.6	☐	☐
1-2	☐	☐	☐
2-3	☐	☐	☐
3-4	☐	☐	☐
4-5	☐	☐	☐
5-6	☐	☐	☐
6-7	☐	☐	☐
Total			

$3 per test ppm × 4 = lb/acre

Cations:	Extractable	Soluble
Calcium	☐	☐
Magnesium	☐	☐
Sodium	☐	☐
Potassium	☐	☐

$3 per test SAR ______

Contact the Analytical Services Laboratory for other special analyses.

FERTILITY GUIDE

Pounds Per Acre						
N	P_2O_5	K_2O				

Remarks: ______

If you wish further details or have questions concerning the soil analysis, please contact your University of Idaho County Extension Agent.

White — Grower copy • Yellow — Fertilizer Dealer copy • Pink — Ag Agent copy • Goldenrod — Laboratory copy

Part II

A. Explain why nitrogen applications are not usually profitable on dry peas and lentils.

B. Why are adequate levels of sulfur necessary for maximum production of peas and lentils?

University of Idaho
College of Agriculture
Cooperative Extension Service
Agricultural Experiment Station

Current Information Series No. 448

Northern Idaho Fertilizer Guide

Peas and Lentils

R. E. McDole and R. L. Mahler

These fertilizer guidelines have been developed by the University of Idaho and Washington State University based on relationships between soil tests and crop yield response. The fertilizer rates suggested are based on research results and are designed to produce above average yields if other factors are not limiting production. Thus, the fertilizer guide assumes good management.

The suggested fertilizer rates will be accurate for your field provided (1) the soil sample was properly taken and is representative of the areas to be fertilized, and (2) the crop and fertilizer history supplied is complete and accurate. For help in obtaining a proper soil sample, refer to University of Idaho CIS No. 162, *Soil Sampling*, or confer with your Extension agricultural agent.

Nitrogen (N)

Peas and lentils are legumes that are capable of obtaining or "fixing" a portion of the nitrogen they require from the atmosphere. The bacteria which forms nodules on the roots of peas and lentils (*Rhizobium leguminosarum*) are present in adequate amounts in most northern Idaho soils. Seed should be inoculated with this bacteria when (1) peas and/or lentils have not been grown on the field for 5 or more years, or (2) when the soil pH is less than 5.7.

In addition to symbiotic nitrogen fixation, the soil often supplies some nitrogen to peas and lentils from residual nitrogen fertilizers and decomposition of organic matter. Thus, nitrogen applications on peas and lentils in most cases have not been profitable. Some contractors recommend about 20 pounds of nitrogen fertilizer per acre to improve the quality of processing peas.

Phosphorus (P)

Phosphorus should be incorporated into the seedbed by whatever method is most convenient for the grower. Acceptable methods include broadcast and plow-down or disk-in, band or drill with seed. Be careful not to allow direct contact between the seed and the fertilizer because peas and lentils are extremely sensitive to excess salts during germination. If heavy applications are required to correct nutrient deficiencies, they should be applied before or during seedbed preparation. Phosphorus needs can be determined effectively with the aid of a soil test (Table 1).

Table 1. Phosphorus (P) fertilizer rates based on a soil test.

Soil test* (0 to 12 inch)	Apply (lb/acre)	
ppm	P_2O_5	P**
0 to 2	60	26
2 to 4	40	18
over 4	0	0

*Sodium acetate extractable PO_4-P.
**$P_2O_5 \times 0.44 = P$ or $P \times 2.29 = P_2O_5$

Potassium (K)

Potassium should be incorporated into the seedbed by whatever method is most convenient for the grower. Acceptable methods include broadcast and plow-down or disk-in, band or drill with seed. Do not allow direct contact between the seed and the fertilizer because peas and lentils are extremely sensitive to excess salts during germination. If heavy applications are required to correct nutrient deficiencies, they should be applied before or during seedbed preparation. Potassium needs can effectively be determined with the aid of a soil test (Table 2).

Table 2. Potassium (K) fertilizer needs based on a soil test.

Soil test* (0 to 12 inch)	Apply (lb/acre)	
ppm K	K_2O	K**
0 to 50	80	66
50 to 75	60	50
over 75	0	0

*Sodium acetate extractable K.
**$K_2O \times 0.83 = K$ or $K \times 1.20 = K_2O$

Sulfur (S)

Adequate levels of sulfur are necessary for maximum production of peas and lentils. Without adequate sulfur, peas and lentils are not able to fix sufficient atmospheric nitrogen to meet the plants' needs. Consequently, soils testing less than 10 ppm SO_4–S should receive 15 to 20 pounds of sulfur per acre. Avoid using granular elemental sulfur applications on peas and lentils because this form of sulfur is only slowly available. Elemental sulfur greatly reduces soil pH.

Micronutrients

Boron (B) — Peas and lentils grown in northern Idaho have been shown to respond to boron (B) applications. Boron need can be determined by a soil test. Soils testing less than 0.5 ppm boron should receive 1 to 2 pounds of B per acre. Boron can be toxic if application rates are excessive or if it is concentrated too close to the seedling. Boron fertilizer should always be broadcast, never banded. For more information on boron and specific fertilizer materials availability, refer to University of Idaho CIS No. 608, *Boron in Idaho.*

Molybdenum (Mo) — Peas and lentils grown in northern Idaho have also been shown to respond to molybdenum (Mo). Because Mo is present only in small amounts, soil Mo analysis is not commercially available. Consequently, Mo fertilization recommendations are based on cropping history and soil pH. Molybdenum should be applied as a seed treatment on peas and lentils at the rate of ⅛ to ½ ounce Mo per acre when (a) the soil pH is less than 5.7, or (b) every third time peas and/or lentils are grown on a field. For more information on molybdenum, refer to University of Idaho CIS No. 589, *Molybdenum in Idaho.*

Zinc (Zn) — Response of peas and lentils to zinc (Zn) applications is extremely rare. Zinc applications of 5 pounds per acre should only be considered where zinc soil test levels are less than 0.6 ppm. For more information on zinc, refer to University of Idaho CIS No. 617, *Zinc in Idaho.*

Other Micronutrients — Peas and lentils have never been shown to respond to applications of chlorine (Cl), copper (Cu), iron (Fe) or manganese (Mn). Therefore, applications of these materials in northern Idaho should be avoided.

Lime — Lime applications of 1 ton/acre for peas and lentils should be considered on fields with pH 5.2 and below. Reduced pea and lentil yields may occur at soil pH 5.3 to 5.4. The yield response, however, from liming at these pH's may not be economical.

Starter Fertilizers

Starter fertilizers have not shown an economic advantage in pea and lentil production. Starter fertilizers are most beneficial on cold, wet soils that are not favorable for peas and lentils. If used, starter fertilizers should be placed adjacent to the seed at planting rather than with the seed. Do not allow direct contact between the seed and fertilizer because peas and lentils are extremely sensitive to excess salts during germination and early seedling growth.

General Comments

1. Early planting, both spring and winter varieties, is of utmost importance to maximum yields.
2. Use of peas and lentils in rotation reduces disease and weed problems that affect grain production.
3. Spring planted peas and lentils do best in a seedbed having a minimum of straw residue on the soil surface. Winter peas require a similar seedbed. Because of erosion problems, however, higher amounts of surface residues are recommended to reduce soil erosion.
4. The seedbed should be of proper moisture level to prevent formation of large clods and prevent soil compaction. Avoid overworking the soil and creating a finely pulverized surface.
5. Avoid planting in poorly drained areas.

If you need further information on cultural practices contact your Extension agricultural agent. Or, obtain a copy of University of Idaho Bulletin No. 578, *Dry Pea and Lentil Production in the Pacific Northwest.*

About the Authors — R. E. McDole is an Extension soil specialist, and R. L. Mahler is an assistant professor of soil science. Both are with the University of Idaho Department of Plant, Soil and Entomological Sciences in Moscow.

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25 cents per copy

DRY PEA AND LENTIL PRODUCTION

AG 320 - I

ANSWERS TO ASSIGNMENT SHEET

Part I

Soil Fertility Guide

Pounds Per Acre						
N	P_2O_5	K_2O	P	Sulfur	Boron	Molybdenum
0	0	0	40	15-20	1-2	1/8 - 1/2 oz/AC

Molybdenum as seed treatment

Part II

A. 1. Symbiotic nitrogen fixations
   2. Residual fertilizers
   3. Decomposition of organic matter

B. Needed for plants to fix sufficient atmospheric nitrogen to meet plants' needs.

DRY PEA AND LENTIL PRODUCTION

AG 320 - I

UNIT TEST

Name ______________________________________ Score________________________________

1. List three advantages of dry peas and lentils to cereal producers.

   a. ____

   b. ____

   c. ____

2. Describe the major production areas of dry peas and lentils.

   ____

   ____

   ____

   ____

3. Indicate the percent of Idaho dry pea and lentil production of the U.S. totals.

   ____

4. List five general recommendations for dry pea and lentil production.

   a.____

   b. ____

   c.____

   d. ____

   e.____

5. Select characteristics of a desirable seedbed from the following list. Write an "X" in the blank before each correct answer.

   _____a. Minimum field slope of 10 percent

   _____b. Adequate moisture

   _____c. Loose and mellow

   _____d. Only small weeds

_____e. Firm and well-packed

_____f. Absence of large clods

_____g. Heavy straw residue on soil surface

_____h. Absence of compaction

6. List three tillage operations involved in seedbed preparation.

a.____

b. ____

c.____

7. Discuss seeding dates for spring peas and lentils, and winter peas.

a. Spring peas and lentils ______________________________

____

____

b. Winter peas ______________________________________

8. List two common varieties of seed for winter peas, spring peas and lentils.

Winter peas

a.____

b. ____

Spring peas

a.____

b. ____

Lentils

a.____

b. ____

9. Indicate the seeding rates for long-vined and short-vined winter peas that are seeded before September 15 in a good seedbed.

a. Long-vined ______________________________________

b. Short-vined ______________________________________

10. Discuss the changes in seeding rates for winter peas when seeding is delayed after September 15, and when seeding into seedbeds that are cloddy or have heavy surface straw residue.

    a. Delayed seeding ______________________________

    ____

    ____

    b. Seedbeds ______________________________

    ____

    ____

11. Indicate the average seeding rates for spring peas and lentils.

    a. Spring peas ______________________________

    b. Lentils ______________________________

12. Indicate the row spacing for peas and lentils.

    ____

13. Discuss why nitrogen fertilizer applications are generally not needed on peas and lentils.

    ____

    ____

    ____

    ____

14. List three ways that weeds compete with peas and lentils.

    a. ______________________________

    b. ______________________________

    c. ______________________________

15. List three ways weeds cause losses in peas and lentils.

    a. ______________________________

    b. ______________________________

    c. ______________________________

16. List three weeds in peas and lentils.

a.________________________________

b. ________________________________

c.________________________________

17. List two ways that weeds can be controlled in peas and lentils.

a.________________________________

b. ________________________________

18. Name two harmful insects of dry peas and/or lentils.

a.________________________________

b. ________________________________

19. Name two diseases of peas and lentils.

a.________________________________

b. ________________________________

20. Discuss harvesting of dry peas and lentils.

____

____

____

____

____

21. Indicate the percentage of U.S. dry peas and lentils that are exported, used for seed and marketed for domestic use.

a. Exported ________________________________

b. Seed ________________________________

c. Domestic use ________________________________

22. Name three countries that are major importers of U.S. dry edible peas.

a.________________________________

b. ________________________________

c.________________________________

23. Name three countries that are major importers of U.S. lentils.

a.____

b. ____

c.____

24. List and discuss the three factors affecting the profitability of dry pea and lentil production.

DRY PEA AND LENTIL PRODUCTION

AG 320 - I

ANSWERS TO TEST

1. Answer should include three of the following:

   Reduced incidence of cereal diseases; Reduced fertilizer costs; Reduced winter annual grass problems in cereals; Reduced cereal surpluses; Increased market flexibility

2. Nearly 100 percent of U.S. dry edible peas and lentils are produced in Idaho and Washington; Nearly all are grown in a region 150 miles long and 40 miles wide extending from Spokane, Washington to Grangeville, Idaho (known as the Palouse and the Camas Prairie)

3. 40%

4. Answer should include five of the following:

   Select well-drained fields with soil pH above 5.4; Use drainage control measures in waterlogged fields if long-term economic benefits are realized; In fields with pH below 5.4, add lime to attain a pH between 5.6 and 6.0, if cost-effective; Do not plant in fields with severe weed, disease and insect problems unless appropriate control measures are available and used; Use cultural and pesticide control measures in a timely manner for weeds, diseases and insects; Avoid soil compaction during and after seedbed preparation; Plant adapted varieties that produce marketable seed; Plant high-quality, disease-free seed; Plant early at recommended rates and depths; Apply adequate fertilizer for optimum yields

5. b, c, f, h

6. Answer should include three of the following:
   Moldboard plow; Ripper (chisel plow); Disk; Harrow; Roller

7. a. Seed as early as possible in the spring; Soil temperature at seeding depth should be at least $40^{o}F$
   b. Seed between September 10 and 15

8. Answer should include two varieties of seed for each:

   Winter peas: Common; Melrose; Glacier
   Spring peas: Small Sieve Alaska; Tracer; Regular Alaska; Latah; Alaska 81; Columbian
   Lentils: Chilean 78; Red Chief; Emerald; Brewer; Laird; Easton

9. a. 75 pounds per acre for long-vined Melrose and Common peas
   b. 100-125 pounds per acre for short-vined Glacier peas

10. a. Increase one pound per acre for each day the seeding is delayed after September 15
    b. In seedbeds that are cloddy or have heavy straw residue on the surface, seeding rates should be increased 90-100 pounds per acre for Melrose or Common peas; 130-150 pounds per acre for Glacier

11. a. 150 pounds per acre
    b. 60-80 pounds per acre

12. 6 to 7 inches

13. Nitrogen applications are usually not needed on peas and lentils since they are capable of obtaining or "fixing" a portion of the nitrogen they require from the atmosphere. They also obtain nitrogen from residual nitrogen fertilizers and decomposition of organic matter in the soil.

14. Competition for water; Competition for plant nutrients; Competition for light

15. Decreased seed yield; Decreased seed quality; Cost of control activities

16. Answer should include three of the following:

    Wild oats; Common lambsquarter; Pigweed; Mayweed chamomile; Nightshades; Mustards

17. Chemical; Cultural (before planting)

18. Answer should include two of the following:

    Pea leaf weevil (peas only); Pea weevil (peas only); Pea aphids and cowpea aphids; Lygus bugs (usually only in lentils)

19. Answer should include two of the following:

    Seed rot; Root rot complex; Ascochyta foot rot; Sclerotinia white mold

20. Occurs primarily in August after the vines and pods have dried; Combined directly with pea bar attached to front of grain combine; If green weeds are a problem, it may be necessary to swath field before combining.

21. a. 70%   b. 9%   c. 21%

22. Answer should include three of the following:
    Columbia, Venezuela, Brazil, United Kingdom, Taiwan, Japan, Canada

23. Answer should include three of the following:
    Columbia, Venezuela, West Germany, Spain, Italy, Greece and Algeria

24. Answer should include the following information:

    <u>Operating or variable costs</u>: Seed (certified, registered, common); Fertilizer; Soil testing; Irrigation (equipment investment, interest on investment, electricity); Interest on operating capital; Pest control (herbicides, fungicides, insecticides, soil fumigation); Machinery and equipment operation (land preparation, chemical application, planting, harvesting, machine hire); Fuel; Crop insurance; Land rent; Part-time labor (salary, social security taxes, disability insurance)
    <u>Fixed costs</u>: Land (investment, interest on investment, taxes); Full-time labor (salary, social security taxes, disability insurance); Machinery and equipment (investment, interest on investment, maintenance and repairs, insurance, depreciation); Buildings (investment, interest on investment, maintenance and repairs, insurance, depreciation); Farm liability insurance
    <u>Marketing</u>: Transportation; Supply and demand

BEAN PRODUCTION

AG 320 - J

UNIT OBJECTIVE

After completion of this unit, students should be able to describe bean production techniques involved in crop rotation, seed inoculation and treatment, land preparation, disease, weed and insect control and planting. Students should also be able to identify potential markets for beans. This knowledge will be demonstrated by completion of the assignment sheet and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. List the five major classes of dry beans grown in Idaho.
2. Discuss crop rotation in bean production.
3. Discuss bean seed inoculation.
4. Discuss in detail land preparation for bean production.
5. List five methods of weed control in bean production.
6. List four factors influencing variety choice in bean production.
7. Identify a dry bean variety for each of the nine bean classes.
8. Discuss bean seed treatment.
9. Discuss soil temperature, depth and ridging when planting beans.
10. List four factors to consider when deciding whether or not to replant a poor stand of beans.
11. List three means of spreading bacterial diseases in beans.
12. State the regulation imposed by the Idaho Department of Agriculture in 1965 regarding bacterial diseases in beans.
13. Identify the major bacterial diseases in beans when given a description of each.
14. List two fungus diseases in beans.
15. State the best control of virus diseases of beans.
16. List two virus diseases in beans.
17. List four physiological problems that may occur in beans.
18. List three insect pests of beans.

19. Describe in detail the harvesting of beans.

20. Describe the combine adjustments that must be made if using a regular combine to harvest beans.

21. Identify potential markets for Pintos, Great Northern Beans, Pink Beans and Small Reds.

22. Indicate the percentage of beans grown in Idaho that are sold for seed.

23. Select the leading bean producing states.

24. Discuss the economic importance of bean production to Idaho.

25. List and describe the three factors affecting profitability of bean production.

26. Make fertilizer recommendations for beans.

BEAN PRODUCTION

AG 320 - J

SUGGESTED ACTIVITIES

I. Suggested activities for instructor

A. Order materials to supplement unit.

1. Literature

a. The following publications are available from the Agricultural Communications Center, Agricultural Publications Building, University of Idaho, Moscow, Idaho 83843-4196, (208-885-7982). List publications by title and number on your order. Make checks payable to Agricultural Communications Center.

CIS 228 *Developmental Stages of the Common Bean Plant* $.25

CIS 302 *Western Bean Cutworm on Beans and Corn* $.25

CIS 319 *"UI 76": A New Small White Navy Bean* $.35

CIS 336 *Current Dry Bean Varieties: Their Origin and Characteristics* $.25

CIS 338 *Bean Production: Estimated Cost Per Acre for Southcentral Idaho* $.25

CIS 359 *Spread of Halo Blight with Sprinkler Irrigation in Idaho Bean Seed Production Fields* $.25

CIS 378 *Idaho Fertilizer Guide: Beans* $.25

CIS 574 *Red Mexican Beans--NW59 and NW63* $.25

CIS 575 *Pinto Beans--NW410, NW590 and Olathe* $.25

CIS 656 *Control of Insect Pests of Beans* $.35

EXP 282 *Bean Production in Idaho* $1.25

EXP 443 *The Mexican Bean Beetle in Idaho and the West* $.40

EXP 550 *The Epidemiology and Control of Halo Blight in Idaho* $.50

EXP 561 *Great Northern UI-61--A White Great Northern Bean* $.40

EXP 592 *History and Biology of Western Bean Cutworm in Southern Idaho (1942-77)* $.75

EXT 649 *Marketing Idaho's Dry Edible Beans* $1.00

NCRP 198 *Dry Bean Production Problems* $5.00

MS 131 *1990 Selection Guide for Dry Bean Varieties* (NC)

2. Films

   a. *Fusarium Root Rot of Beans*, Program #167; 5 minutes, VHS or Beta format; describes history, symptomology and treatment; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196, (208-885-6436); purchase cost $25; rental cost $10 for 14 days.

   b. *Pithium Wilt of Beans*, Program #179; 8 minutes, VHS or Beta format; describes history, symptomology and treatment; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196, (208-885-6436); purchase cost $25; rental cost $10 for 14 days.

   c. *White Mold of Beans*, Program # 166; 8 1/2 minutes, VHS or Beta format; describes history, symptomology and treatment; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196, (208-885-6436); purchase cost $25; rental cost $10 for 14 days.

B. Make transparencies and necessary copies of materials.

C. Provide students with objective sheet and discuss.

D. Provide students with information and assignment sheets and discuss.

E. Do a community survey on bean production and publish the results in a local newspaper.

F. Calibrate a bean planter as a class project.

G. Invite local bean specialist to speak on bean production.

H. Arrange for a field trip to a local bean warehouse to discuss storage and marketing of beans.

I. Make arrangements with a seed company for class to visit local test plots and variety trials.

J. Review and give test.

K. Reteach and retest if necessary.

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Idaho Dry Edible Producing Counties

2. TM 2--Idaho Dry Edible Bean Types

3. TM 3--Weed Control

4. TM 4--Factors Influencing Variety Choice

5. TM 5--Bean Markets

E. Assignment sheet

1. AS 1--Make Fertilizer Recommendations for Beans

F. Answers to assignment sheet

G. Test

H. Answers to test

III. Unit references

A. Kolar, John J., et al., *Current Dry Bean Varieties: Their Origin and Characteristics*, University of Idaho Current Information Series No. 336, Moscow, Idaho.

B. LeBaron, Marshall J., *Bean Production: Estimated Cost Per Acre for Southcentral Idaho*, University of Idaho Current Information Series No. 338, Moscow, Idaho.

C. LeBaron, Marshall, et al., *Bean Production in Idaho*, University of Idaho Bulletin No. EXP 282, Moscow, Idaho.

D. LeBaron, Marshall J., *Developmental Stages of the Common Bean Plant*, University of Idaho Current Information Series No. 228, Moscow, Idaho.

E. LeBaron, Marshall, et al., *Spread of Halo Blight with Sprinkler Irrigation*, University of Idaho Current Information Series No. 359, Moscow, Idaho.

F. Martin, John H., et al., *Principles of Field Crop Production*, 3rd edition, MacMillan Publishing Co., Inc., New York, 1976.

G. Meyer, Neil L., et al., *Marketing Idaho's Dry Edible Beans*, University of Idaho Bulletin No. 649, Moscow, Idaho.

H. Stoltz, Robert L., et al., *Control of Insect Pests of Beans*, University of Idaho Current Information Series No. 656, Moscow, Idaho.

I. Stoltz, Robert L., et al., *Western Bean Cutworm on Beans and Corn*, University of Idaho Current Information Series No. 302, Moscow, Idaho.

BEAN PRODUCTION

AG 320 - J

INFORMATION SHEET

I. Major market classes of dry beans grown in Idaho (Transparencies 1, 2)

A. Pinto

B. Pink

C. Great Northern

D. Red Mexican

E. Small White or Navy

II. Crop rotation

A. May follow alfalfa, clover, cereals, potatoes, peas, sugar beets and most other crops grown in Idaho

B. Should allow at least two years between bean crops on a field

C. Bean-cereal rotation is satisfactory if properly executed

1. Winter wheat--Irrigate and plow immediately after harvest for rapid and complete straw decomposition

2. Plowing should be completed by early September

III. Seed inoculation (with nitrogen-fixing bacteria)

A. Bean seeds should be inoculated with the proper specific Rhizobium bacteria when grown for the first time on newly developed, virgin desert lands

(Note: Inoculation is not necessary when beans are grown on lands in Idaho where beans have been raised previously.)

IV. Land preparation

(Note: Preparation of land varies with the machinery available and the preceding crop.)

A. Plow land in fall or spring

B. Two methods of seedbed preparation

1. Oldest method

a. Place shallow corrugates at 30- to 32-inch spacings

b. Soak the entire soil surface

c. Allow soil to dry until surface is dry (about 10 days)

d. Disc to depth of 3 to 4 inches while applying preemergence weed control chemicals

e. Final seedbed preparation accomplished in the chemical incorporation

2. Bedding method

a. Apply and incorporate weed control chemicals

b. Place shallow (3 inch) corrugates at 48-inch spacings (these will be used for the crop production season)

c. Soak field laterally from the corrugates to a point just beyond where the seed is placed when planted

(Note: A second procedure for bedding is to put deeper (6 inch) corrugates at 24-inch spacing which can be done earlier in the season if desired. The preplant irrigation water will be applied in every other corrugate or again at the 48-inch spacing.)

d. A deep, firm seedbed free from clods and coarse debris is desirable

e. Partially level ridges off by harrowing

f. A cultivator shovel should be placed to operate ahead of each planter

V. Weed control (Transparency 3)

A. Preplant tillage operations

B. Preplant herbicide application

C. Harrow before bean plant emerges

D. Cultivation

E. Selective herbicides

VI. Factors influencing variety choice (Transparency 4)

A. Plant habit

B. Maturity

C. Disease resistance

D. Seed supply

E. Seed needs in other U.S. and foreign production areas

VII. Dry bean varieties

(Note: There are many more varieties. This is only a sample listing.)

A. Pintos

1. UI 111
2. UI 114
3. Ouray

B. Great Northerns

1. UI 31
2. UI 59
3. Tara

C. Large Round White

1. Perry
2. Marrow
3. Idaho

D. Small Whites

1. California 53
2. Atlas
3. UI 76

E. Small Reds or Red Mexican

1. UI 34
2. UI 35
3. Rufus

F. Kidney

1. Royal Red
2. Common White
3. Red Kote

G. Pinks

1. Sutter Pink

2. Roza

3. Gloria

H. Cranberry

1. Michigan Improved

2. UI 50

3. UI 51

I. Miscellaneous

1. Black Turtle

2. Steuben Yellow Eye

3. Swedish Brown

VIII. Seed treatment

A. Especially valuable with white-seeded varieties

B. Fungicides

1. Seed-rot

2. Damping-off of seedlings

C. Insecticide-fungicide combinations

1. Wireworms

2. Seed-corn maggot

IX. Planting

A. Soil temperature of top four inches of soil should be 55^{o}F and expected to remain there or higher

B. Depth

1. 2 1/2 -3 1/2 inches to insure that adequate moisture is available for germination

2. Deeper planting if moisture is low

C. Ridge of soil over row at planting time helps maintain moisture around seed and aids with weed control

1. May be left intact

2. May be harrowed off within 4 to 5 days of planting (harrowing may damage emerging seedlings after 4 to 5 days)

D. Planting rates and spacing

Plants/ft	Space between plants (inches)	Average planting rates for 22- to 24-inch rows in lb/acre				
		Pinto	Great Northerns	Viva and Small Pinks	Other Pinks and Red Mexican	Small Whites
4	3	70-75*	65-70	50-55	60-65	40-45
3	4	55-60	50-55	40-45	45-50	30-35
2.5	5	45-60	40-45	35-40	37-42	25-30

* These two numbers represent the pound rates for 22- to 24-inch rows respectively based on average seed size of these beans. Rates can be adjusted according to seed size of beans being sown

X. Factors to consider when deciding whether or not to replant a poor stand of beans

A. If there is sufficient time to replant and mature the crop

B. If there is sufficient moisture in the soil surface to germinate the seed

C. The number of plants that constitute a stand

D. If the reduction in stand is uniform or spotty as in the case of frost damage

(Note: Semivining field beans will usually produce a good crop if the plant population is an average spacing of 6 inches between plants in 22- to 24-inch rows. Snap bush beans will usually produce a good crop if the average spacing of the plant population is 4 inches between plants in 22- to 24-inch rows.)

XI. Bacterial diseases

A. Means of spreading

1. On and in the seed

2. Hail and rain storms

3. Movement of farm machinery, animals, insects and man

B. Regulation imposed by Idaho Department of Agriculture in 1965 which required that bean seed being brought into Idaho must be found free of bacterial pathogens before it could be planted

C. Major diseases

1. Halo blight

a. Most common in Idaho

b. Characterized by water-soaked, greasy looking spots on pods and dead spots surrounded by a chloritic halo on leaves

2. Common blight

a. Pod and leaf symptoms are similar to Halo blight

b. Usually has a more distinct, narrow, lemon-yellow border around the dead spot on the leaf

3. Bacterial wilt

a. Infected plants wilt, especially during warm afternoons

b. Pod symptoms are similar to Halo or Common blight, except that the circular, water-soaked spots do not usually develop

XII. Fungus diseases

A. Fusarium root rot

1. Widespread in Idaho

2. Especially destructive in snap beans and on soils repeatedly planted to beans

3. Symptoms

a. Most common--Reddish discoloration of tap root

b. Severe cases--Tap root and all lateral roots may be rotted

(Note: If there is sufficient moisture in the surface soil and the soil is ridged up around the stem, new roots may develop above the point of injury.)

4. Treatment/control methods

a. No soil fumigants or seed-treating agents have proven to be entirely satisfactory in controlling root rot

b. Best prevention--Cultural practices that provide good conditions for root growth and a crop rotation in which beans do not follow beans

B. White mold (sclerotinia wilt)

1. Requires high humidity and a moist soil surface to cause infection and spread within the field

2. Can destroy an entire field in 7 to 10 days under ideal conditions (can attack all above-ground parts of bean plant)

3. Symptoms

a. Rapid, soft rot of infected tissues which are usually covered by a mass of white fungus growth

b. Hard, black fungal masses (sclerotia) are present on the external plant surfaces or in the pith or pods

4. Treatment/control methods

a. Fungicides help suppress the disease, but must be applied <u>before</u> infection

b. After infection--Only control is to permit surface soil to dry thoroughly between irrigations

C. Pythium wilt

1. Cause--Fungus attacks stem before pod formation

2. Symptoms

a. Soft, slimy rot occurs at soil line and extends several inches up into plant

b. Affected plants wilt suddenly without noticeable loss of green color

c. Symptoms may be confused with white mold, except no presence of sclerotia

3. Usually of little economic importance

4. No specific control measures are recommended

XIII. Virus diseases

(Note: Control of virus diseases of beans is best achieved by planting certified seed of resistant varieties, when available.)

A. Bean common mosaic

1. Spread within and between fields by aphids

2. Symptoms

    a. Green to bluish-green mottled (or mosaic) pattern on leaves which usually exhibit a downward curling or cupping and general malformation

    b. Leaf veins often become slightly harder than the interveinal area

    c. Veinal necrosis of leaves

B. Bean yellow mosaic

1. Spread within and between fields by aphids

2. Symptoms

    a. Usually a yellow and green mottling

    b. Some strains may also cause veinal necrosis

    c. Leaves often brittle, glossy, cupped downward and may be malformed

C. Curly top

1. Transmitted by the sugarbeet leafhopper

2. Symptoms

    a. Early-season infections cause severe stunting, chlorosis and death

    b. In later season infections, the leaves may first appear harder than normal, and later become brittle, chloritic and cupped downward, and malformed

3. Resistant varieties available, but even the seedlings of these may become infected

D. Red node

1. Believed to be transmitted by insects (although this has not been proven)

2. Does not occur very often in Idaho

3. Little is known about this disease--no recommended control measures

4. Symptoms

    a. Reddish-purple discoloration at the nodes of stems and leaf attachment areas

    b. Reddish rings on pods

c. Pods may be shriveled and not produce seed

d. Severely diseased plants may bend over or break at affected nodes

XIV. Physiological problems

(Note: There are several disease-like conditions in beans that are not caused by parasites. Some of these conditions may become especially important in unfavorable environmental conditions.)

A. Baldheads

1. Emerged seedlings that don't have a growing point

2. Principal cause is injury to the growing point of the seed during handling or threshing

3. More common in snap beans than dry beans

B. Heat injury lesions

1. Appear as constrictions of the stems close to the soil line when bean plants are exposed to high day-time temperatures

2. May be more of a problem in light sandy soil

(Note: Do not confuse this with damping-off, which is caused by Pythium species or other soilborne micro-organisms.)

C. Sunscald

1. Similar to heat injury, but affects all above-ground parts of older plants that are exposed to direct or reflected sun rays

2. Caused by intense sunlight rather than heat

3. Small brown spots appear between the veins of the leaves, often fusing together to make larger spots

4. Partial defoliation or even complete death may follow

D. Salt injury

1. Only appears when the total salts in the soil are relatively high

2. Symptoms may vary from near normal appearing plants to yellow, stunted plants that may actually show some corrosive action of the salt on the leaves

3. Leaf edges will be brown and dead

4. Salt accumulations are often seen on the leaf surface

XV. Insect pests of beans

A. Beet leafhoppers

1. Description--Tiny, grey-green insect

2. Damage--Transmits curly top virus

3. Methods of control

a. Plant resistant varieties

b. Plant as early as possible

c. Treat roadside and farm yard breeding areas with an insecticide-herbicide combination to reduce the incidence of curly top

d. Treating beans with systematic insecticides at planting will give some control of leafhoppers

(Note: Satisfactory control is difficult after the leafhopper has moved into host crops.)

B. Lygus bugs

1. Description--Green to dark brown; about 1/4 inch long

2. Damage--Their feeding may kill young bean plants or the terminal portions of older plants; petiole attack results in blossom and pod drop. Later, they may force their beaks through large, developed pods and into the developing seeds

3. Seldom a pest in Idaho

a. Usually moves into bean fields too late to cause blossom to drop

b. Beans begin to mature as lygus bugs come into the field, and the adults stay only a few days

c. Little lygus bug reproduction takes place in bean fields

C. Mexican bean beetles

1. Description

a. Adult is 1/4 to 1/3 inch in length, oval, yellow to coppery-brown in color, with 16 black spots arranged in three rows across the body

b. Larva is oval, yellow in color, and has six rows of long, branching, black-tipped spines on its body

2. Damage--Both adults and larvae feed on the under surfaces of the bean leaves causing skeletonizing. Pods may also be attacked. Plants dry rapidly and may be killed within a month after the insect attack

3. Control--A contact or stomach poison spray can be used to kill the adults and larvae

   (Note: This insect is not currently a problem in Idaho, but is a constant threat to Idaho's bean industry because of it's extensive damage in other areas and the costs of controlling it.)

D. Two-spotted spider mites

1. Description--Microscopic, eight-legged, leaf or lemon-green color, two black spots on either side of back

2. Damage--First injury appears as pale yellow to reddish-brown spots on the under surface of the leaves. Later, both surfaces of the entire leaf are damaged

3. Control methods

   a. A 50- to 100-foot miticide spray border on the edge of the bean field, adjacent to alfalfa or clover hay, will reduce the potential mite invasion

   b. Treating weedy field margins at the time of hay harvest is also effective

   c. Spray with miticide when mites are first beginning to colonize bean fields

   d. Apply systemic soil insecticide 20-30 days after planting in areas with perennial mite problems

E. Seed-corn maggots

1. Description--(Adult) greenish-yellow, gray-colored fly with black legs, slender body, long wings

2. Damage--Maggots burrow into and feed in the developing seeds and plant stems. Severely attacked plants are often killed

3. Control--Plant insecticide-treated seed in warm, well-prepared seedbeds

F. Western bean cutworms

1. Description

   a. Adult--Miller moth; only active at night; body is 3/4 inch long and wing span is 1 1/2 inches. Forewings are rich brown with light tan to darker brown shading on the outer margin

b. Larvae--Newly hatched larvae are creamy white to light gray with a black head capsule. Mature larvae are tan colored, about 1 1/2 inches long and about 1/4 inch in diameter. The segment immediately behind the head has three longitudinal white stripes

2. Damage--Newly hatched larvae feed on the undersides of the leaves, buds and blossoms. When half grown, they begin feeding on pods and seeds

3. Control--Insecticide should be applied 10 to 20 days after peak moth flight

G. Wireworms

1. Description--Shiny yellow, hard-bodied worms; up to 3/4 inch long

2. Damage--Bean seeds and seedlings are sometimes killed and large plants weakened; bean stands will be severely thinned and may have to be replanted when the soil is infested

3. Control--No satisfactory control after seed is planted; must control by seed treatment or insecticide application at planting

XVI. Harvesting beans

(Note: The dry ripe bean seed must be handled as gently as possible to prevent injury and loss of germination.)

A. Cut and windrow when seed moisture content is 40 percent or greater

1. Most varieties will have approximately 80 percent of their pods showing yellow and mostly ripe

2. There will be greater losses from shattering and mechanical damage at seed moisture below 40 percent

3. Make into windrows immediately after cut--usually 6 to 8 rows (larger windrows help to protect seed from injury and discoloration by sun)

4. Cutting and windrowing should be done when the plants are damp with dew to reduce shattering losses

5. Cutters or pullers usually are blades that slide along just below the soil surface and lift the plants

6. Large windrows are made with tractor-mounted windrowers. (A conventional side delivery rake may be used, but it doesn't separate rocks and clods from the bean plants)

B. Threshing

1. Should be done as soon as the seeds can be readily separated from the pods

2. Threshers may be specialized units designed specifically for beans or regular combines that have been properly adjusted

3. Necessary combine adjustments

    a. Slow cylinder speed (250-400 rpm)

    b. Long drops in the separating and loading operations should be prevented

    c. Clearance between the cylinder and concave bar should allow seed to pass through without injury

XVII. Bean markets (Transparency 5)

A. Pintos

1. Sold mainly at a retail level in a dry form or canned as refried beans

2. Domestic market has been expanding with increases in U.S. Hispanic population and Mexican food popularity

3. Major export market purchasers include Mexico, the Netherlands, the Dominican Republic and Angola

B. Great Northern Beans

1. Steady domestic market

2. Increasing export market--mainly sold in dry form to nations such as Algeria and France

C. Pink Beans (used for packaging and canning, especially with meat products)

1. Primarily confined to domestic market

2. Exported to Puerto Rico and Brazil

D. Small Reds (used in packaging and canning, especially in chili)

1. Primarily confined to domestic market

2. Some exports to Latin American countries

(Note: Approximately 24 percent of the beans grown in Idaho are sold for seed, both domestic and foreign.)

XVIII. Leading bean producing states

A. Nebraska

B. California

C. North Dakota

D. Colorado

E. Idaho

F. Michigan

XIX. Economic importance of bean production to Idaho

A. 119,000 acres harvested

B. 1,890 pounds yield per harvested acre

C. 2,249,000 pounds total production

D. Economic value to the state of $63,422,000

XX. Factors affecting profitability of bean production

A. Operating or variable costs

1. Seed (certified, registered, common)

2. Fertilizer

3. Soil testing

4. Irrigation (equipment investment, interest on investment, electricity)

5. Interest on operating capital

6. Pest control (herbicides, fungicides, insecticides, soil fumigation)

7. Machinery and equipment operation (land preparation, chemical application, planting, harvesting, machine hire)

8. Fuel

9. Crop insurance

10. Land rent

11. Part-time labor (salary, social security taxes, disability insurance)

B. Fixed costs

1. Land (investment, interest on investment, taxes)

2. Full-time labor (salary, social security taxes, disability insurance)

3. Machinery and equipment (investment, interest on investment, maintenance and repairs, insurance, depreciation)

4. Buildings (investment, interest on investment, maintenance and repairs, insurance, depreciation)

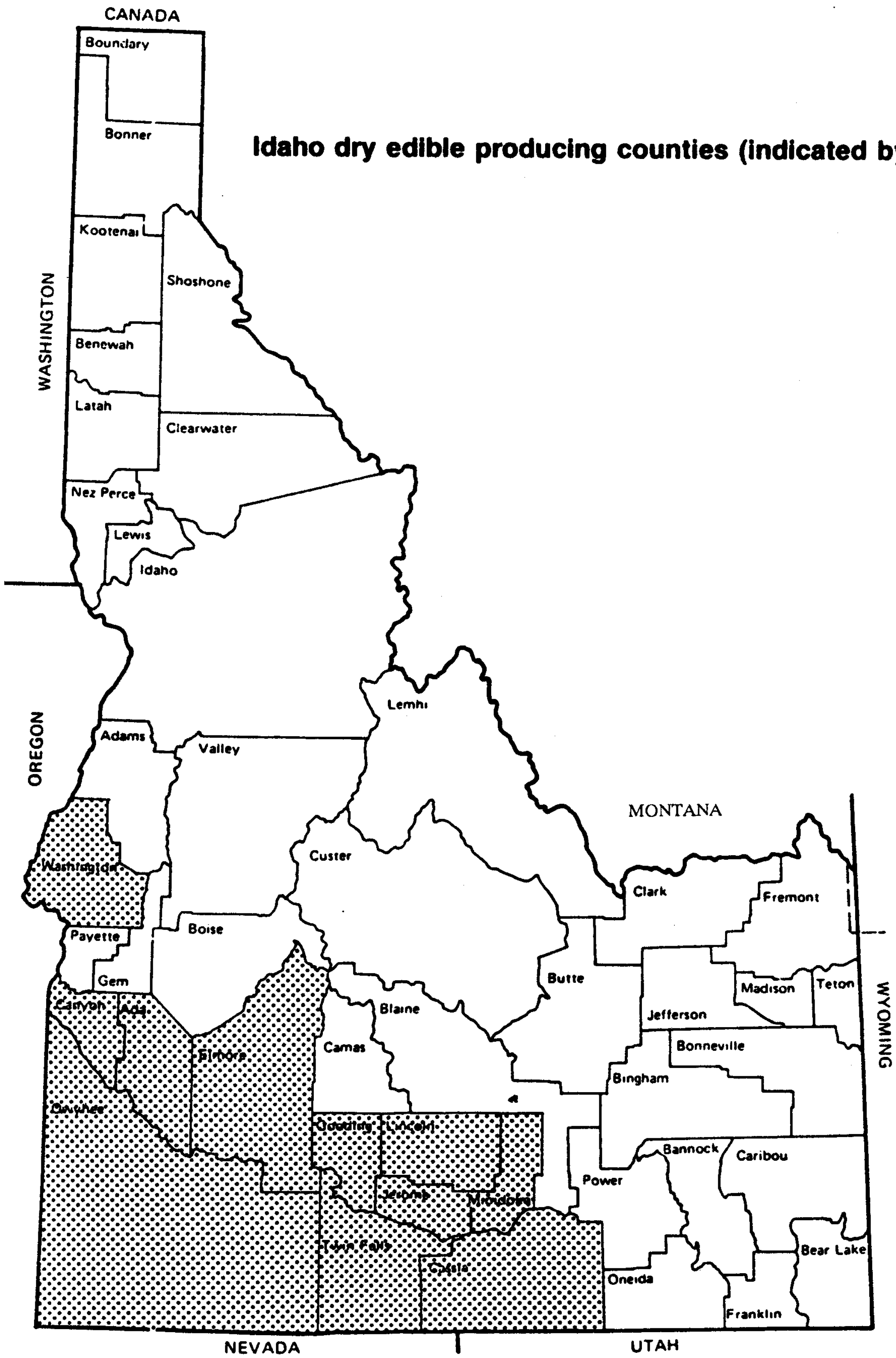
5. Farm liability insurance

C. Marketing

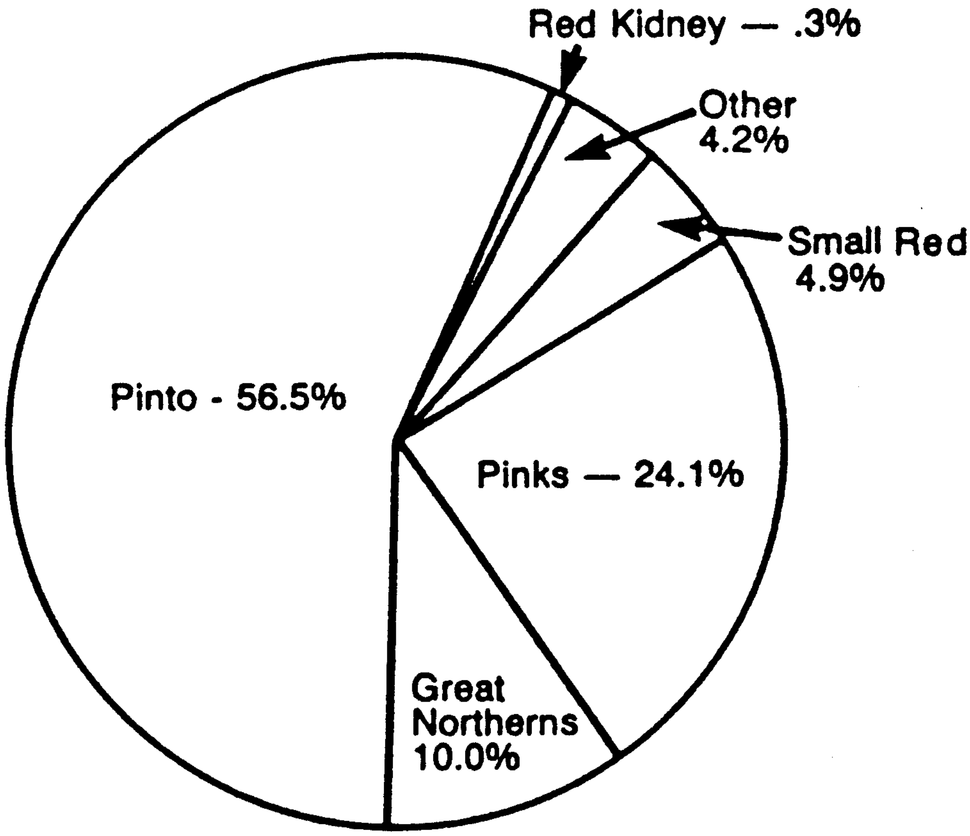
1. Transportation

2. Supply and demand

Idaho dry edible producing counties (indicated by ⁙).



Idaho Dry Edible Bean Types Produced in 1981.



WEED CONTROL

Preplant tillage operations

Preplant herbicide application

Harrow before bean plant emerges

Cultivation

Selective herbicides

FACTORS INFLUENCING VARIETY CHOICE

Plant habit

Maturity

Disease resistance

Seed supply

Seed needs in other U.S. and foreign production areas

BEAN MARKETS

PINTOS

Sold mainly at a retail level in a dry form or canned as refried beans

Domestic market has been expanding with increases in U.S. Hispanic population and Mexican food popularity

Major export market purchasers include Mexico, the Netherlands, the Dominican Republic and Angola

GREAT NORTHERN BEANS

Steady domestic market

Increasing export market--mainly sold in dry form to nations such as Algeria and France

PINK BEANS

Primarily confined to domestic market

Exported to Puerto Rico and Brazil

SMALL REDS

Primarily confined to domestic market

Some exports to Latin American countries

BEAN PRODUCTION

AG 320 - J

ASSIGNMENT SHEET #1--MAKE FERTILIZER RECOMMENDATIONS FOR BEANS

Name ______________________________________ Score________________________________

Using the information provided on the soil test report for Bob Beansprout and University of Idaho CIS #378--Idaho Fertilizer Guide for Beans, recommend the amount of fertilizer that will need to be applied to achieve above average yields (if other factors are not limiting production). Refer to the fertilizer guide for more complete directions.

Part I See next page

Soil Test Request and Report Form

Form #88

DO NOT WRITE IN THIS SPACE
Lab no. 2T-003-15
Fee $25.00
Status: Paid Bill Other
Check no. 01563

Analytical Services Laboratory
College of Agriculture
Moscow, ID 83843-4196
(208) 885-6201

University of Idaho

Mailing Name Bob Beansprout
Address 1956 Back 40 Drive
Lost Woods, ID 84163

Phone: (208) 743-3121
Date: 3-28-90

FIELD INFORMATION			
Irrigation: ☐ Sprinkler ☐ Furrow ☐ None			
Rotation	Crop	Fertilizer applied lb/acre	Yield
Next crop	Beans		
Previous crop	Barley	200 #	2200 lb/AC
Grown in 19(88)	Alfalfa	100 #	4T/AC
Grown in 19(87)	Alfalfa	100 #	3T/AC

County: Twin Falls
Grower: Bob Beansprout
Sample Identification:
#1 Beans

☑ CHECK TEST REQUIRED: Please make checks payable to Bursar, University of Idaho.

☒ Standard Fertility Test* ($10.00)
*Includes drying and grinding ($1.50), pH, P, K and O.M.

X Bicarbonate P & K ___ Acetate P & K

☐ pH (soil reaction)	$ 1	7.7
☐ Available P (ppm P)	$ 3	4.0
☐ Available K (ppm K)	$ 3	80
☐ Organic matter (%)	$ 3	1.65
Other Tests:		
☒ Sulfate-S (ppm S)	$ 3	5
☐ Boron (ppm B)	$ 5	
☒ Total Salts (E.C.) (mmhos/cm)	$ 2	1.63
☐ Gypsum Requirement	$20	
☐ Lime Requirement	$ 4	
☐ Cation Exchange Capacity (meq/100g)	$ 7	
☒ Zinc (ppm Zn)	$ 4	0.43
☐ Copper (ppm Cu)	$ 4	
☐ Manganese (ppm Mn)	$ 4	
☐ Iron (ppm Fe)	$ 4	

Depth (feet)	Nitrate N (ppm)	Ammonium N (ppm)	Available Moisture (inches)
0-1	☒ 5.4	☒ 0.36	☐
1-2	☐	☐	☐
2-3	☐	☐	☐
3-4	☐	☐	☐
4-5	☐	☐	☐
5-6	☐	☐	☐
6-7	☐	☐	☐
Total			

$3 per test ppm x 4 = lb/acre

Cations:	Extractable	Soluble
Calcium	☐	☐
Magnesium	☐	☐
Sodium	☐	☐
Potassium	☐	☐

$3 per test SAR ______

Contact the Analytical Services Laboratory for other special analyses.

FERTILITY GUIDE

Pounds Per Acre						
N	P_2O_5	K_2O				

Remarks: ______

If you wish further details or have questions concerning the soil analysis, please contact your University of Idaho County Extension Agent.

White — Grower copy • Yellow — Fertilizer Dealer copy • Pink — Ag Agent copy • Goldenrod — Laboratory copy

Part II

A. When would nitrogen fertilizer most likely be recommended for beans? Why?

B. What conditions normally cause zinc deficiencies?

C. At what level will salt in the soil begin to cause some injury to the bean plants?

University of Idaho
College of Agriculture
Cooperative Extension System
Agricultural Experiment Station

Current Information Series No. 378

Idaho Fertilizer Guide

BEANS

R. L. Mahler, G. E. Kleinkopf and D. T. Westermann

The following fertilizer guidelines are based on relationships between University of Idaho soil tests and crop yield response. The fertilizer rates suggested are based on research results and are designed to produce above average yields if other factors are not limiting production. Thus, the fertilizer guide assumes use of good crop management practices.

The suggested fertilizer rates will be accurate for your field provided (1) the soil samples are properly taken and represent the area to be fertilized, and (2) the crop history information supplied is complete and accurate. For help in obtaining a proper soil sample, see Idaho Extension Bulletin 704, *Soil Sampling*, or confer with the Extension agricultural agent in your county.

Nitrogen

Nitrogen (N) fertilizer is generally not needed for beans. If large quantities of crop residue such as cereal straw have been returned to the soil, fertilizer N may be needed to replace nutrients immobilized in decomposition of the straw and to provide sufficient available nitrogen for the early growth of the bean crop. Beans grown on new land should be inoculated with the proper *Rhizobium*. For information on availability, use and effectiveness of *Rhizobium*, refer to University of Idaho Current Information Series (CIS) 838, *Inoculation of Legumes in Idaho.*

Nitrogen fertilizer can be surface broadcast, incorporated or banded away from the seed. Recommended rates of N to apply based on previous crops and residues are shown in Table 1.

Nitrogen Soil Test

An N soil test can evaluate the carryover from heavily fertilized row crops. Since nitrate-nitrogen (NO_3-N) is mobile in the soil, samples should represent the 0- to 12-inch depth or the effective root zone of the plant.

Soil test values and recommended N rates are shown in Table 2. The soil test values represent the sum of the NO_3-N and ammonium nitrogen (NH_4-N) in the top foot of soil. (Nitrogen soil test following alfalfa has limited value.)

Phosphorus

Phosphorus (P) should be incorporated into the seedbed before planting or applied at planting by whatever method is most convenient for the grower. Phosphorus fertilizer can be surface-broadcast and plowed down or tilled into the soil. For more information on fertilizer application refer to University of Idaho CIS 757, *Fertilizer Placement*. Be careful not to allow direct contact between the seed and the fertilizer if the fertilizer material contains any N or potassium (K) in addition to P. Beans are sensitive to excess salts (contained in N and K) during germination. If heavy applications are required to correct nutrient deficiencies, apply before or during seedbed preparation. Phosphorus needs can be determined effectively with the aid of a soil test (Table 3).

Table 1. Suggested nitrogen fertilizer rates based on previous crop.

Previous crop	lb N/acre
Grain or corn (residue returned)	50
Grain or corn (residue removed)	30
Beans, peas, alfalfa stubble	0

Table 2. Nitrogen fertilizer rate based on nitrogen test.

Nitrogen soil test 0- to 12-inch depth	N application*
(N) ppm	(lb N/acre)
0	50
10	20
20	0

*Add 15 pounds N per ton of grain straw or non-legume residue plowed under up to 50 pounds N/acre. Straw yields are normally 3 to 4 tons/acre.

Table 3. Phosphorus fertilizer rates based on soil test (for a surface 12-inch sample).

Soil test* (0 to 12 inches)	P_2O_5**
(ppm)	(Apply lb/acre)
0 to 3	240
4 to 6	120
6 to 10	60
over 10	0

*P test is by $NaHCO_3$ extraction.
**$P_2O_5 \times 0.44 = P$ or $P \times 2.29 = P_2O_5$.

Potassium

Beans have a low requirement for soil potassium (K). Such crops as potatoes, alfalfa and corn are more likely to respond to applied K than are beans. Soils in southern Idaho generally contain sufficient K for bean production. Potassium needs can be effectively determined with the aid of a soil test (Table 4).

Table 4. Potassium fertilizer rates based on soil test (for a surface 12-inch sample).

Soil test* (0 to 12 inches)	K_2O**
(ppm)	(Apply lb/acre)
0 to 22	200
22 to 45	100
45 to 68	60
over 68	0

*K test is by $NaHCO_3$ extraction.
**$K_2O \times 0.83 = K$ or $K \times 1.20 = K_2O$.

Sulfur

The major bean-growing regions of Idaho should not experience a shortage of sulfur (S) since irrigation water generally contains S levels adequate for bean production. If low S water is used to irrigate beans, however, and a soil test at the 0- to 12-inch soil depth is less than 10 ppm, apply 30 pounds S/acre.

Zinc

Beans are sensitive to zinc (Zn) deficiency. Zinc deficiency of beans occurs most often on scraped (land leveled) or eroded areas, on fields receiving heavy applications of manure or straw and on fields following sugarbeets.

When soils test less than 0.6 ppm Zn, at the 0- to 12-inch soil depth, 10 pounds Zn/acre in an inorganic form, or equivalent, is recommended. If a soil test is not used, apply 5 pounds Zn/acre every year beans are grown or 10 pounds Zn/acre every third year for continuous beans.

For more information on Zn in Idaho soils and Zn fertilizer materials, consult University of Idaho CIS 617, *Zinc in Idaho.*

To correct Zn deficiency after the crop is up, use a foliar application of 2½ pounds Zn/acre. When applied before July 15 on fields showing deficiency symptoms, foliar Zn applications have hastened maturity and increased yields. Foliar Zn should be considered only as a corrective measure since soil-applied Zn is available at the beginning of the plant's growth period and therefore is of more value to the plant.

Other Micronutrients

Deficiency symptoms for manganese (Mn), copper (Cu), iron (Fe), molybdenum (Mo) and chlorine (Cl) have never been observed in Idaho bean fields. Therefore, applications of these materials in southern Idaho are not needed.

Boron (B) deficiencies are rare in southern Idaho. Care should be taken if a B deficiency is suspected since there is a narrow range between deficient and toxic B levels in soils. For further information on B, refer to University of Idaho CIS 608, *Boron in Idaho.*

Salinity (Salts)

Beans are extremely sensitive to salty soils. Soils testing over 2.0 mmhos/cm of salt would normally cause some injury to the bean plants and may reduce yields. Salt readings of 3.5 mmhos/cm and over would result in severe yield losses.

Salty irrigation water can contribute to salt accumulation on soils and requires special irrigation management techniques. For more information on salt-affected soils, see Idaho Extension Bulletin 703, *Salt- and Sodium-affected Soils.*

General Comments

1. Complete information on varieties, diseases and cultural practices are available in Idaho Experiment Station Bulletin 282, *Bean Production in Idaho.*
2. Zinc and potassium can all be effectively fall-applied or applied anytime before planting. Phosphorus, boron, nitrogen and sulfur should be applied as close to planting as possible.
3. Apply inoculum containing suitable *Rhizobium* to ensure nodulation and optimum nitrogen fixation if beans have not been grown in the field.
4. Irrigation, weeds, insects and disease control can influence the effectiveness of fertilizer programs.
5. Most bean plants in southern Idaho are affected by root rot to some degree. Fertilizer material should be incorporated into the top 6 inches of soil for maximum availability.

If you have any questions regarding the interpretation of this information, contact the Extension agricultural agent in your county.

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BEAN PRODUCTION

AG 320 - J

ANSWERS TO ASSIGNMENT SHEET

Part I

Soil Fertility Guide

Pounds Per Acre						
N	P_2O_5	K_2O	Zinc	Sulfur		
50	120	0	10	30		

Part II

A. When large quantities of crop residue such as cereal straw have been returned to the soil, nitrogen may be needed to replace nutrients immobilized in decomposition of the straw and to provide sufficient available nitrogen for the early growth of the bean crop.

B.
1. Land-leveled or eroded areas
2. Fields receiving heavy applications of manure or straw
3. Fields following sugarbeets

C. Over 2.0 mmhos/cm

BEAN PRODUCTION

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UNIT TEST

Name ____ Score _________________________________

1. List the five major classes of dry beans grown in Idaho.

   a. ____

   b. ____

   c. ____

   d. ____

   e. ____

2. Discuss crop rotation in bean production.

____

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3. Discuss bean seed inoculation.

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4. Discuss in detail land preparation for bean production.

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____

____

5. List five methods of weed control in bean production.

a.____

b. ____

c.____

d. ____

e.____

6. List four factors influencing variety choice in bean production.

a.____

b. ____

c.____

d. ____

7. Identify a dry bean variety for each of the nine bean classes.

a. Pintos ____

b. Great Northerns ______________________________________

c. Large Round White ____________________________________

d. Small Whites ____

e. Small Reds or Small Mexican ____________________________

f. Kidney ______________________________

g. Pinks ______________________________

h. Cranberry ______________________________

i. Miscellaneous ______________________________

8. Discuss bean seed treatment.

a. ______________________________

____

b. ______________________________

____

c. ______________________________

____

9. Discuss soil temperature, depth and ridging when planting beans.

a. Temperature ______________________________

____

____

b. Depth ______________________________

____

____

c. Ridging ______________________________

____

____

10. List four factors to consider when deciding whether or not to replant a poor stand of beans.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

11. List three means of spreading bacterial diseases in beans.

    a.____

    b. ____

    c.____

12. State the regulation imposed by the Idaho Department of Agriculture in 1965 regarding bacterial diseases in beans.

    ____

    ____

    ____

    ____

13. Identify the major bacterial diseases in beans by writing the name of the disease before the correct description.

    ________________________a. Pod and leaf symptoms are similar to Halo blight; usually has a more distinct, narrow, lemon-yellow border around the dead spot on the leaf

    ________________________b. Most common in Idaho; characterized by water-soaked, greasy looking spots on pods and dead spots surrounded by a chloritic halo on leaves

    ________________________c. Infected plants wilt, especially during warm afternoons; pod symptoms are similar to other diseases, except that the circular, water-soaked spots do not usually develop

14. List two fungus diseases in beans.

    a.____

    b. ____

15. State the best control of virus diseases of beans.

    ____

    ____

16. List two virus diseases in beans.

    a. ____

    b. ____

17. List four physiological problems that may occur in beans.

a.____________________

b. ____________________

c.____________________

d. ____________________

18. List three insect pests of beans.

a.____________________

b. ____________________

c.____________________

19. Describe in detail the harvesting of beans.

20. Describe the combine adjustments that must be made if using a regular combine to harvest beans.

a.____________________

b. ____________________

c.____________________

21. Identify potential markets for Pintos, Great Northern Beans, Pink Beans and Small Reds.

a. Pintos ____

____

____

____

b. Great Northern Beans ____

____

____

c. Pink Beans ____

____

____

d. Small Reds ____

____

____

22. Indicate the percentage of beans grown in Idaho that are sold for seed.

____

23. Select the leading bean producing states.

_____a. Oregon

_____b. California

_____c. Idaho

_____d. Washington

_____e. Nebraska

_____f. South Dakota

_____g. Colorado

_____h. North Dakota

_____i. Michigan

24. Discuss the economic importance of bean production to Idaho.

25. List and describe the three major factors affecting the profitability of bean production.

BEAN PRODUCTION

AG 320 - J

ANSWERS TO TEST

1. Pinto; Pink; Great Northern; Red Mexican; Small White or Navy

2. May follow alfalfa, clover, cereals, potatoes, peas, sugarbeets and most other crops grown in Idaho; Should allow at least two years between bean crops on a field; Bean-cereal rotation is satisfactory if properly executed

3. Bean seeds should be inoculated with the proper specific Rhizobium bacteria when grown for the first time on newly developed, virgin desert land

4. Plow land in fall or spring; Oldest methods: Place shallow corrugates at 30- to 32-inch spacings; Soak the entire soil surface; Allow soil to dry until surface is dry (about 10 days); Disc to depth of 3 to 4 inches while applying preemergence weed control chemicals; Final seedbed preparation accomplished in the chemical incorporation; Bedding method: Apply and incorporate weed control chemicals; Place shallow (3 inch) corrugates at 48-inch spacings; Soak field laterally from the corrugates to a point just beyond where the seed is placed when planted; A deep, firm seedbed free from clods and coarse debris is desirable; Partially level ridges off by harrowing; A cultivator shovel should be placed to operate ahead of each planter

5. Preplant tillage operations; Preplant herbicide application; Harrow before bean plant emerges; Cultivation; Selective herbicides

6. Answer should include four of the following:

   Plant habit; Maturity; Disease resistance; Seed supply; Seed needs in other U.S. and foreign production areas

7. Answer should include one variety in each class.

   a. Pintos: UI 111, UI 114, Ouray
   b. Great Northerns: UI 31, UI 59, Tara
   c. Large Round White: Perry, Marrow, Idaho
   d. Small Whites: California 53, Atlas, UI 76
   e. Small Reds or Red Mexican: UI 34, UI 35, Rufus
   f. Kidney: Royal Red, Common White, Red Kote
   g. Pinks: Sutter Pink, Roza, Gloria
   h. Cranberry: Michigan Improved, UI 50, UI 51
   i. Miscellaneous: Black Turtle, Steuben Yellow Eye, Swedish Brown

8. Especially valuable with white-seeded varieties; Fungicides: Seed-rot; Damping-off of seedlings; Insecticide-fungicide combinations: Wireworms; Seed-corn maggot

9. a. Soil temperature of top four inches of soil should be 55^{o}F and expected to remain there or higher
   b. Depth: 2 1/2 - 3 1/2 inches to insure that adequate moisture is available for germination; Deeper planting if moisture is low
   c. Ridge of soil over row at planting time helps maintain moisture around seed and aids with weed control; May be left intact; May be harrowed off within 4 to 5 days of planting (harrowing may damage emerging seedlings after 4 to 5 days)

10. If there is sufficient time to replant and mature the crop; If there is sufficient moisture in the soil surface to germinate the seed; The number of plants that constitute a stand; If the reduction in stand is uniform or spotty as in the case of frost damage

11. On and in the seed; Hail and rain storms; Movement of farm machinery, animals, insects and man

12. Regulation required that bean seed being brought into Idaho must be found free of bacterial pathogens before it could be planted

13. a. Common blight
    b. Halo blight
    c. Bacterial wilt

14. Answer should include two of the following:
    Fusarium root rot; White mold (sclerotinia wilt); Pythium wilt

15. Control of virus diseases of beans is best achieved by planting certified seed of resistant varieties (when resistant varieties are available)

16. Answer should include two of the following:
    Bean Common Mosaic; Bean Yellow Mosaic; Curly Top; Red Node

17. Baldheads; Heat injury lesions; Sunscald; Salt injury

18. Answer should include three of the following:

    Beet leafhoppers; Lygus bugs; Mexican bean beetles; Two-spotted spider mites; Seed-corn maggots; Western bean cutworms; Wireworms

19. Answer should include the following information:

    Cut and windrow when seed moisture content is 40 percent or greater; Most varieties will have approximately 80 percent of their pods showing yellow and mostly ripe; There will be greater losses from shattering and mechanical damage at seed moisture below 40 percent; Make into windrows immediately after cut--usually 6 to 8 rows (larger windrows help to protect seed from injury and discoloration by sun); Cutting and windrowing should be done when the plants are damp with dew to reduce shattering losses; Cutters or pullers usually are blades that slide along just below the soil surface and lift the plants; Large windrows are made with tractor mounted windrowers; Threshing: Should be done as soon as the seeds can be readily separated from the pods; Threshers may be specialized units designed specifically for beans or regular combines that have been properly adjusted

20. Slow cylinder speed (250-400 rpm); Long drops in the separating and loading operations should be prevented; Clearance between the cylinder and concave bar should allow seed to pass through without injury

21. Pintos: Sold mainly at a retail level in a dry form or canned as refried beans; Domestic market has been expanding with U.S. Hispanic populations and Mexican food popularity; Major export market purchasers include Mexico, the Netherlands, the Dominican Republic and Angola
Great Northern Beans: Steady domestic market; Increasing export market--mainly sold in dry form to nations such as Algeria and France
Pink Beans (used for packaging and canning, especially with meat products): Primarily confined to domestic market; Exported to Puerto Rico and Brazil
Small Reds (used in packaging and canning, especially in chili): Primarily confined to domestic market; Some exports to Latin American countries

22. Approximately 24 percent of the beans grown in Idaho are sold for seed, both domestic and foreign

23. b, c, e, g, h, i

Answer should include the following information:

119,000 acres harvested; 1,890 pounds yield per harvested acre; 2,249,000 pounds total production; Economic value to the state of $63,422,000

Answer could include information from the following:

Operating or variable costs: Seed (certified, registered, common); Fertilizer; Soil testing; Irrigation (equipment investment, interest on investment, electricity); Interest on operating capital; Pest control (herbicides, fungicides, insecticides, soil fumigation); Machinery and equipment operation (land preparation, chemical application, planting, harvesting, machine hire); Fuel; Crop insurance; Land rent; Part-time labor (salary, social security taxes, disability insurance)
Fixed costs: Land (investment, interest on investment, taxes); Full-time labor (salary, social security taxes, disability insurance); Machinery and equipment (investment, interest on investment, maintenance and repairs, insurance, depreciation); Buildings (investment, interest on investment, maintenance and repairs, insurance, depreciation); Farm liability insurance
Marketing: Transportation; Supply and demand

WINTER RAPESEED PRODUCTION

AG 320 - K

UNIT OBJECTIVE

After completion of this unit, students should be able to describe rapeseed production techniques involved in seedbed preparation, fertilizer requirements, planting, disease and insect control, weed control and harvest. This knowledge will be demonstrated by the completion of an assignment sheet and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Select plant characteristics of winter rapeseed.
2. List and describe the two types of rapeseed and two varieties of each.
3. Identify the correct Idaho rapeseed production districts when given a description of each.
4. List three factors that limit establishment of winter rapeseed.
5. Describe seedbed preparation for winter rapeseed.
6. List four characteristics of a desirable seedbed for winter rapeseed.
7. Discuss seeding rates of winter rapeseed.
8. Discuss seeding depth of winter rapeseed.
9. Identify the optimum time span for seeding winter rapeseed.
10. Name two primary insect pests of winter rapeseed.
11. Name three secondary insect pests of winter rapeseed.
12. Discuss weed competition with winter rapeseed.
13. List two perennial weeds that could be a problem in winter rapeseed.
14. List two annual weeds that could be a problem in winter rapeseed.
15. Name two diseases of winter rapeseed.
16. Discuss rapeseed harvesting equipment, equipment adjustments and moisture content.
17. Discuss potential markets for rapeseed.

18. List and discuss the three major factors affecting the profitability of winter rapeseed production.

19. Make fertilizer recommendations for winter rapeseed.

WINTER RAPESEED PRODUCTION

AG 320 - K

SUGGESTED ACTIVITIES

I. Suggested activities for instructor

A. Order materials to supplement unit.

1. Literature

a. The following publications can be purchased from your University of Idaho Cooperative Extension System county office, or you can order directly from Agricultural Communications Center, Agricultural Publications Building, University of Idaho, Moscow, Idaho 83843-4196, (208-885-7982). List publications by title and number on your order. Make your check payable to the University of Idaho.

CIS 715 *Winter Rape Production Practices in Northern Idaho* $1.00

CIS 782 *Cabbage Seedpod Weevil Control in Winter Rapeseed* $.35

CIS 785 *Northern Idaho Fertilizer Guide: Winter Rapeseed* $.25

CIS 801 *Cascade and Bridger Winter Rapeseed Varieties* $.35

CIS 818 *Production, Processing and Marketing Potential for Rapeseed in the Pacific Northwest* $.35

CIS 819 *Rapeseed Production Districts in Idaho* (NC)

EXP 598 *Vegetable Oil as an Agricultural Fuel for the Pacific Northwest* $.50

EXT 660 *An International Market Profile: Winter Rapeseed* $1.00

EXT 681 *Spring Rapeseed Culture in Idaho* $.50

B. Make transparencies and necessary copies of materials.

C. Provide students with objective sheet and discuss.

D. Provide students with information and assignment sheets and discuss.

E. Do a community survey on rapeseed production and publish the results in the local newspaper.

F. Calibrate a drill to seed rapeseed as a class project.

G. Invite a local rapeseed specialist to speak on rapeseed production.

H. Arrange for a field trip to a local elevator to discuss storage and marketing of rapeseed.

I. Make arrangements with a seed company or extension office for the class to visit local test plots and variety trials.

J. Review and give test.

K. Reteach and retest if necessary.

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Idaho Rapeseed Production Districts

2. TM 2--Factors That Limit Establishment of Winter Rapeseed

3. TM 3--Characteristics of a Desirable Seedbed

E. Assignment sheet

1. AS 1--Make Fertilizer Recommendations for Winter Rapeseed

F. Answers to assignment sheet

G. Test

H. Answers to test

III. Unit references

A. Auld, D.L., *Cascade and Bridger Winter Rapeseed Varieties,* University of Idaho Current Information Series No. 801, Moscow, Idaho, 1987.

B. Kephart, K.D., et al., *Rapeseed Production Districts in Idaho*, University of Idaho Current Information Series No. 819, Moscow, Idaho, 1988.

C. Kephart, K.D., et al., *Spring Rapeseed Culture in Idaho,* University of Idaho Bulletin No. 681, Moscow, Idaho, 1988.

D. Mahler, R.L., et al., *Northern Idaho Fertilizer Guide: Winter Rapeseed*, University of Idaho Current Information Series No. 785, Moscow, Idaho, 1986.

E. Murray, G.A., *Winter Rape Production Practices in Northern Idaho*, University of Idaho Bulletin No. 715, Moscow, Idaho.

F. Peterson, C.L., *Vegetable Oils as an Agricultural Fuel for the Pacific Northwest*, University of Idaho Bulletin No. EXP 598, Moscow, Idaho.

G. *PNW Winter Rapeseed Production Conference Notes*, Moscow, Idaho, 1986.

H. Prato, Tony, *Production, Processing and Marketing Potential for Rapeseed in the Pacific Northwest*, University of Idaho Current Information Series No. 818, Moscow, Idaho, 1988.

I. Schermerhorn, R.W., *An International Market Profile: Rapeseed*, University of Idaho Bulletin No. 660, Moscow, Idaho, 1986.

WINTER RAPESEED PRODUCTION

AG 320 - K

INFORMATION SHEET

I. Plant characteristics

  A. Winter annual

  B. Mustard family

  C. Growth

    1. Seedlings emerge in late summer and early fall

    2. Overwinter as dense rosette of leaves that prevent soil erosion

    3. Much of the leaf tissue freezes during winter

    4. New growth regenerated from thickened crown in February or March to a single flowering stalk

    5. Bright yellow flowers appear in early May

  D. Self-fertile (although under field conditions may be completely cross-pollinated if sufficient insect pollinators are available)

II. Types of rapeseed

  A. Industrial

    1. Oil used for producing synthetic lubricants, varnishes and plastics

    2. Must have minimum of 45 percent euricic acid content in the fatty acid composition

    3. May not be used for human consumption

    4. Varieties

      a. Dwarf Essex

      b. Bridger

      c. Gorczanski

      d. Norde

      e. Hector

B. Edible

1. Oil used for human consumption in food products such as margarine, salad and cooking oil and processed food products

2. May have no more than 2 percent euricic acid content in the fatty acid composition

3. Excellent in human diets because it combines low levels of saturated fats (less than 6 percent), high levels of mono-saturated fats (62 percent) and a desirable level of alpha-linolenic acid (10 percent)

4. Also known as canola oil

5. Varieties

a. Cascade

b. Jet Neuf

c. WW 827

d. Primor

e. Brink

f. Quinta

g. Sipal

III. Idaho rapeseed production districts (Transparency 1)

A. District 1

1. Includes all land south of the Canadian border and north of U.S. Interstate 90

2. Only edible type rapeseed varieties

B. District II

1. All land south of U.S. Interstate 90 and north of the Clearwater River

2. Only industrial type rapeseed varieties

C. District III

1. All land south of the Clearwater River and north of the Salmon River

2. Industrial type varieties can be grown with restrictions

a. Grower must consult and obtain written permission from all landowners bordering the field to be planted

b. Edible rapeseed fields must be at least 1/2 mile from industrial rapeseed fields

D. District IV

1. All land in Ada, Canyon, Elmore, Gem, Owyhee, Payette and Washington counties

2. No rapeseed may be planted except for the purposes of research, testing or introduction of rapeseed under trial ground requirements

E. District V

1. All land in Blaine, Cassia, Gooding, Jerome, Lincoln, Minidoka and Twin Falls counties

2. Industrial type rapeseed varieties may be planted without restriction

3. Edible type rapeseed may be planted with restrictions

a. Grower must consult and obtain written permission from all landowners bordering the field to be planted

b. Edible rapeseed fields must be at least 1/2 mile from industrial rapeseed fields

IV. Factors that limit establishment of winter rapeseed (Transparency 2)

A. Lack of moisture in top foot of soil

B. Soil crusting

C. Waterlogging

V. Seedbed preparation

A. Usually planted in fallow ground

B. Begins in the fall with the harvest of the previous crop

C. Leave stubble standing to capture snow in areas of 14 to 18 inches of precipitation and in areas where soils are unfrozen for most of the winter

D. Fall chisel plow in areas where the soil is frozen in the winter to capture the most water

E. Fallowing should begin as soon as soil conditions permit in the spring and continue at intervals to prevent weed growth and moisture loss

1. Before two or three expanded leaves develop on weeds

2. Maintain plant residues on surface for as long as possible by using sweep cultivation (residues are important for moisture conservation early in the year)

3. Rod-weeding or sweep cultivation can be used later in the season as surface residues decline (the dust layer is more important later in the season than the surface residue in preventing soil moisture loss)

4. Cultivation depth should be shallow and uniform except for the first and last cultivations

    a. Excessive soil moisture loss will occur if the cultivation depth is gradually increased over the fallowing period

    b. Last cultivation should be deep enough to allow seeding into moisture

F. Final seedbed

1. Fine

2. Firm enough to allow good soil contact with the seed

G. May have to firm up loose seedbeds with a roller

H. Soil crusting prevention

1. Avoid excessive working of the soil

2. Avoid cultivating or rolling wet soil or when rain is expected within a few days

I. Wet bottomlands and drainage areas should not be seeded to winter rapeseed (it doesn't tolerate poorly drained sites)

VI. Characteristics of a desirable seedbed (Transparency 3)

A. Fine but firm

B. Free of weeds

C. Free of volunteer crop growth

D. Moderate amount of crop residue (to reduce erosion)

VII. Row spacing and seeding rates

A. Seeding rates of 3 to 6 pounds per acre with 7-inch row spacings

B. Seeding rates of 7 to 10 pounds per acre if any of the following apply

1. 14 inch row spacings

2. Seeded later than August 25

3. Residue and clods prevent soil contact with the seed

VIII. Seeding depth

A. Seeding deeper than 2 inches reduces vigor and fall development of seedlings

B. Depth to moisture is a critical factor in establishment of winter rapeseed

C. Deep seeding

1. Increases the chances of good soil moisture for seed germination

2. Delays emergence, which may increase the probability of soil crusting

3. Reduces stands

IX. Planting dates

A. First two weeks of August

1. Highest percent winter survival

2. Highest seed yields

B. Late August

1. Slight decline in winter survival

2. Slight decline in seed yields

C. Mid-September

1. Winter survival reduced by 50 percent (compared to early August)

2. Seed yield reduced by 34 percent (compared to early August)

X. Primary insect pests

A. Cabbage seedpod weevil (major insect pest of winter rapeseed in Idaho)

1. Description

a. Adult--Ash-gray weevil, less than 1/8 inch long, curved snout

b. Larvae--White, legless grub with light brown head

2. Damage--Larvae feed on seeds within pod; each larvae can destroy 5 - 7 seeds; average yield losses are 20 - 30 percent

3. Control--Insecticides; applied after full-bloom, but before end of bloom; predators contribute to control

B. Cabbage aphid

1. Description--Winged and non-winged forms; 1/8 inch or less; green-gray body coloring

2. Damage--Sap-sucking can affect rosette size and vigor that affects overwintering survival; feeding can stop terminal growth which results in reduced plant size and seed yields

3. Control--Predation and parasites help control; no insecticides registered

XI. Secondary insect pests

A. Cabbage maggot

1. Description

a. Adult--Dark gray with black stripes on thorax and many bristles over body; about 1/4 inch long

b. Larvae--White maggots about 1/4 inch long

2. Damage--Larvae feed on roots

3. Control--No insecticides registered

B. Armyworms

1. Description

a. Adult--Brown moths of various sizes

b. Larvae--Green-brown caterpillars

2. Damage--Defoliation

3. Control--No insecticides registered

C. Lygus bug

1. Description

a. Adult--Pale, green-brown bugs about 1/4 inch long, winged

b. Nymphs--Similar to adult, but smaller and without wings

2. Damage--Bud and seed blast; reduce yield

3. Control--No insecticides registered

D. Flea beetles

1. Description

a. Adult--Shiny, green-black, about 1/8 inch long; some species have light colored markings or wing covers

b. Larvae--Whitish, worm-like with small legs and brownish heads

2. Damage--Adults feed on cotyledons shortly after seedling emergence

3. Control--No insecticides registered

E. Diamond back moth

1. Description

a. Adult--Small (1/3 inch long) gray moths with a row of three diamond-shaped yellow spots down middle of back

b. Larvae--Small (1/3 inch long) greenish worms with fine, scattered, erect hairs on body

2. Damage--Feeding on leaves can lead to total defoliation

3. Control--No insecticides registered; parasites and predators often important in control

XII. Weed competition with winter rapeseed

A. Compete for nutrients

B. Compete for water

C. Compete for light

D. Weed seeds could become crop contaminants

(Note: Weeds are usually not a problem when winter rapeseed is properly established on well-managed fallow ground. Properly timed cultivations during the fallow period and dense ground cover provided by well established rapeseed controls most annual weeds and reduces growth of perennials.)

XIII. Weeds

A. Perennial weeds

1. Canada thistle

2. Field bindweed

3. Quackgrass

B. Annual weeds

1. Wild mustards
2. Volunteer cereals
3. Prickly lettuce
4. Sowthistle
5. Fiddleneck
6. Wild buckwheat

XIV. Diseases

A. Pythium

1. Leads to damping-off of seedlings
2. Prevention
   a. Seed before September 1, preferably between August 1 - 15
   b. Seed in well-drained fields

B. Sclerotinia

1. Stem rot
   a. Girdling of plant stems
   b. Premature ripening
   c. Yield reductions
2. Prevention
   a. Avoid excess nitrogen application
   b. Use good rotation practices (cereal crops are non-susceptible; peas, lentils, beans and potatoes are susceptible crops)

XV. Harvesting

A. Conventional combine

1. Slow cylinder speed
2. Fairly wide space between concave and cylinder

B. Moisture content

1. Eight percent or less

2. High moisture content will cause rapeseed to heat and mold when stored

XVI. Potential markets

A. Edible rapeseed

1. Must compete with other oil crops such as palm oil, soybean oil, other vegetable oils and animal fats

2. Japan is the major potential market for edible rapeseed, but the U.S. must be able to compete with Canadian rapeseed in quality and price

3. Domestic markets for oilseed, oil and meal are very large, but in order for rapeseed from the Pacific Northwest to gain a share of these markets, two conditions must exist:

a. Must be priced competitively with oil and meal produced from soybean, palm and cottonseed (as well as rapeseed oil and meal produced in Canada)

b. Must use crushing facilities in Canada, the northern plains or the Midwest, or expand its own oilseed crushing facilities

B. Industrial rapeseed

1. Current U.S. markets can be served with production from 40,000 acres

2. Current marketing potential appears quite limited, but its suitability as a biological source for industrial products indicates good potential for long-term market expansion

XVII. Factors affecting profitability of winter rapeseed production

A. Operating or variable costs

1. Seed (certified, registered, common)

2. Fertilizer

3. Soil testing

4. Irrigation (equipment investment, interest on investment, electricity)

5. Interest on operating capital

6. Pest control (herbicides, fungicides, insecticides, soil fumigation)

7. Machinery and equipment operation (land preparation, chemical application, planting, harvesting, machine hire)

8. Fuel

9. Crop insurance

10. Land rent

11. Part-time labor (salary, social security taxes, disability insurance)

B. Fixed costs

1. Land (investment, interest on investment, taxes)

2. Full-time labor (salary, social security taxes, disability insurance)

3. Machinery and equipment (investment, interest on investment, maintenance and repairs, insurance, depreciation)

4. Buildings (investment, interest on investment, maintenance and repairs, insurance, depreciation)

5. Farm liability insurance

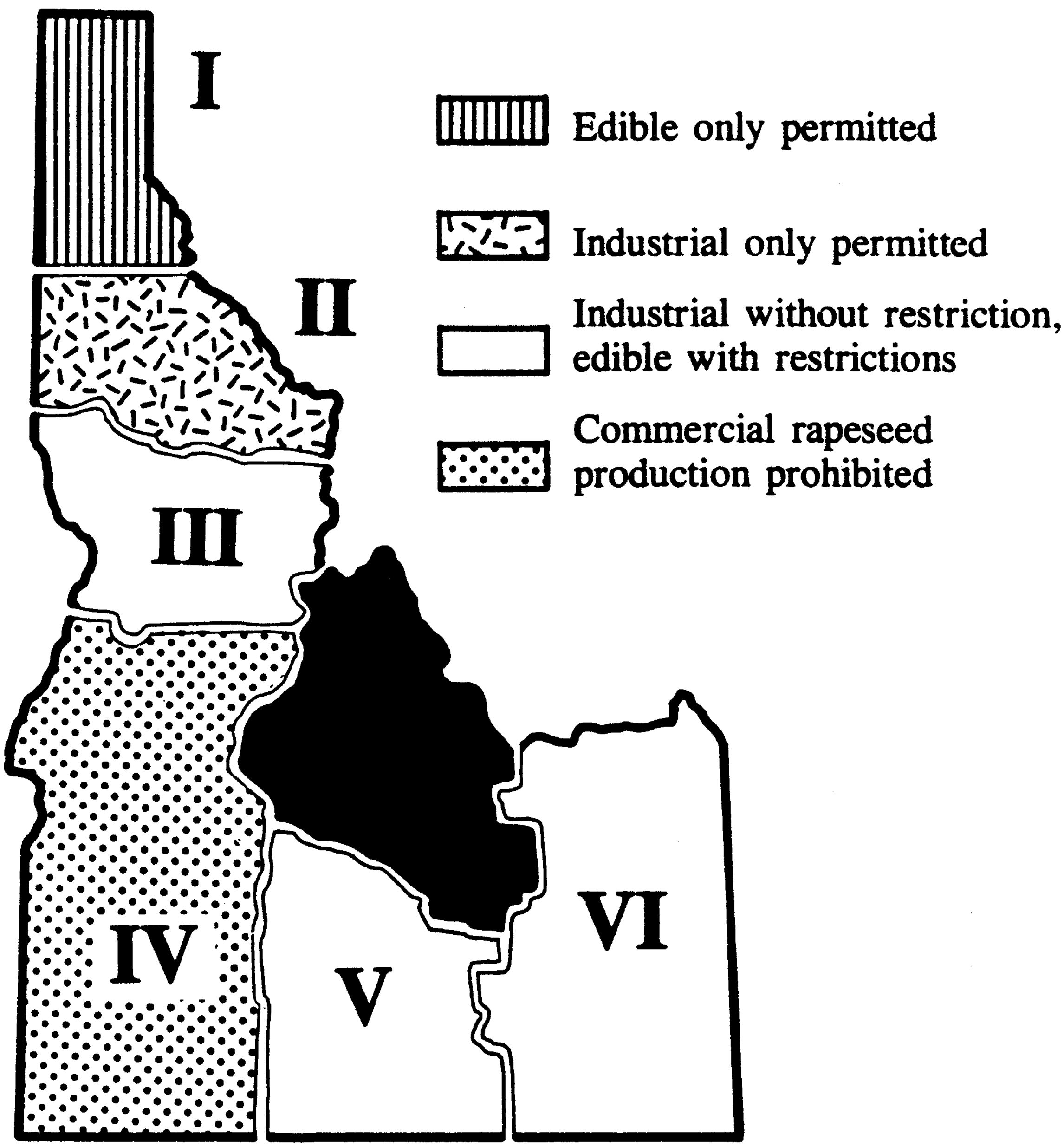
C. Marketing

1. Transportation

2. Supply and demand

320K - 16

IDAHO RAPESEED PRODUCTION DISTRICTS



TM 1

FACTORS THAT LIMIT ESTABLISHMENT OF WINTER RAPESEED

Lack of moisture in top foot of soil

Soil crusting

Waterlogging

CHARACTERISTICS OF A DESIRABLE SEEDBED

Fine but firm

Free of weeds

Free of volunteer crop growth

Moderate amount of crop residue (to reduce erosion)

WINTER RAPESEED PRODUCTION

AG 320 - K

ASSIGNMENT SHEET #1--MAKE FERTILIZER RECOMMENDATIONS FOR WINTER RAPESEED

Name ____ Score _________________________________

Using the information provided on the soil test report for Rad Rapper and University of Idaho CIS #785--Northern Idaho Fertilizer Guide for Winter Rapeseed, recommend the amount of fertilizer that will need to be applied to achieve above average yields (if other factors are not limiting production). Refer to the fertilizer guide for more complete directions.

Part I See next page

Soil Test Request and Report Form

Form #88

Analytical Services Laboratory
College of Agriculture
Moscow, ID 83843-4196
(208) 885-6201

University of Idaho

DO NOT WRITE IN THIS SPACE
Lab no. I-004-15
Fee $40.00
Status: Paid Bill Other
Check no. 0145

Mailing Name: Rad Rapper
Address: Yellow Blossom Lane
Flowerton, ID 81249

Phone: (208) 412-3181
Date: 4-4-90

FIELD INFORMATION

Irrigation: ☐ Sprinkler ☐ Furrow ☐ None

Rotation	Crop	Fertilizer applied lb/acre	Yield
Next crop	Rape (winter) pot. yield = 2,500		
Previous crop	Barley	226 #	2200 lb/AC
Grown in 19(88)	Wheat	200 #	70 bu/AC
Grown in 19(87)	Barley	220 #	2000 lb/AC

County: Idaho
Grower: Rapper
Sample Identification: Pond Field

☑ CHECK TEST REQUIRED: Please make checks payable to Bursar, University of Idaho.

☒ Standard Fertility Test* ($10.00)
*Includes drying and grinding ($1.50), pH, P, K and O.M.

___ Bicarbonate P & K X Acetate P & K

☐ pH (soil reaction)	$ 1	5.6
☐ Available P (ppm P)	$ 3	3.5
☐ Available K (ppm K)	$ 3	200+
☐ Organic matter (%)	$ 3	2.89
Other Tests:		
☒ Sulfate-S (ppm S)	$ 3	3
☒ Boron (ppm B)	$ 5	0.36
☐ Total Salts (E.C.) (mmhos/cm)	$ 2	
☐ Gypsum Requirement	$20	
☐ Lime Requirement	$ 4	
☐ Cation Exchange Capacity (meq/100g)	$ 7	
☒ Zinc (ppm Zn)	$ 4	1.8
☐ Copper (ppm Cu)	$ 4	
☐ Manganese (ppm Mn)	$ 4	
☐ Iron (ppm Fe)	$ 4	

Depth (feet)	Nitrate N (ppm)	Ammonium N (ppm)	Available Moisture (inches)
0-1	☒ 1.4	☒ 0.30	☐
1-2	☒ 2.6	☒ 0.25	☐
2-3	☒ 0.8	☒ 0.41	☐
3-4	☐	☐	☐
4-5	☐	☐	☐
5-6	☐	☐	☐
6-7	☐	☐	☐
Total			

$3 per test ppm x 4 = lb/acre

Cations:	Extractable	Soluble
Calcium	☐	☐
Magnesium	☐	☐
Sodium	☐	☐
Potassium	☐	☐

$3 per test SAR ______

Contact the Analytical Services Laboratory for other special analyses.

FERTILITY GUIDE

Pounds Per Acre						
N	P_2O_5	K_2O				

Remarks: ______

If you wish further details or have questions concerning the soil analysis, please contact your University of Idaho County Extension Agent.

White — Grower copy • Yellow — Fertilizer Dealer copy • Pink — Ag Agent copy • Goldenrod — Laboratory copy

Part II

A. What is mineralizable nitrogen based on?

B. At what depth is winter rapeseed capable of efficiently removing nitrogen?

C. When should nitrogen fertilizer be applied?

D. When should phosphorus and/or potassium be applied?

University of Idaho
College of Agriculture
Cooperative Extension System
Agricultural Experiment Station

Current Information Series No. 785

Northern Idaho Fertilizer Guide

Winter Rapeseed

Robert L. Mahler and Glen A. Murray

These guidelines were developed from research at the University of Idaho. (For the actual data, see University of Idaho Bulletin 634 and University of Idaho Progress Report 226.) The suggested fertilizer rates are based on research results from fallow fields and are designed to produce above-average yields unless other factors are limiting production. Thus, the fertilizer guide assumes the use of good management practices.

The suggested fertilizer rates will be accurate for your field if: (1) soil samples are properly taken and represent the area to be fertilized and (2) the crop history you supply is complete and accurate. For soil sampling instructions, refer to University of Idaho Extension Bulletin 704, *Soil Sampling*. Soil sampling should be done within one month of planting.

Optimum production and returns from rapeseed are achieved when the crop is managed properly. Low yields are most often caused by poor stands, inadequate fertilization and poor control of cabbage seedpod weevil. Managing summer fallow for effective water conservation and erosion, avoiding soil compaction and not planting in fields that become waterlogged during winter and early spring are essential for economic returns from proper fertilization.

Nitrogen

Total nitrogen need based on potential yield — The total nitrogen (N) requirement can be estimated from the field's potential yield (Table 1).

Once the *total* amount of N needed to produce a winter rapeseed crop is known, the following equation can be used to determine the amount of *fertilizer* N to be applied to meet this need:

$$\begin{array}{c}\text{Fertilizer}\\\text{N needed}\end{array} = \begin{array}{c}\text{total N}\\\text{need based}\\\text{on potential}\\\text{yield}\end{array} - \left[\begin{array}{c}\text{mineralizable}\\\text{N}\\\text{(Table 2)}\end{array} + \begin{array}{c}\text{soil}\\\text{test N}\\\text{(Table 3)}\end{array}\right]$$

Mineralizable nitrogen — Northern Idaho soils release mineralizable N (N contained in organic matter) at four levels based on their organic matter contents (Table 2). Low levels of mineralizable N are released from severely eroded clay knobs and hilltops, cutover timberland soils, soils in areas of low precipitation, soils with low water-holding capacities and soils with low organic matter contents.

Table 1. Estimated total N needed by a winter rapeseed crop based on potential yield.

Potential yield	Estimated total N
(lb/acre)	(lb/acre)
1,500	150
2,000	185
2,500	220
3,000	255
3,500	285
4,000	310

Table 2. Mineralizable N release rates for northern Idaho soils.

	Organic matter content			
	Severely eroded or < 2%	2 to 3%	3 to 4%	>4%
Release level	low	medium	medium high	high
lb/acre N released	25	35	45	55

Soil test nitrogen — The amount of inorganic N in the soil can be evaluated most effectively with a soil test. The soil samples should represent the crop's entire rooting depth because nitrate-nitrogen (NO_3-N) is mobile in soil. Winter rapeseed is capable of efficiently removing N to a depth of 3 feet or more unless its roots are blocked by a restricting layer.

Soil test values include both NO_3-N and ammonium-nitrogen (NH_4-N). To convert soil test NO_3-N and NH_4-N values to pounds N per acre, add the N values (ppm) for each foot increment of sampling depth and multiply by 4 (Table 3).

Table 3. Calculation to convert N soil test results (ppm) to pounds N per acre.

Depth	Soil test results NO_3-N	NH_4-N	Total	Total N*
(inches)	(ppm)	(ppm)	(ppm)	(lb/acre)
0 to 12	5	1	6	24
12 to 24	6	2	8	32
24 to 36	8	1	9	36
Total	19	4	23	92

*ppm x 4 = lb/acre.

Fertilizer nitrogen — The calculation for N fertilizer needed is:

Total N needed (Table 1)	________
Minus mineralizable N (Table 2)	- ________
Minus soil test N (lb/acre) (Table 3)	- ________
Equals N fertilizer required (lb/acre)	________

Example: With a potential yield of 2,200 pounds per acre, 2.5 percent soil organic matter and soil levels of inorganic N from soil test values in Table 3, the calculation for fertilizer N needed is:

Total N needed (Table 1)	200
Minus mineralizable N (Table 2)	-35
Minus soil test N (Table 3)	-92
Equals N fertilizer required (lb/acre)	73

The calculation assumes rapeseed is planted into fallow ground. If stubble is left standing through the winter and summer and incorporated into the soil before planting, extra N will be needed for rapeseed residue breakdown. Add 15 pounds available N for each ton of straw or nonlegume residue up to 50 pounds N per acre. Remember, 1 ton of residue is produced for each 20 bushels of wheat or 1,400 pounds of barley grain. Subtract approximately 25 percent of the cereal residue production in this calculation to allow for residue decomposition prior to planting rapeseed.

Fertilizer nitrogen need based on the previous crop—You may also estimate the amount of N fertilizer required for winter rapeseed based on the previous crop. The values in Table 4 are generalized recommendations based on field experiments and observations of production after the various crops. Note that N recommendations based on the previous crop are not as accurate as recommendations based on good soil tests.

Phosphorus

Winter rapeseed has a moderate requirement for phosphorus (P) (Table 5). Phosphorus deficiencies in rapeseed are difficult to diagnose visually. Usually the plants remain dark green, but growth is stunted. Because phosphorus is not mobile in soils, it must be banded or incorporated into the soil for efficient utilization by rapeseed. Commonly, P is broadcast incorporated or drill banded.

Table 5. Phosphorus fertilizer rates based on a soil test.

Soil test P* (0 to 12 inch)	Application rate P_2O_5	P**
(ppm)	(lb/acre)	(lb/acre)
0 to 2	60	26
2 to 4	40	18
over 4	0	0

*Sodium acetate extractable P.
**P_2O_5 x 0.44 = P, or P x 2.29 = P_2O_5.

Potassium

Potassium (K) levels are normally sufficient for rapeseed production, but K should be applied when soils test low (Table 6). Fertilizer can be effectively surface broadcast incorporated or drill banded. Fertilizer can be placed with the seed, below the seed or to the side.

Table 6. Potassium fertilizer rates based on a soil test.

Soil test K* (0 to 12 inch)	Application rate K_2O	K**
(ppm)	(lb/acre)	(lb/acre)
0 to 50	80	66
50 to 75	60	50
over 75	0	0

*Sodium acetate extractable K.
**K_2O x 0.83 = K, or K x 1.20 = K_2O.

Table 4. Estimated N fertilizer requirements for winter rapeseed based on the field's potential yield and previous crop.

Previous crop	Potential yield (lb/acre) 1,500	2,200	3,000	>4,000
	(lb/acre)	(lb/acre)	(lb/acre)	(lb/acre)
Fallow	50 to 70	75 to 95	120 to 140	170 to 190
Grain (residue returned)	140 to 160	155 to 185	210 to 230	265 to 285
Grain (residue removed)	100 to 120	115 to 145	170 to 190	225 to 245
Alfalfa or green manure	40 to 60	65 to 85	110 to 130	160 to 180

When applied with the seed, the total N and K (as K_2O) should not exceed 25 pounds of nutrient per acre. Use whichever application method is most convenient.

Sulfur

Adequate levels of sulfur (S) are necessary for maximum production of winter rapeseed. Without adequate S the rapeseed will appear light green to yellow. Plants require S to use N efficiently. Because S is mobile in soils, it is prone to leaching during winter and early spring. Consequently, soil testing for S is important. Sulfur needs based on soil test results are in Table 7.

Table 7. Sulfur fertilizer needs based on a soil test.

Soil test S (0 to 12 inch)	S application rate
(ppm SO_4-S)	(lb/acre)
0 to 10	25
over 10	0

Sulfur can be surface applied and will move into the soil with precipitation. Elemental S is not recommended because it becomes available to plants slowly.

Micronutrients

Boron — Winter rapeseed requires high levels of boron (B). On deficient soils — soils testing at less than 0.5 ppm B — apply 1 to 2 pounds of B in a uniform broadcast application. Never band B. For information on B and availability of specific fertilizer materials, see University of Idaho CIS 608, *Essential Plant Micronutrients: Boron in Idaho.*

Zinc — Zinc (Zn) deficiencies are rare, occurring only in severely eroded soils. If soils are severely eroded and a soil test for Zn shows less than 0.6 ppm of Zn, see University of Idaho CIS 617, *Essential Plant Micronutrients: Zinc in Idaho.* Rapeseed growers in the Kootenai River Valley of Boundary County should watch for Zn deficiencies.

Other micronutrients — Winter rapeseed should not respond to applications of chlorine (Cl), copper (Cu), iron (Fe), manganese (Mn) or molybdenum (Mo). Extensive field experiments on micronutrients have not been conducted. Still, micronutrient applications often are more likely to create toxicity problems than to correct deficiencies. Avoid applications of these materials in northern Idaho. However, growers in the Kootenai River Valley of Boundary County should watch for manganese deficiencies.

General Comments

1. Nitrogen fertilizer applications should be split between spring and fall in areas receiving more than 18 inches of precipitation. Research has shown that heavy fall applications can reduce rapeseed's winter hardiness. Fall-applied N is also susceptible to leaching. Consequently, no more than 50 percent of the required N should be applied in fall. In areas receiving less than 18 inches of precipitation, including traditionally summer-fallowed areas, all N may be applied in fall.
2. Phosphorus can either be banded below the seed or applied before planting and incorporated. Banding below the seed appears to be the most efficient method.
3. Potassium can be surface broadcast, broadcast incorporated or banded below the seed. Banding below the seed appears to be the most efficient method.
4. Sulfur can either be incorporated or surface applied in fall. Sulfur may also be applied with N in spring.
5. Contact the Extension agricultural agent in your county if you need more information.

The Authors — Robert L. Mahler is research soil scientist and Glen A. Murray is research agronomist and crop physiologist, both in the University of Idaho Department of Plant, Soil and Entomological Sciences, Moscow.

SERVING THE STATE

Teaching . . . Research . . . Service . . . this is the three-fold charge of the College of Agriculture at your state Land-Grant institution, the University of Idaho. To fulfill this charge, the College extends its faculty and resources to all parts of the state.

Service . . . The Cooperative Extension Service has offices in 42 of Idaho's 44 counties under the leadership of men and women specially trained to work with agriculture, home economics and youth. The educational programs of these College of Agriculture faculty members are supported cooperatively by county, state and federal funding.

Research . . . Agricultural Research scientists are located at the campus in Moscow, at Research and Extension Centers near Aberdeen, Caldwell, Parma, Tetonia and Twin Falls and at the U. S. Sheep Experiment Station, Dubois and the USDA/ARS Soil and Water Laboratory at Kimberly. Their work includes research on every major agricultural program in Idaho and on economic activities that apply to the state as a whole.

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1.3M, 1986-89; 1M, 9-90 (revised)

35 cents per copy

WINTER RAPESEED PRODUCTION

AG 320 - K

ANSWERS TO ASSIGNMENT SHEET

Part I

Table 2

Nitrogen
(Mineralizable)
Organic matter = 2.89%
= 35 lb/A N released

Table 3

Nitrogen	add	1.4
Soil test		2.6
		.8
		.30
		.25
		.41
		5.76 total ppm

5.76 x 4 = lb/acre (available N)

Total N needed (Table 1) - Need 220 lbs/acre (To nearest yield in Table 1)

220
-23
-35
162 lbs N/acre

Soil Fertility Guide

Pounds Per Acre						
N	P_2O_5	K_2O	P	Sulfur	Boron	
162	0	0	40	25	1-2	

Part II

A. Soil's organic matter content

B. At least three feet, unless roots are restricted by a root restricting layer

C. Split between spring and fall--no more than 50 percent of the required nitrogen should be applied in the fall

D. Before planting

WINTER RAPESEED PRODUCTION

AG 320 - K

UNIT TEST

Name ______________________________ Score ______________________________

1. Select from the following list plant characteristics of winter rapeseed. Write an "X" in the blank before each correct answer.

_____a. Bright yellow flowers appear in early August

_____b. Winter annual

_____c. Self-fertile

_____d. Member of the mustard family

_____e. Seedlings emerge in early spring

_____f. Much of the crop will be killed if the leaf tissue freezes during the winter

_____g. Overwinter as dense rosette of leaves that prevent soil erosion

_____h. New growth regenerated from thickened crown in August or September to form a single flowering stalk

2. List and describe the two types of rapeseed and two varieties of each.

a.____

____

____

Varieties____

b. ____

____

____

Varieties____

3. Identify the correct Idaho rapeseed production districts below. Write the district name in the blank before the correct description.

______________________ a. Includes all land south of the Canadian border and north of U.S. Interstate 90; only edible type rapeseed varieties

______________________ b. All land in Ada, Canyon, Elmore, Gem, Owyhee, Payette and Washington counties; no rapeseed may be planted except for the purposes of research, testing or introduction of rapeseed under trial ground requirements

______________________ c. All land south of U.S. Interstate 90 and north of the Clearwater River

______________________ d. All land in Blaine, Cassia, Gooding, Jerome, Lincoln, Minidoka and Twin Falls counties; industrial type rapeseed varieties may be planted without restriction; edible type rapeseed may be planted with restrictions

______________________ e. All land south of the Clearwater River and north of the Salmon River; industrial type varieties can be grown without restrictions

4. List three factors that limit establishment of winter rapeseed.

a.____

b. ____

c.____

5. Describe seedbed preparation for winter rapeseed.

a.____

____

b. ____

____

c.____

____

d. ____

____

e.____

____

f. ______________________________

____

g. ______________________________

____

h. ______________________________

____

i. ______________________________

____

6. List four characteristics of a desirable seedbed for winter rapeseed.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

7. Discuss seeding rates of winter rapeseed.

____

____

____

____

____

8. Discuss seeding depth of winter rapeseed.

a. ______________________________

____

b. ______________________________

____

c. ______________________________

____

9. Identify the optimum time span for seeding winter rapeseed.

____

____

10. Name two primary insect pests of winter rapeseed.

a.____

b. ____

11. Name three secondary insect pests of winter rape.

a.____

b. ____

c.____

12. Discuss weed competition with winter rapeseed.

a.____

b. ____

c.____

d. ____

13. List two perennial weeds that could be a problem in winter rapeseed.

a.____

b. ____

14. List two annual weeds that could be a problem in winter rapeseed.

a.____

b. ____

15. Name two diseases of winter rapeseed.

a.____

b. ____

16. Discuss rapeseed harvesting equipment, equipment adjustments and moisture content.

    a. Equipment ____________________

    b. Adjustments ____________________

    ____

    c. Moisture content ____________________

    ____

17. Discuss potential markets for rapeseed.

    Edible rapeseed ____________________

    ____

    ____

    ____

    ____

    Industrial rapeseed ____________________

    ____

    ____

    ____

    ____

    ____

18. List and discuss the three major factors affecting the profitability of winter rapeseed production.

    ____

    ____

    ____

    ____

    ____

    ____

    ____

    ____

WINTER RAPESEED PRODUCTION

AG 320 - K

ANSWERS TO TEST

1. b, c, d, g

2. Industrial: Oil used for producing synthetic lubricants, varnishes and plastics; Must have minimum of 45 percent euricic acid content in the fatty acid composition; May not be used for human consumption; **Varieties** (answer should include two of the following): Dwarf Essex; Bridger; Gorczanski; Norde; Hector

   Edible: Oil used for human consumption in food products such as margarine, salad and cooking oil and processed food products; May have no more than 2 percent euricic acid content in the fatty acid composition; Excellent in human diets because it combines low levels of saturated fats (less than 6 percent), high levels of mono-saturated fats (62 percent) and a desirable level of alpha-linolenic acid (10 percent); Also known as canola oil; **Varieties** (answer should include two of the following): Cascade; Jet Neuf; WW 827; Primor; Brink; Quinta; Sipal

3. a. District I
   b. District IV
   c. District II
   d. District V
   e. District III

4. Lack of moisture in top foot of soil; Soil crusting; Waterlogging

5. Usually planted in fallow ground; Begins in the fall with the harvest of the previous crop; Leave stubble standing to capture snow in areas of 14 to 18 inches of precipitation and in areas where soils are unfrozen for most of the winter; Fall chisel plow in areas where the soil is frozen in the winter to capture the most water; Fallowing should begin as soon as soil conditions permit in the spring and continue at intervals to prevent weed growth and moisture loss; Final seedbed: Fine; Firm enough to allow good soil contact with the seed; May have to firm up loose seedbeds with a roller; Soil crusting prevention; Wet bottomlands and drainage areas should not be seeded to winter rapeseed

6. Fine but firm; Free of weeds; Free of volunteer crop growth; Moderate amount of crop residue (to reduce erosion)

7. Answer should include the following information:

   Seeding rates of 3 to 6 pounds per acre with 7 inch row spacings; Seeding rates of 7 to 10 pounds per acre if any of the following apply; 14 inch row spacings; Seeded later than August 25; Residue and clods prevent soil contact with the seed

8. Seeding deeper than 2 inches reduces vigor and fall development of seedlings; Depth to moisture is a critical factor in establishment of winter rapeseed; Deep seeding: Increases the chances of good soil moisture for seed germination; Delays emergence, which may increase the probability of soil crusting; Reduces stands

9. First two weeks of August

10. Cabbage seedpod weevil; Cabbage aphid

11. Answer should include three of the following: Cabbage maggot; Armyworms; Lygus bug; Flea beetles; Diamond back moth

12. Compete for nutrients; Compete for water; Compete for light; Weed seeds could become crop contaminants

13. Answer should include two of the following: Canada thistle; Field bindweed; Quackgrass

14. Answer should include two of the following: Wild mustards; Volunteer cereals; Prickly lettuce; Sowthistle; Fiddleneck; Wild buckwheat

15. Pythium; Sclerotinia

16. a. Conventional combine
    b. Slow cylinder speed; Fairly wide space between concave and cylinder
    c. Moisture content: Eight percent or less; High moisture content will cause rapeseed to heat and mold when stored

17. <u>Edible rapeseed</u>: Must compete with other oil crops such as palm oil, soybean oil, other vegetable oils and animal fats; Japan is the major potential market for edible rapeseed, but the U.S. must be able to compete with Canadian rapeseed in quality and price; Domestic markets for oilseed, oil and meal are very large, but in order for rapeseed from the Pacific Northwest to gain a share of these markets, two conditions must exist: (1) Must be priced competitively with oil and meal produced from soybean, palm and cottonseed (as well as rapeseed oil and meal produced in Canada); (2) Must use crushing facilities in Canada, the northern plains or the Midwest, or expand its own oilseed crushing facilities

    <u>Industrial rapeseed</u>: Current U.S. markets can be served with production from 40,000 acres; Current marketing potential appears quite limited, but its suitability as a biological source for industrial products indicates good potential for long-term market expansion

18. Answer should include information from the following:

    <u>Operating or variable costs</u>: Seed (certified, registered, common); Fertilizer; Soil testing; Irrigation (equipment investment, interest on investment, electricity); Interest on operating capital; Pest control (herbicides, fungicides, insecticides, soil fumigation); Machinery and equipment operation (land preparation, chemical application, planting, harvesting, machine hire); Fuel; Crop insurance; Land rent; Part-time labor (salary, social security taxes, disability insurance)

    <u>Fixed costs</u>: Land (investment, interest on investment, taxes); Full-time labor (salary, social security taxes, disability insurance); Machinery and equipment (investment, interest on investment, maintenance and repairs, insurance, depreciation); Buildings (investment, interest on investment, maintenance and repairs, insurance, depreciation); Farm liability insurance

    <u>Marketing</u>: Transportation; Supply and demand

SPECIALTY CROPS

AG 320 - L

UNIT OBJECTIVE

After completion of this unit, students should be able to match terms associated with specialty crops to the correct definitions. Students should also be able to list and summarize information about specialty crops. This knowledge will be demonstrated by completion of the unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with specialty crops to the correct definitions.
2. List six specialty crops produced in Idaho.
3. Summarize the production of one specialty crop produced in Idaho.
4. List one specialty crop in Idaho and discuss its rank in the nation, economic value and percent of U.S. crop.
5. Research and report on a specialty crop raised in Idaho.

SPECIALTY CROPS

AG 320 - L

SUGGESTED ACTIVITIES

I. Suggested activities for instructor

A. Order materials to supplement unit.

1. Literature

a. Publications available from Oregon State University. For a catalog of publications write to: Bulletin Mailing Office, Industrial Building, Oregon State University, Corvallis, Oregon 97331.

b. Publications available from Washington State University. For a catalog of publications write to: Bulletin Department, Cooperative Extension, Cooper Publications Building, Washington State University, Pullman, Washington 99164.

c. The following publications are available from Agricultural Communications Center, Ag Publications Building, University of Idaho, Moscow, Idaho 83843-4196, (208-885-7982).

CIS 280 *Strawberry Production in the Idaho Panhandle* $.25

CIS 294 *Soybeans in Idaho* $.25

CIS 315 *Idaho Fertilizer Guide: Onions* $.25

CIS 406 *Preparing Onions for Harvest and Storage* $.25

CIS 570 *Chickpeas--A Potential New Pulse Crop for Northern Idaho* $.35

CIS 647 *Idaho Fertilizer Guide: Peppermint* $.35

CIS 698 *Purple Blotch in Onions* $.25

CIS 714 *Peppermint Tissue Analysis-Nitrogen* $.35

CIS 773 *Insect Control Recommendations for Mint Production in Idaho* $.35

CIS 821 *Strawberry Culture in Northern Idaho* $.35

CIS 822 *Red Raspberry Culture in Northern Idaho* $.35

PNW 240 *Natural Grass Athletic Fields* $1.50

PNW	299	*Turfgrass Seeding Recommendations for the Pacific Northwest* $.75
EXT	419	*Raspberry Growing in Idaho* $.50
EXT	440	*Strawberry Growing in Idaho* $.50
EXP	543	*Drying and Humidification of Hops* $.50
EXP	574	*The Effect of Nitrogen, Phosphorus, Potassium and Micronutrients on Yield, Grade and Storage of Onion Bulbs in Southwestern Idaho* $.50
EXP	603	*Triticale--A Potential New Crop for the Pacific Northwest--An Economic Study* $.50
EXP	615	*Garbanzo Beans--A Potential New Pulse Crop for Idaho* $.50
CIS	279	*Strawberry Diseases and Their Control in Idaho* .25
CIS	293	*Powdery Mildew of Ornamentals* $.25
CIS	341	*Crumbly Fruit in Raspberries* $.25
CIS	690	*Apple Scab* $.25
CIS	726	*Cytospora Canker Disease in Idaho Orchards* $.25
CIS	789	*Diseases of Raspberries in Idaho* $.35
CIS	847	*Virus and Nematode Diseases of Raspberries* $.35
PNW	265	*Turnip and Rutabaga Seed Production in the Pacific Northwest* $.25
PNW	266	*Cucurabit--Seed Production in the Pacific Northwest* $.50
PNW	267	*Spinach Seed Production in the Pacific Northwest* $.25
PNW	268	*Cabbage, Brussels Sprouts, Cauliflower and Kohlrabi Seed Production in the Pacific Northwest* $.25
PNW	269	*Kale and Collard Seed Production in the Pacific Northwest* $.25
PNW	270	*Mustard and Chinese Cabbage Seed Production in the Pacific Northwest* $.25
PNW	271	*Table Beet and Swiss Chard Seed Production in the Pacific Northwest* $.25

PNW	272	*Carrot, Parsnip and Parsley Seed Production in the Pacific Northwest* $.25
PNW	273	*Lettuce Seed Production in the Pacific Northwest* $.25
PNW	274	*Radish Seed Production in the Pacific Northwest* $.25
PNW	277	*Onion Storage--Guidelines for Commercial Growers* $.75
EXP	676	*Fairy Rings in Turf* $.50
CIS	655	*Idaho Fertilizer Guide: Orchards* $.35
CIS	788	*Northern Idaho Fertilizer Guide: Bluegrass Seed* $.25
CIS	815	*Northern Idaho Fertilizer Guide: Blueberries, Raspberries, Strawberries* $.35
CIS	820	*Northern Idaho Fertilizer Guide: Grass Seedlings for Conservation Programs* $.25
CIS	826	*Northern Idaho Fertilizer Guide: Chickpeas* $.25
EXP	575	*The Effect of Nitrogen, Phosphorus, Potassium and Micronutrients on Yield and Quality of Onion Seed in Southwestern Idaho* $.50
CIS	141	*Your Christmas Tree* $.35
CIS	528	*Plant Your Container-Grown Seedlings Right* $.35
CIS	735	*Transplanting Native Seedlings* $.25
PNW	6	*Growing Christmas Trees in the Pacific Northwest* $.75
PNW	33	*Plant Your Trees Right* $.25
PNW	96	*Raising Forest Tree Seedlings at Home* $.25
PNW	184	*Thinning--An Introduction to a Timber Management Tool* $.50
PNW	219	*Weed Control in Christmas Trees* $.50
PNW	226	*Developing High Quality True Fir Christmas Trees* $.75
PNW	227	*Developing Sheared Douglas-Fir Christmas Trees* $.75

EXT 621 *How To Prune Deciduous Trees* $.50

CIS 374 *Bluegrass Billbug in Idaho Lawns* $.25

CIS 808 *The Mint Stem Borer in Idaho* $.25

PNW 251 *A Sampling Plan for Two-Spotted Spider Mites in Mint* $.25

PNW 322 *Mint Root Borer in the Pacific Northwest* $.75

PNW 219 *Managing Weeds and Vegetation in Christmas Trees* $.50

2. Films

   a. *The Bluegrass Story*, Program #316; 17 1/2 minutes, VHS or Beta format; an overview of the Kentucky Bluegrass grass seed industry in northern Idaho and eastern Washington; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196, (208-885-6436); purchase cost $25; rental cost $10 for 14 days.

   b. *Cytospora Canker of Orchard Trees*, Program #236; 16 1/2 minutes, VHS or Beta format; details history, economic importance, symptomology, prevention and control of cytospora canker; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196, (208-885-6436); purchase cost $25; rental cost $10 for 14 days.

   c. *Downy Mildew of Onions*, Program #189; 6 1/2 minutes, VHS or Beta format; describes history, symptomology and treatment of downy mildew of onions; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196, (208-885-6436); purchase cost $25; rental cost $10 for 14 days.

   d. *Wood Rots of Orchard Trees*, Program #230; 18 1/2 minutes, VHS or Beta format; explains history, economic importance, symptomology, prevention and control recommendations of wood rots; available from Agricultural Communications Center, 10 Ag Science Bldg., Moscow, Idaho 83843-4196, (208-885-6436); purchase cost $25; rental cost $10 for 14 days.

B. Make necessary copies of materials.

C. Provide students with objective sheet and discuss.

D. Provide students with information sheet and discuss.

E. Identify specialty crops grown in your area and invite local fieldmen, farmers, extension personnel, research specialists, etc. to give a presentation to the class on the production of each crop.

F. Review and give test.

G. Reteach and retest if necessary.

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Assignment sheet

1. AS 1--Research an Idaho Specialty Crop

E. Test

F. Answers to test

III. Unit references

A. 1982 Idaho Agricultural Statistics.

B. 1984 Idaho Agricultural Statistics.

C. 1989 Idaho Agricultural Statistics

SPECIALTY CROPS

AG 320 - L

INFORMATION SHEET

I. Terms and definitions

A. Grain--The seed of any cereal plant, such as wheat, barley and oats

B. Forage--Vegetative material in a fresh, dried or ensiled state which is fed to livestock

C. Pulses--Leguminous plants or their seeds; this includes chiefly those plants with large seed used for food

D. Legume--Soil improving plant which manufactures nitrogen

E. Root crop--Plant that stores food and is harvested primarily for its root

F. Tree crop--Tree that is raised for the harvest of its fruit

G. Oil seed crop--Plants harvested primarily for the oil in their seeds or leaves

H. Warm-season crop--Makes best growth under relatively warm conditions; are generally damaged by cold weather; includes beans, corn and sugarbeets

I. Cool-season crop--Makes best growth under relatively cool conditions; are generally damaged by warm weather; includes wheat, barley and oats

J. Grass--Plant with longer, narrower leaves with parallel veination; monocots

K. Broadleaf--Plant with shorter, wider leaves that usually have pinnate or netted veination; dicots

L. Annual--Completes life cycle within a period of one year

M. Perennial--Lives for three years or more, and can reproduce sexually and asexually by means of rhizomes and stolons

N. Cwt--Hundred weight; 100 pounds

O. Bushel--Thirty-two dry quarts

P. Ton--Two thousand pounds

II. Specialty crops produced in Idaho

A. Pulses

1. Dry beans

2. Peas

3. Lentils

4. Garbanzo beans (chickpeas)

B. Tree crops

1. Apples

2. Sweet cherries

3. Prunes and plums

4. Peaches

C. Oil crops

1. Spearmint

2. Peppermint

3. Sunflower

4. Safflower

D. Root crops

1. Sugar beets

2. Onions

E. Seed crops

1. Alfalfa

2. Carrot

3. Sweet corn

4. Bean

5. Lettuce

6. Red clover

7. Bluegrass

F. Miscellaneous specialty crops

1. Hops

2. Sweet corn for processing

III. Summary of specialty crops produced in Idaho

Crop	Planted (acres)	Harvested (acres)	Yield Per Harvested acre	Total Production
Sugarbeets	168,000	166,000	24.6 ton	4,084,000 ton
Dry beans	120,000	119,000	1,890 lbs	2,249,000 lbs
Dry peas	64,000	63,000	2,200 lbs	1,386,000 lbs
Lentils	23,000	23,000	1,300 lbs	2,990,000 cwt
Hops	NA	2,800	1,400 lbs	3,920,000 lbs
Apples	NA	NA	NA	135,000,000 lbs
Peaches	NA	NA	NA	11,200,000 lbs
Prunes/plums	NA	NA	NA	5,600 ton
Sweet cherries	NA	NA	NA	2,200 ton
Peppermint oil	NA	11,900	68 lbs	809,000 lbs
Spearmint oil	NA	1,900	87 lbs	165,000 lbs
Onions	7,700	7,600	530 cwt	4,028,000 cwt
Sweet corn	18,800	18,200	9 ton	163,800 ton

IV. Economic value and Idaho's rank in the nation in production (1988)

Crop	Rank Among States	Production	Economic Value	Percent of U.S.
Hops	3	3,920,000 lbs	$ 4,155,000	7.2
Apples	10	135,000,000 lbs	25,650,000	1.5
Peaches	NA	11,200,000 lbs	2,914,000	NA
Prunes/Plums	4	6,500 ton	1,585,000	12.5
Sweet cherries	6	2,300 ton	2,040,000	1.2
Peppermint oil	NA	809,000 lbs	10,113,000	NA
Spearmint oil	NA	165,000 lbs	2,360,000	NA
Onions	3	4,028,000 cwt	36,645,000	11.7
Sweet corn	5	163,800 ton	8,829,000	6.9

(Note: Drought caused production to be lower than average in 1988.)

SPECIALTY CROPS

AG 320 - L

ASSIGNMENT SHEET #1--RESEARCH AND REPORT ON A SPECIALTY CROP RAISED IN IDAHO

Name ______________________________________ Score________________________________

Choose a specialty crop raised in Idaho that has not been extensively covered in this course. Research the crop and write a five to six page report about it. Include as much of the following information as possible.

- Vegetative and reproductive growth
- Economic importance to Idaho
- Common varieties of seed
- Major points in selecting and preparing seed
- Planting equipment used
- Major factors involved in planting
- General fertilizer recommendations
- Harmful pests and control methods
- Harvesting techniques
- Procedures to follow in handling the crop
- Poor, average and excellent yields for the crop
- Potential markets

Resources may include your school or other libraries, resource materials in your vo-ag classroom, the Idaho Department of Agriculture, your local county agent, agricultural magazines, local farmers, information from the University of Idaho Publications Center, and others. Summarize your written report and give an oral report to your class.

SPECIALTY CROPS

AG 320 - L

UNIT TEST

Name ______________________________________ Score________________________________

1. Match terms associated with specialty crops to the correct definitions. Write the correct number in the blank.

_____a.	Makes best growth under relatively warm conditions; are generally damaged by cool weather	1.	Grain
		2.	Forage
_____b.	Completes life cycle within a period of one year	3.	Pulses
_____c.	Plant with longer, narrower leaves with parallel veination; monocots	4.	Legume
		5.	Root crop
_____d.	Leguminous plants or their seeds; this includes chiefly those plants with large seed used for food	6.	Tree crop
_____e.	Tree that is raised for the harvest of its fruit	7.	Oil seed crop
_____f.	Two-thousand pounds	8.	Warm-season crop
_____g.	The seed of any cereal plant, such as wheat, barley and oats	9.	Cool-season crop
		10.	Grass
_____h.	Soil improving plant which manufactures nitrogen	11.	Broadleaf
_____i.	Thirty-two dry quarts	12.	Annual
_____j.	Makes best growth under relatively cool conditions; are generally damaged by warm weather	13.	Perennial
		14.	Cwt
_____k.	100 pounds	15.	Bushel
_____l.	Plants harvested primarily for the oil in their seeds or leaves	16.	Ton
_____m.	Vegetative material in a fresh, dried or ensiled state which is fed to livestock		
_____n.	Plant that stores food and is harvested primarily for its root		

_____o. Lives for three years or more and can reproduce sexually and asexually by means of rhizomes and stolons

_____p. Plant with shorter, wider leaves that usually have pinnate or netted veination; dicots

2. List six specialty crops produced in Idaho.

a.______________________________

b. ______________________________

c.______________________________

d. ______________________________

e.______________________________

f. ______________________________

3. Summarize the production of one specialty crop produced in Idaho.

Crop: ______________________________

Planted acres: ______________________________

Harvested acres: ______________________________

Yield per harvested acre: ______________________________

Total production: ______________________________

4. List one specialty crop in Idaho and discuss its rank in the nation, economic value and percent of U.S. crop.

Crop: ______________________________

Rank among states: ______________________________

Economic value: ______________________________

Percent of U.S. crop: ______________________________

SPECIALTY CROPS

AG 320 - L

ANSWERS TO TEST

1. | | | | | | |
|---|---|---|---|---|---|
| a. | 8 | g. | 1 | m. | 2 |
| b. | 12 | h. | 4 | n. | 5 |
| c. | 10 | i. | 15 | o. | 13 |
| d. | 3 | j. | 9 | p. | 11 |
| e. | 6 | k. | 14 | | |
| f. | 16 | l. | 7 | | |

2. Answer should include six of the following:

   Dry beans; Peas; Lentils; Garbanzo beans (chickpeas); Apples; Sweet cherries; Prunes and plums; Peaches; Spearmint; Peppermint; Sunflower; Safflower; Sugarbeets; Onions; Alfalfa; Carrot; Sweet corn; Bean; Lettuce; Red clover; Bluegrass; Hops; Sweet corn for processing

3. Evaluated to satisfaction of instructor.

Crop	Planted (acres)	Harvested (acres)	Yield Per Harvested acre	Total Production
Sugarbeets	168,000	166,000	24.6 ton	4,084,000 ton
Dry beans	120,000	119,000	1,890 lbs	2,249,000 lbs
Dry peas	64,000	63,000	2,200 lbs	1,386,000 lbs
Lentils	23,000	23,000	1,300 lbs	2,990,000 cwt
Hops	NA	2,800	1,400 lbs	3,920,000 lbs
Apples	NA	NA	NA	135,000,000 lbs
Peaches	NA	NA	NA	11,200,000 lbs
Prunes/plums	NA	NA	NA	5,600 ton
Sweet cherries	NA	NA	NA	2,200 ton
Peppermint oil	NA	11,900	68 lbs	809,000 lbs
Spearmint oil	NA	1,900	87 lbs	165,000 lbs
Onions	7,700	7,600	530 cwt	4,028,000 cwt
Sweet corn	18,800	18,200	9 ton	163,800 ton

4. Evaluated to the satisfaction of the instructor.

Crop	Rank Among States	Production	Economic Value	Percent of U.S.
Hops	3	3,920,000 lbs	$ 4,155,000	7.2
Apples	10	135,000,000 lbs	25,650,000	1.5
Peaches	NA	11,200,000 lbs	2,914,000	NA
Prunes/Plums	4	6,500 ton	1,585,000	12.5
Sweet cherries	6	2,300 ton	2,040,000	1.2
Peppermint oil	NA	809,000 lbs	10,113,000	NA
Spearmint oil	NA	165,000 lbs	2,360,000	NA
Onions	3	4,028,000 cwt	36,645,000	11.7
Sweet corn	5	163,800 ton	8,829,000	6.9

CROP STORAGE

AG 320 - M

UNIT OBJECTIVE

After completion of this unit, students should be able to match terms and definitions, list kinds of storage facilities, and discuss factors affecting crop storability. This knowledge will be demonstrated by completion of an assignment sheet and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with crop storage to the correct definitions.
2. List three causes of deterioration in storage.
3. Select methods of post harvest preservation of crops.
4. Select advantages of proper crop storage.
5. Name three types of crop storage.
6. List four reasons farm storage is needed.
7. Name five kinds of grain storage facilities.
8. Discuss the functions of harvesting machines.
9. Select factors affecting crop storability.
10. Select conditions of a safe storage facility.
11. Select factors which affect length of storage time.
12. List two basic rules for storing seed.
13. List three qualities of grain necessary in order to store grain for an extended period.
14. List three management steps for proper grain storage.
15. Discuss factors to consider when planning an aeration system.
16. Match long-term grain storage management practices to the season in which they should be carried out.
17. List three ways of packaging seed for storage.
18. Discuss the control of insects in storage.
19. List three seed treatments used in disease control.

20. Discuss the control of rodents and birds in storage.
21. List two crops stored for relatively short periods.
22. List two crops stored for relatively long periods.
23. List four factors to consider in planning storage facilities.
24. Discuss measures to prevent suffocation in grain.
25. State the major objective of a grain-drying system.
26. List three disadvantages of over drying grain.
27. List the three steps to follow when calculating volume of grain in storage.
28. Calculate volume of grain in storage.

CROP STORAGE

AG 320 - M

SUGGESTED ACTIVITIES

I. Suggested activities for instructor

A. Order materials to supplement unit.

1. Literature

a. Several publications available from Washington State University. Order publications catalog from Bulletin Department, Cooperative Extension, Cooper Publications Building, Washington State University, Pullman, Washington 99164.

b. Several publications available from Oregon State University. Order publications catalog from Bulletin Mailing Office, Oregon State University, Corvallis, Oregon 97331.

c. The following publications are available from Agricultural Communications Center, Ag Publications Building, University of Idaho, Moscow, Idaho 83843-4196, (208-885-7982).

CIS 312 *Insect Control in Farm-stored Grain* $.35

CIS 536 *Aeration for Grain Storage* $.45

CIS 644 *Fumigation of Farm-stored Grain* $.25

CIS 297 *Potato Storage--Construction and Management* $.25

PNW 236 *Designing Bulk Potato Storage Structures* $.50

PNW 257 *Potatoes--Storage and Quality Maintenance in the Pacific Northwest* $.75

PNW 295 *Insulation and Vapor Barriers in Potato Storage Buildings* $.75

EXP 520 *Storage Losses of Irrigated vs CIPC-treated Russet Burbank Potatoes* $.50

EXP 533 *Storage Studies on Sugarbeets in Southeastern Idaho* $.50

CIS 406 *Preparing Onions for Harvest and Storage* $.25

PNW 277 *Onion Storage--Guidelines for Commercial Growers* $.75

CIS 518 *Maintaining Stored Grain Quality* $.45

2. Filmstrips, slideshows, etc.

   a. *Protecting Your Stored Grain*, Program #225; 8 1/2 minutes, VHS or Beta format; describes a simple, low cost system to eliminate losses from mold and insects; available from Agricultural Communications Center, 10 Ag Science Building, University of Idaho, Moscow, Idaho 83843-4196, (208-885-6436); rental cost $10 for 14 days; purchase cost $25. One in each University of Idaho District Extension Office.

B. Make transparencies and necessary copies of materials.

C. Provide students with objective sheet and discuss.

D. Provide students with information and assignment sheets and discuss.

E. Set up a moisture tester and demonstrate to the class how to operate it.

F. Plan a field trip to observe different types of farm crop storage in the area.

G. Plan a field trip for students to tour a local elevator and/or seed cleaning plant.

H. Develop a bulletin board with pictures of different types of crop storage.

I. Review and give test.

J. Reteach and retest if necessary.

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Advantages of Proper Crop Storage

2. TM 2--Kinds of Grain Storage Facilities

3. TM 3--Factors Affecting Crop Storability

4. TM 4--Factors Affecting Length of Storage Time

5. TM 5--Maximum Moisture Content for Safe Grain Storage

6. TM 6--Maximum Allowable Storage Time for Grains

7. TM 7--Costs of Drying Corn Below 15.5%

E. Assignment sheet

1. AS 1--Calculate Volume of Grain in Storage

F. Answers to assignment sheet

G. Test

H. Answers to test

III. Unit references

A. *Agricultural Machinery Safety: Fundamentals of Machine Operation*, John Deere Service Publications, Moline, Illinois, 1974.

B. Christensen, C.M. and Kaufmann, H., *Grain Storage, The Role of Fungi in Quality Loss*, University of Minnesota Press, Minneapolis, Minnesota, 1969.

C. Christensen, C.M., *Storage of Cereal Grains and Their Products*, American Association of Cereal Chemists, Inc., St. Paul, Minnesota, 1982.

D. Copeland, L.O. and McDonald, M.B., *Principles of Seed Science and Technology*, 2nd edition, Burgess Publishing Company, Minneapolis, Minnesota, 1985.

E. *Doane's Agricultural Report, Reference Volume*, Doane Publishing, St. Louis, Missouri 63146, 1986.

F. Farrington, W.E., et al., *Fertilizers, Chemicals and Seed*, McGraw-Hill Book Company, New York, New York, 1980.

G. Hartmann, H.T., et al., *Plant Science; Growth, Development, and Utilization of Cultivated Plants*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1981.

H. *Protecting Our Food*, USDA Yearbook of Agriculture, 1966.

I. *Safety Handbook*, College of Agriculture, Cooperative Extension Service, University of Idaho, Moscow, Idaho, 1980.

J. Thomson, J.R., *An Introduction to Seed Technology*, John Wiley and Sons, New York, New York. 1979.

K. *Will There Be Enough Food*? USDA Yearbook of Agriculture, 1981.

CROP STORAGE

AG 320 - M

INFORMATION SHEET

I. Terms and definitions

A. Pest--Any living organism that damages crops or is annoying or destructive to humans in some way

B. Pesticide--Any substance used to kill insects, rodents, weeds or other pests

C. Fungicide--A pesticide used to kill fungi

D. Insecticide--A chemical or other substance used to kill or control populations of insects and related animals

E. Fumigation--The process of using chemicals in a gaseous form in order to kill pathogens or insect pests

F. Pathogen--Disease-causing microscopic organisms

G. Relative humidity--The ratio, expressed as a percentage, of the quantity of water vapor actually present in the air to the greatest amount it could contain at that temperature

H. Moisture content--The weight of water in a crop sample expressed as a percentage of the total weight of the sample

I. Perishable--Something liable to spoil or deteriorate quickly, such as food with high moisture content

J. Aeration--Process of moving small amounts of air through the stored crop at low flow rates to remove moisture and/or to cool the crop, and thus prevent deterioration of crop quality

K. Spontaneous combustion--The process of ignition and burning as a result of heat generated by internal chemical action

L. Crop preservation--Retardation of physiological processes in plant tissues to present a finished product in an attractive or usable form

M. Germination--The point at which a seed or plant vegetative reproductive organ having adequate moisture, temperature and oxygen begins to grow

N. Germination capacity--The percentage of seeds or plant vegetative reproductive organs capable of germinating to produce seedlings robust enough to establish in good field conditions

O. Crib--A structure with a roof and open sides for drying corn ears

II. Causes of deterioration in storage

(Note: What does it take to protect stored commodities against quality loss and damage from pests? It takes facilities that are built right, practices that deter spoilage and pest attacks, and controlled use of chemicals to create surroundings hostile to molds, insects and other hazards.)

A. Physical

1. High temperature

2. Moisture

B. Chemical

1. Physiological degradation from aging

2. Improper use of storage pesticides

C. Biological

1. Rodents

2. Insects, fungi and bacteria

III. Methods of post harvest preservation of crops

A. Preservation by cooling

1. Refrigeration

2. Hydrocooling

3. Forced air-cooling

4. Vacuum cooling

B. Preservation by drying

1. Dehydration by hot forced air

2. Dehydration by freezing

C. Preservation by modified atmospheres

1. Vacuum storage

2. Control of relative humidity

3. Control of temperature

4. Control of oxygen and carbon dioxide levels

D. Preservation by processing

1. Canning (heat)
2. Quick freezing
3. Processing with sugar
4. Processing with salt
5. Processing by milling

IV. Advantages of proper crop storage (Transparency 1)

A. Maintenance of crop quality

B. Decreased crop loss

C. Increased longevity of crop

D. Potential marketing advantage

(Note: Crop prices may increase if they are held in storage.)

E. Holding of crop until ready for use

(Note: Increased food production alone does not solve the world food problem. Food must be stored or preserved in an edible, nutritionally adequate condition until it can be distributed and consumed in and out of season. Proper storage prolongs the life of unprocessed plant products. Storage also moderates price by regulating the supply available to the market.)

V. Types of crop storage

A. On-farm storage

B. Cooperative storage

C. Custom storage

VI. Reasons on-farm storage space is needed

A. To hold crop immediately after harvest, until it can be moved to better storage space or to market

B. The producer can decide to delay marketing

C. The producer can hold for later consumption on his own farm

D. To reduce hauling time during harvest

E. To eliminate put-through charges at local elevator by hauling directly to major terminal when ready to sell

F. Producer can reduce risk by holding assets on farm (producer could lose assets stored in elevator if elevator would go bankrupt)

G. To eliminate storage charges paid to elevator

VII. Kinds of grain storage facilities (Transparency 2)

A. On the ground

(Note: Grain should be piled on the ground only after harvest and in the absence of available storage space or available transport equipment to move it to a safer place.)

B. Underground

(Note: Its principle drawback is the high cost of grain handling.)

C. Bagged and stored in buildings

(Note: Bags can be transported and handled without special equipment. But both bags and bag storage space become expensive where manpower costs are high.)

D. Farm bins

(Note: Farm storage may consist of any available space that will hold grain and keep out moisture, ranging from wooden enclosures, round steel bins, to silo-type or quonset hut bins.)

E. Bin sites

(Note: In recent years, much of the surplus grain owned by the U.S. government has been stored in farm-type bins in large numbers, called bin sites.)

F. Country elevators

(Note: Country elevators receive grain directly from producers. Their principle function is to accumulate grain from nearby farms, to reload it into trucks, railroad cars or barges, and to send it to market. In addition, they offer storage space and other services.)

G. Terminal elevators

(Note: Terminal elevators are usually located in transportation terminals and larger markets. They receive grain from country elevators and transfer it to storage or into other transportation equipment such as barges or other vessels.)

VIII. Function of harvesting machines

A. Remove edible plant parts by cutting, digging, shaking or stripping

B. Gather plant parts

C. Separate desired from undesired parts

D. Cleaning

E. Loading crop for transport

(Note: A seed lot which has ripened under good conditions, has been well harvested, and has been properly dried, possesses a high field planting value when it goes into storage, for example, the seeds are capable of producing strong seedlings able to establish themselves in adverse field conditions. Some of this value is lost during storage, slowly or rapidly, depending on storage conditions.)

IX. Factors affecting crop storability (Transparency 3)

A. Length of storage

B. Moisture level

C. Temperature

(Note: The effect of low temperature is to slow down or stop processes contributing to deterioration.)

D. Maturity of crop at harvest

E. Crop variety

F. Aeration

G. Handling of crop

X. Conditions of a safe storage facility

A. Maintain quality and quantity

B. Protect from pests

C. Protect from moisture

D. Protect from destructively high or low temperatures

E. Protect from objectionable odors and contamination

F. Protect against unauthorized distribution

(Note: A safe storage place must be provided for the greater part of crops produced until they are needed for consumption, since crop production is seasonal, and consumption is continuous.)

XI. Factors affecting length of storage time (Transparency 4)

A. Current price and demand for crop

B. Availability of storage facilities

C. Kind of crop being stored

D. Condition and quality of the crop

E. Conditions of storage

F. Cash needs of the farmer

XII. Basic rules for storing seed

A. Store seed dry

B. Keep seed dry

(Note: Most problems that arise during seed storage can be traced to the neglect of one or both of these rules. Losses usually occur when seed is either stored with a high moisture content or it is allowed to accumulate moisture while it is in storage. The aim in storage is to maintain the germination capacity of the seed, and generally this requires more stringent conditions than the conservation of nutritional or industrial qualities. For practical purposes, storage life comes to an end when the germination capacity begins to fall.)

XIII. Qualities of grain necessary to store for extended period

A. Dry

B. Cool

C. Clean

XIV. Management steps for grain storage (Transparency 5)

A. Make sure grain goes into storage at a safe moisture level and is relatively clean

B. Use aeration properly to cool grain and equalize temperature differentials

C. Prevent damage caused by insect infestations

XV. Planning an aeration system

A. Bins should be provided with a minimum of 1/10 cfm of air movement for each bushel of storage capacity

(Note: A 10,000-bushel bin requires a minimum of 1,000 cfm of aeration capacity.)

B. Common design errors reduce the efficiency of air movement, such as

1. Connecting duct from the fan too small to handle the airflow

2. Too small a perforated area where air enters grain

3. Ducts not arranged properly

   (Note: In flat storage buildings or large diameter bins, perforated ducts should be arranged so that the distance between ducts is not greater than the depth of the grain. Distance from the nearest duct to the wall should not exceed one half the depth of the grain.)

XVI. Long term grain storage management practices

A. Fall

1. Clean and treat bin

2. Dry grain to proper moisture for long-term storage

3. Bin and cool grain as soon as possible

4. Aerate continuously for one week (1/10 cfm)

5. Check grain regularly

B. Winter

1. Aerate grain in the late fall - early winter to bring grain temperature near the winter norm

2. Do not freeze grain

3. Check grain regularly

C. Spring

1. Warm grain by continuous aeration to about 50^{o}F if grain will be held over summer

2. Check grain regularly

D. Summer

1. Do not aerate unless problems develop

2. Fumigate the bin if insect infestation develops

3. Check grain regularly

XVII. Ways of packaging seed for storage

A. Bulk

B. Burlap bags

C. Cotton bags

D. Paper bags and packets

E. Cardboard boxes

F. Cardboard drums

XVIII. Control of insects in storage

A. Storage bins should be cleaned prior to seed storage

B. Storage bins should be made as air-tight as possible

C. Do not store fresh seed on top of old seed

D. Treat inside of storage bins with approved insecticide

E. Do not cone grain up under the bin roof unless you plan to remove this excess at the earliest time possible

(Note: Peaking grain makes it impossible to get into the bin to properly inspect the grain.)

XIX. Seed treatments used in disease control

A. Mechanical treatment

(Note: Mechanical treatment of seed removes any materials, such as soil or extraneous plant parts that are mixed in with the seed and that may cause disease. This is one of the first steps in seed processing, and is actually a cleaning operation.)

B. Physical treatment

(Note: Physical treatment includes washing the seed with hot water; bombarding it with x-rays, ultraviolet rays or gamma rays; and soaking it in water. These treatments are used to kill diseases on the surface of or within the seed.)

C. Chemical treatment

(Note: Chemical treatment is the most common method of treating seed. Chemical methods do the least amount of damage to the seed and appear to be the most effective in reducing losses from disease.)

XX. Control of rodents and birds in storage

(Note: Rodents and birds are of concern not only because they eat seed, but also because they contaminate it and spread disease.)

A. Area around storage bins should be kept clean

(Note: Rubbish should be removed immediately, stacks of lumber and other materials in which birds and rodents might hide should be removed and storage bins should be made as air-tight as possible to prevent rodents and birds from reaching the seed.)

B. Use of poisons

(Note: Great care must be taken when using all poisons since they may be harmful to humans and to other animals.)

XXI. Crops stored for relatively short periods

A. Fresh fruits

B. Vegetables

XXII. Crops stored for relatively long periods (Transparency 6)

A. Cereal grains

B. Dried forage crops

XXIII. Factors to consider in planning storage facilities

A. Proper size for current and future needs

B. Should preserve proper quality

C. Should provide for control of

1. Light

2. Temperature

3. Moisture

4. Pests

a. Insects

b. Rodents

D. Should be convenient for storing and removal of crops

XXIV. Measures to prevent suffocation in grain

(Note: You sink in about a foot when walking on dry grain in a grain bin. Grain removal will almost instantly submerge you over the knees. It takes less than 5 seconds to render you completely helpless. The average man occupies about 7 cubic feet of space. It takes about 20 seconds with a typical 6-inch auger to fill this space. That's how long it takes to completely sink and be covered by flowing grain.)

A. NEVER enter a grain bin when unloading equipment is running, whether or not grain is flowing

(Note: If grain bridges, shut off the unloader and use a pipe or some other long object to break the bridge and get the grain flowing again.)

B. If you must enter a bin, disconnect the power source and make sure no one can turn it on while you're inside

(Note: If the grain should start flowing for some reason, stay near the outer wall and keep walking until the grain flow stops or the bin is empty.)

C. Install ladders in all bins

(Note: This will provide an exit if you need to get out, as well as a safe way of getting in. But remember that even if there is a ladder in the bin, you must be able to get to it. If you walk out to the center of the bin and get caught in the flowing grain, you may not be able to reach the ladder.)

D. If you must enter a bin, tie yourself with a rope and harness so you have a way of getting out

XXV. Major objective of a grain-drying system--To dry grain only enough to safely maintain its condition and quality under your particular climatic conditions until it is marketed or fed

XXVI. Disadvantages of over drying grain (Transparency 7)

A. Increases drying costs

B. Wastes energy

C. Discounts the price you receive (because there is less weight to sell)

XXVII. Calculating volume of grain in storage

A. Figure volume

1. Volume of storage structure = all dimensions in feet

2. If square or rectangular--Volume = length x width x height

Example: Crib 6 feet wide, 30 feet long, 20 feet high

6 x 30 x 20 = 3,600 cubic feet

3. If round and diameter is known--

Volume = 1/2 diameter x 1/2 diameter x height x 3.14

Example: Bin 21 feet in diameter, 20 feet high

1/2 x 21 x 1/2 x 21 x 20 x 3.14 = 6,924 cubic feet

4. If round and only circumference is known--

$$\text{Volume} = \frac{7 \times \text{circ.}}{44} \times \frac{7 \times \text{circ}}{44} \times \text{height} \times 3.14$$

Example: Bin 66 feet in circumference, 20 feet high

$$\frac{7 \times 66}{44} \times \frac{7 \times 66}{44} \times 20 \times 3.14 = 6{,}924 \text{ cubic ft}$$

B. Determine bushels of grain

$$\text{Bushels of grain} = \frac{\text{Volume}}{\text{cubic feet of one bushel grain}}$$

C. Make corrections for moisture for more accurate calculation

(Note: These adjustment factors shown are those used by CCC. They are intended for inventory purposes, not for buying and selling grain.)

1. Ear corn

a. A bushel of ear corn measures 2.5 cubic feet and has no more than 16% moisture

b. Adjust for higher moisture as shown in the chart below

Ear corn moisture content (percent)	Adjustment factor (percent)
16.1 to 17.0 both inclusive	98
17.1 to 18.0 both inclusive	96
18.1 to 19.0 both inclusive	94
19.1 to 20.0 both inclusive	92
20.1 to 21.0 both inclusive	90
Above 21.0--no loan	

2. Shelled corn

a. A bushel of shelled corn measures 1.25 cubic feet if the test weight is 56 pounds per bushel

b. Adjust for different weights by using the chart below

For shelled corn testing	Percent
60 pounds or over	107
59 or over, less than 60	105
58 or over, less than 59	104
57 or over, less than 58	102
56 or over, less than 57	100
55 or over, less than 56	98
54 or over, less than 55	96
53 or over, less than 54	95
52 or over, less than 53	93
51 or over, less than 52	91
50 or over, less than 51	89
49 or over, less than 50	88

3. Wheat

a. A bushel of wheat measures 1.25 cubic feet and has a test weight of 60 pounds per bushel

b. Adjust for different test weights by using the chart below

For wheat testing	Percent
65 pounds or over	108
64.0 to 64.9	107
63.0 to 63.9	105
62.0 to 62.9	103
61.0 to 61.9	102
60.0 to 60.9	100
59.0 to 59.9	98
58.0 to 58.9	97
57.0 to 57.9	95
56.0 to 56.9	93
55.0 to 55.9	92
54.0 to 54.9	90
53.0 to 53.9	88
52.0 to 52.9	87

4. Oats

a. A bushel of oats must measure 1.25 cubic feet and test 32 pounds per bushel

b. Adjust for different test weights by using the chart below

For oats testing	**Percent**
40 pounds or over	125
39 or over, but less than 40	121
38 or over, but less than 39	118
37 or over, but less than 38	115
36 or over, but less than 37	112
35 or over, but less than 36	109
34 or over, but less than 35	106
33 or over, but less than 34	103
32 or over, but less than 33	100
31 or over, but less than 32	96
30 or over, but less than 31	93
29 or over, but less than 30	90

5. Barley

a. A bushel or barley must measure 1.25 cubic feet and test 48 pounds

b. Adjust for different test weights by using the chart below

For barley testing	**Percent**
50 pounds or over	104
49 or over, but less than 50	102
48 or over, but less than 49	100
47 or over, but less than 48	98
46 or over, but less than 47	96
45 or over, but less than 46	94
44 or over, but less than 45	92
43 or over, but less than 44	90
42 or over, but less than 43	88
41 or over, but less than 42	85

ADVANTAGES OF PROPER CROP STORAGE

Maintenance of crop quality

Decreased crop loss

Increased longevity of crop

Potential marketing advantage

Holding of crop until ready to use

KINDS OF GRAIN STORAGE FACILITIES

On the ground

Underground

Bagged and stored in buildings

Farm bins

Bin sites

Country elevators

Terminal elevators

FACTORS AFFECTING CROP STORABILITY

Length of storage

Moisture level

Temperature

Maturity of crop at harvest

Crop variety

Aeration

Handling of crop

FACTORS AFFECTING LENGTH OF STORAGE TIME

Current price and demand for crop

Availability of storage facilities

Kind of crop being stored

Kind of crop and quality of the crop

Conditions of storage

Cash needs of the farmer

MAXIMUM MOISTURE CONTENT FOR SAFE GRAIN STORAGE

Grain type and storage time	Maximum Moisture %
Shelled corn and sorghum	
Sold as #2 grain by spring	15 1/2
Stored 6 - 12 months	14
Stored more than one year	13
Wheat, oats, barley	
Stored up to six months	14
Stored more than six months	13

MAXIMUM ALLOWABLE STORAGE TIME FOR GRAINS

% Grain Moisture

Grain Temp (ºF)	16	18	20	22	24	26
	Days Storage					
35	670	265	112	74	49	37
40	500	200	85	56	38	28
45	385	150	64	42	28	21
50	290	115	48	32	21	16
55	215	86	36	24	16	12
60	165	65	28	18	12	9
65	125	49	21	14	9	7
70	93	37	16	10	7	5
75	70	28	12	8	5	4

COSTS OF DRYING CORN BELOW 15.5%

Moisture Content	Extra Drying Costs	Extra Shrinkage Costs	Total Overdrying Costs
		cents/bushel	
14 %	2.6	4.4	7.0
13 %	4.3	7.2	11.5
12 %	6.2	9.9	16.1
11 %	8.2	12.6	20.8

Note: Costs are based on the following:

Shelled corn at $2.50/bushel

Propane at $.70/gallon

Electricity at $.05/kilowatt hour

CROP STORAGE

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ASSIGNMENT SHEET #1--CALCULATE VOLUME OF GRAIN IN STORAGE

Name ______________________________________ Score________________________________

1. Calculate the volume of ear corn in a corn crib that measure 8 feet wide, 30 feet long and 15 feet high. The crib is filled to the top and the ear corn has 17.5% moisture. Show all your calculations.

Bushels ear corn = __________________________

2. Calculate the volume of wheat in a grain bin that is 27 feet in diameter. The bin is filled to 26 feet high and the wheat has a test weight of 62.5 pounds. Show all your calculations.

Bushels wheat = ____________________________

3. Calculate the volume of barley in a grain bin that has a circumference of 87 feet. The bin is filled 23 feet high and the barley tests 43.8 pounds. Show all your calculations.

Bushels barley = ___________________________

CROP STORAGE

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ANSWERS TO ASSIGNMENT SHEET

Assignment Sheet #1

1. 1,382.4 bushels

2. 12,260.2 bushels

3. 9,960 bushels

CROP STORAGE

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UNIT TEST

Name ______________________________________ Score________________________________

1. Match terms associated with crop storage to the correct definitions. Write the correct numbers in the blanks.

_____a.	A structure with a roof and open sides for drying corn ears	1.	Pest
		2.	Pesticide
_____b.	Any living organism that damages crops or is annoying or destructive to humans in some way	3.	Fungicide
_____c.	The weight of water in a crop sample expressed as a percentage of the total weight of the sample	4.	Insecticide
		5.	Fumigation
_____d.	A pesticide used to kill fungi	6.	Pathogen
_____e.	The point at which a seed or plant vegetative reproductive organ having adequate moisture, temperature and oxygen begins to grow	7.	Relative humidity
		8.	Moisture content
_____f.	Something liable to spoil or deteriorate quickly, such as food with high moisture content	9.	Perishable
_____g.	The process of using chemicals in a gaseous form in order to kill pathogens or insect pests	10.	Aeration
		11.	Spontaneous combustion
_____h.	The process of ignition and burning as a result of heat generated by internal chemical action	12.	Crop preservation
_____i.	The ratio, expressed as a percentage, of the quantity of water vapor actually present in the air to the greatest amount it could contain at that temperature	13.	Germination
		14.	Germination capacity
_____j.	Any substance used to kill insects, rodents, weeds or other pests	15.	Crib
_____k.	The percentage of seeds or plant vegetative reproductive organs capable of germinating to produce seedlings robust enough to establish in good field conditions		
_____l.	Process of moving small amounts of air through the stored crop at low flow rates to remove moisture and/or to cool the crop, and thus prevent deterioration of crop quality		

_____m. Disease-causing microscopic organisms

_____n. A chemical or other substance used to kill or control populations of insects and related animals

_____o. Retardation of physiological processes in plant tissues to present a finished product in an attractive or usable form

2. List three causes of deterioration in storage.

a. ____

b. ____

c. ____

3. Select from the following list methods of postharvest preservation of crops. Write an "X" in the blank before each correct answer.

_____a. Processing with salt

_____b. Canning

_____c. Processing with sugar

_____d. Germination control

_____e. Control of relative humidity

_____f. Drying

_____g. Growth retardation

_____h. Refrigeration

_____i. Control of temperature

_____j. Control of oxygen and carbon dioxide levels

_____k. Chemical processing

_____l. Vacuum storage

_____m. Quick freezing

4. Select from the following list advantages of proper crop storage. Write an "X" in the blank before each correct answer.

_____a. Increased crop loss

_____b. Decreased longevity of crop

_____c. Maintenance of crop quality

_____d. Marketing advantage

_____e. Holding of crop until ready for use

5. Name three types of crop storage.

a.____

b. ____

c.____

6. List four reasons farm storage is needed.

a.____

____

b. ____

____

c.____

____

d. ____

____

7. Name five kinds of grain storage facilities.

a.____

b. ____

c.____

d. ____

e.____

8. Discuss the functions of harvesting machines.

____

____

____

____

____

____

____

____

9. Select from the following list factors affecting crop storability. Write an "X" in the blank before each correct answer.

_____a. Maturity of crop at harvest

_____b. Possibility of contamination

_____c. Temperature

_____d. Handling of crop

_____e. Demand for crop

_____f. Length of storage

_____g. Cash needs of farmer

_____h. Crop variety

_____i. Moisture level

10. Select from the following list conditions of a safe storage facility. Write an "X" in the blank before each correct answer.

_____a. Maintain quality and quantity of crop

_____b. Protect against price fluctuations

_____c. Guard against unauthorized distribution

_____d. Guard against contamination

_____e. Protect from pests

_____f. Protect from moisture

11. Select from the following list factors that affect length of storage time. Write an "X" in the blank before each correct answer.

_____a. Cash needs of the farmer

_____b. Seed treatments available

_____c. Conditions of storage

_____d. Condition and quality of the crop

_____e. Average outside temperature

_____f. Kind of crop being stored

_____g. Average rainfall in area

_____h. Availability of storage facilities

_____i. Current price and demand for crop

12. List two basic rules for storing seed.

a. ____

b. ____

13. List three qualities of grain necessary in order to store grain for an extended period.

a. ____

b. ____

c. ____

14. List three management steps for proper grain storage.

a. ____

____

b. ____

____

c. ____

____

15. Discuss factors to consider when planning an aeration system.

____

____

____

____

____

____

____

____

____

16. Match long-term grain storage management practices to the season in which they should be carried out. (Note: Answers will be used more than once, and there may be more than one answer for some practices.)

1. Fall 2. Winter 3. Spring 4. Summer

_____a. Check grain regularly

_____b. Aerate grain to bring grain temperature near winter norm

_____c. Warm grain by continuous aeration to 50°F if grain will be held over summer

_____d. Clean and treat bin

_____e. Do not aerate unless problems develop

_____f. Fumigate the bin if insect infestation develops

_____g. Bin and cool grain as soon as possible

_____h. Dry grain to proper moisture for long-term storage

_____i. Do not freeze grain

_____j. Aerate continuously for one week (1/10 cfm)

17. List three ways of packaging seed for storage.

a.____

b. ____

c.____

18. Discuss the control of insects in storage.

19. List three seed treatments used in disease control.

a.

b.

c.

20. Discuss the control of rodents and birds in storage.

21. List two crops stored for relatively short periods.

    a.____

    b. ____

22. List two crops stored for relatively long periods.

    a.____

    b. ____

23. List four factors to consider in planning storage facilities.

    a.____

    b. ____

    c.____

    d. ____

24. Discuss measures to prevent suffocation in grain.

25. State the major objective of a grain-drying system.

____

____

____

____

26. List three disadvantages of over drying grain.

a.____

b. ____

c.____

27. List the three steps to follow when calculating volume of grain in storage.

a.____

____

b. ____

____

c.____

____

CROP STORAGE

AG 320 - M

ANSWERS TO TEST

1.

a.	15	f.	9	k.	14
b.	1	g.	5	l.	10
c.	8	h.	11	m.	6
d.	3	i.	7	n.	4
e.	13	j.	2	o.	12

2. Physical; Chemical; Biological

3. a, b, c, e, f, h, i, j, l, m

4. c, d, e

5. On-farm storage; Cooperative storage; Custom storage

6. Answer should include four of the following:

   To hold crop immediately after harvest, until it can be moved to better storage space or to market; The producer can decide to delay marketing; The producer can hold for later consumption on his own farm; To reduce hauling time during harvest; To eliminate put-through charges at local elevator by hauling directly to major terminal when ready to sell; Producer can reduce risk by holding assets on farm (producer could lose assets stored in elevator if elevator would go bankrupt); To eliminate storage charges paid to elevator

7. Answer should include five of the following:

   On the ground; Underground; Bagged and stored in buildings; Farm bins; Bin sites; Country elevators; Terminal elevators

8. Answer should include the following information:

   Remove edible plant parts by cutting, digging, shaking or stripping; Gather plant parts; Separate desired from undesired parts; Cleaning; Loading crop for transport

9. a, c, d, f, h, i

10. a, c, d, e, f

11. a, c, d, f, h, i

12. Store seed dry; Keep seed dry

13. Dry; Cool; Clean

14. Make sure grain goes into storage at a safe moisture level and is relatively clean; Use aeration properly to cool grain and equalize temperature differentials; Prevent damage caused by insect infestations

15. Answer should include information from the following:

    Bins should be provided with a minimum of 1/10 cfm of air movement for each bushel of storage capacity; Common design errors reduce the efficiency of air movement, such as: Connecting duct from the fan too small to handle the airflow; Too small a perforated area where air enters grain; Ducts not arranged properly

16.

a.	1, 2, 3, 4	f.	4
b.	2	g.	1
c.	3	h.	1
d.	1	i.	2
e.	4	j.	1

17. Answer should include three of the following:

    Bulk; Burlap bags; Cotton bags; Paper bags and packets; Cardboard boxes; Cardboard drums

18. Answer should include information from the following:

    Storage bins should be cleaned prior to seed storage; Storage bins should be made as air-tight as possible; Do not store fresh seed on top of old seed; Treat inside of storage bins with approved insecticide; Do not cone grain up under the bin roof unless you plan to remove this excess at the earliest time possible

19. Mechanical treatment; Physical treatment; Chemical treatment

20. Answer should include the following information:

    Rodents and birds are of concern not only because they eat seed, but also because they contaminate it and spread disease; Area around storage bins should be kept clean; Rubbish should be removed immediately, stacks of lumber and other materials in which birds and rodents might hide should be removed and storage bins should be made as air-tight as possible to prevent rodents and birds from reaching the seed; Use of poisons; Great care must be taken when using all poisons since they may be harmful to humans and to other animals

21. Fresh fruits; Vegetables

22. Cereal grains; Dried forage crops

23. Answer should include four of the following factors:

    Proper size for current and future needs; Should preserve proper quality; Should provide for control of light, temperature, moisture, and pests such as insects and rodents; Should be convenient for storing and removal of crops

24. Answer could include the following information:

    NEVER enter a grain bin when unloading equipment is running, whether or not grain is flowing; If grain bridges, shut off the unloader and use a pipe or some other long object to break the bridge and get the grain flowing again; If you must enter a bin, disconnect the power source and make sure no one can turn it on while you're inside; If the grain should start flowing for some reason, stay near the outer wall and keep walking until the grain flow stops or the bin is empty; Install ladders in all bins; This will provide an exit if you need to get out, as well as a safe way of getting in. But remember that even if there is a ladder in the bin, you must be able to get to it. If you walk out to the center of the bin and get caught in the flowing grain, you may not be able to reach the ladder; If you must enter a bin, tie yourself with a rope and harness so you have a way of getting out

25. To dry grain only enough to safely maintain its condition and quality under your particular climatic conditions until it is marketed or fed

26. Increases drying costs; Wastes energy; Discounts the price you receive (because there is less weight to sell)

27. Figure volume; Determine bushels of grain; Make corrections for moisture for more accurate calculation

CROP MARKETING AND EXPORTING

AG 320 - N

UNIT OBJECTIVE

After completion of this unit, students should be able to match terms to the correct definitions and distinguish between supply and demand as related to the crop marketing industry. Students should also be able to select factors affecting grades of commodities and list sources of crop market information. This knowledge will be demonstrated by completion of the assignment sheet and unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Match terms associated with crop marketing and exporting to the correct definitions.
2. Distinguish between supply and demand.
3. Select factors that distinguish between supply and demand curves.
4. Select factors causing shifts in demand of a commodity.
5. List and describe two of the four types of markets.
6. Name three standard and grade acts that have affected the crops market.
7. Select factors that influence time to market.
8. Select sources for marketing crops.
9. Match the classes of elevators to the correct descriptions.
10. List five job opportunities in crop marketing.
11. List three functions of product standards.
12. Select factors affecting grades of grain, hay, fruit and vegetables.
13. List four of the six basic marketing strategies that most farmers and ranchers use.
14. List four programs, services or regulatory functions of the USDA Agricultural Marketing Service.
15. Match the steps of the marketing channel to the correct descriptions.
16. Discuss hedging as it relates to crop marketing.
17. List three characteristics of the futures market.
18. Discuss the difference between hedging and speculation.

19. List three advantages and one disadvantage of farmers' use of the futures market as a true hedge.

20. Select ways of using futures market.

21. Name three leading grain futures markets.

22. List six sources of crop market information.

23. List four major U.S. agricultural export commodities.

24. Select correct statements describing U.S. agricultural exports.

25. Calculate net price for grass seed sold.

CROP MARKETING AND EXPORTING

AG 320 - N

SUGGESTED ACTIVITIES

I. Suggested activities for instructor

A. Order materials to supplement unit.

1. Literature

a. *Farm and Ranch Business Management*, available from John Deere Distribution Service Center, Service Publications, Department 150, 1400 - 13th Street, East Moline, Illinois 61244; textbook: cost $20.71, order no. FBM10102B; instructor guide: cost $13.88, order no. FBM10502T; student guide: cost $6.91, order no. FBM10602W; slide set: cost $105.48, order no. FBM10202S.

b. *Marketing for Farmers*, available from Hobar Publications, 1234 Tiller Lane, St. Paul, Minnesota 55112, (612-633-3170); approximate cost $24.95; order no. Doanes MFF-1.

c. The following publications are available from Agricultural Communications Center, Ag Publications Building, University of Idaho, Moscow, Idaho 83843-4196, (208-885-7982).

EXT	649	*Marketing Idaho's Dry Edible Beans* $1.00
CIS	348	*Buying and Selling Alfalfa Hay, Corn Silage, Barley* $.25
CIS	449	*Buying and Selling High-Moisture Grain* $.25
PNW	230	*Waterway User Fees and Wheat Transportation* $.35
EXP	636	*Idaho Grain Producers: Adoption of New Marketing Methods* $1.50
EXP	653	*Transporting and Marketing Idaho's Wheat and Barleys* $.75
WREP	1	*Farmer Use of Wheat Futures in the Pacific Northwest* $.50
CIS	539	*Setting a Price for Alfalfa Feeds* $.35
EXP	619	*Northwest Export Shipping of Potato Products--Hinterland Delineation and Growth Potential* $1.00
EXP	710	*The Potato Export Market* $.50

CIS	818	*Production, Processing and Marketing Potential for Rapeseed in the Pacific Northwest* $.35
EXT	660	*An International Market Profile: Rapeseed* $1.00
EXT	667	*Transporting and Marketing Idaho's Dry Edible Peas and Lentils* $.50
MS	93	*Farm Management and Marketing Publications* (NC)
CIS	683	*Agricultural Trade Policy: Who Are the Actors?* $.35
CIS	715	*Electronic Marketing--What, How and Why?* $.35
CIS	724	*Countertrade: Is it the Answer for Agricultural Exporters?* $.45
CIS	806	*Considering the Export Market?* $.35
PNW	241	*Developing a Marketing Plan for Fresh Produce* $.75
EXP	585	*Containerized Movements of Kentucky Bluegrass Seed Exports Through Pacific Northwest Ports* $.50

2. Filmstrips, slideshows, etc.

   a. *Agricultural Marketing*, sound filmstrip; provides insight into the workings of hedging, cash forward contracts, cooperative bargaining and commodity groups; available from Vocational Educations Productions, California Polytechnic State University, San Luis Obispo, California 93407, (1-800-235-4146); cost $19.95; order no. 1-810-133J.

   b. *Green Light for Grain*, Program #252; 26 minutes, VHS or Beta format; reviews grain transportation problems and their effect on farm prices; available from Agricultural Communications Center, 10 Ag Science Bldg., University of Idaho, Moscow, Idaho 83843-4196, (208-885-6436).

   c. *Hedging: A Potato Marketing Tool*, Program #2; 27 minutes, VHS or Beta format; explains the process of "hedging" a commodity such as potatoes on the Chicago Mercantile Exchange; available from Agricultural Communications Center, 10 Ag Science Bldg., University of Idaho, Moscow, Idaho 83843-4196, (208-885-6436); purchase cost $25; rental cost: $10 for 14 days.

d. *Merchants of Grain*, Program #146; 60 minutes, VHS or Beta format; focuses on world grain movements and makes a parallel between grain and petroleum while describing how grain marketing decisions are controlled by the "Big 5" world companies that move grain; available from Agricultural Communications Center, 10 Ag Science Bldg., University of Idaho, Moscow, Idaho 83843-4196, (208-885-6436).

e. *Ocean Barge Transportation*, Program #3; 29 minutes, VHS or Beta format; illustrates marine transportation in ocean barges and harbor improvement; available from Agricultural Communications Center, 10 Ag Science Bldg., University of Idaho, Moscow, Idaho 83843-4196, (208-885-6436).

B. Make transparencies and necessary copies of materials.

C. Provide students with objective sheet and discuss.

D. Provide students with information and assignment sheets and discuss.

E. Lead a discussion on how things would be without any of our modern marketing functions--in other words, without any "middlemen".

F. Develop a class project around marketing some sort of product. Have students plan marketing strategies and discuss the factors that affected the success of the project.

G. Have students collect market reports and graph market trends.

H. Invite a broker who deals in the futures market to talk to the class.

I. Invite a progressive farmer to discuss marketing techniques with the class.

J. Visit a nearby grain elevator and discuss with the manager his buying and selling policies with the manager.

K. Review and give test.

L. Reteach and retest if necessary.

II. Instructional materials

A. Objective sheet

B. Suggested activities

C. Information sheet

D. Transparency masters

1. TM 1--Types of Markets

2. TM 2--USDA Agricultural Marketing Service

3. TM 3--Steps of Marketing Channel

4. TM 4--Farm Exports Stimulate Added Economic Activity

E. Assignment sheet

1. AS 1--Calculate Net Price for Grass Seed Sold

F. Answers to assignment sheet

G. Test

H. Answers to test

III. Unit references

A. *Agriculture III*, Curriculum and Instructional Materials Center, Stillwater, Oklahoma.

B. *Basic Vo-Ag IV*, Vocational Instructional Services, Texas A & M University.

C. Carlile, R.B., and Stewart, B.R., *Agribusiness*, Instructional Materials Laboratory, Columbia, Missouri.

D. *Foreign Agricultural Trade Statistical Report*, United States Department of Agriculture, Economic Research Service, Washington, DC, 1983.

E. *Highlights of the U.S. Export and Import Trade*, U.S. Bureau of the Census, December, 1990.

F. Kohls, R.L. and Uhl, J.N., *Marketing of Agricultural Products*, 6th edition, The MacMillan Company, New York, New York, 1985.

G. *Marketing U.S. Agriculture: 1988 Yearbook of Agriculture*, U.S. Government Printing Office, Washington, DC 20402, 1988.

H. *The Merrill Lynch Guide to Hedging*, Merrill Lynch, Pierce, Fenner and Smith, Inc., April, 1978.

I. Rush, M. and Foster, R., *Farm Management*, Department of Agricultural and Extension Education, Moscow, Idaho.

J. *Survey of Current Business*, U.S. Bureau of Economic Analysis, June, 1989.

CROP MARKETING AND EXPORTING

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INFORMATION SHEET

I. Terms and definitions

A. Market--Place at which an exchange of commodities occurs between a buyer and a seller

B. Marketing--Activity involved in buying or selling a product

C. Cooperative marketing--Process whereby farmers pool their crops for shipment to market to increase bargaining power

D. Consumer--Final buyer and user of product

E. Forward contract--An agreement to sell a specified quantity of a product for a specified price and at a specified time in the future

F. Futures contract--A contract to deliver or accept delivery of a specified quantity and grade of a commodity at a specific future month

G. Futures market--An exchange where futures contracts for commodities are bought and sold

H. Contract--Promise to deliver or accept delivery of a specific grade of commodity at a specified time, place and price

I. Basis--Difference between the cash price and futures price

J. Commission--A fee given to an agent in exchange for a service, usually a service provided in selling a product

K. Hedge--A contract entered into for protection of an investment

L. Speculate--Attempt to make a profit by predicting what the market will do and buying or selling based on that prediction

M. Marketing margin--Difference between the amount consumers pay for the final product and the amount producers receive

N. Law of demand--Principle in economics which states that the quantity of an economic good purchased will vary inversely with its price

(Note: The lower the price is, the more goods will be purchased; conversely, the higher the price is, the less goods will be purchased.)

O. Commodity--Agricultural product

P. Export--To send commodities from one country to another for purpose of sale

Q. Import--To bring commodities into one country from another

R. Tariff--A system of taxes placed by a government upon imports

II. Supply and demand

A. Demand--Schedule of different quantities of a commodity that buyers will purchase at different prices at a given time and place

(Note: One price is always associated with one quantity.)

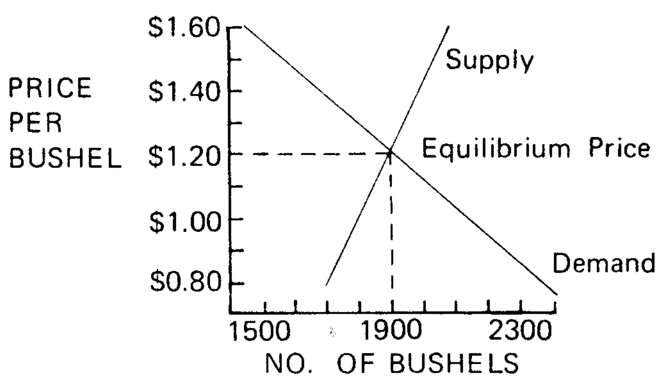
B. Supply--Schedule of different quantities of a commodity that will be offered for sale at different prices at a given time and place

(Note: One price is always associated with one quantity.)

III. Supply and demand curves

A. Demand curve always slopes downward

B. Supply curve always slopes upward



(Note: This is correct for an industry, such as wheat. It is also correct for a firm that sells a perceptible portion of an industries output, such as G.M. But, it is not correct for a firm whose sales do not affect the market price, such as a wheat farmer. For that type of firm, the demand curve is horizontal, meaning the quantity sold has no impact on the market price.)

IV. Factors causing shifts in demand of a commodity

A. Population increase or decrease

B. Difference in income and purchasing power

C. Changes in tastes and preferences of consumers

D. Cost of product

E. Expectations of buyers

V. Types of markets (Transparency 1)

A. Direct purchase--Product is obtained directly from the farmer by the processing plant or by the consumer

B. Central or terminal market--Products are shipped to a common location where products and buyers are brought together

C. Auction--Products are brought together by farmers where they are sold through competitive, verbal bidding

(Note: Electronic auctions are becoming more popular with the auction being conducted over the telephone or closed circuit television.)

D. Cooperative markets--Farmers band together to combine their products and market them collectively

VI. Standard and grade acts that have affected the crops market

A. Agricultural Marketing Act--Established in 1946 giving the Secretary of Agriculture power to develop and establish grades and standards for most farm commodities

B. Grain Standards Act--Established in 1916 setting federal standards requiring all grain to be graded if sold through interstate commerce

C. Standard Containers Act--Established in 1916 setting standards on the 2 quart, 4 quart and 12 quart baskets

D. Agricultural Adjustment Act--Established in 1933 for the purpose of organizing criterion for a fair price for agricultural products

E. Pure Food and Drug Act--Established in 1906, expanded in 1938; designed to prevent shipment of adulterated or misbranded food and drugs

VII. Factors influencing time to market

A. Price at harvest

B. Futures

C. Carry-over

D. Cost of storage

E. Storage facilities

F. Financial status of producer

G. Potential exports

H. Projected national yield

VIII. Sources for marketing crops

A. Home farm use

(Note: Grains may be used for animal consumption on the farm or in a commercial feedlot. The grains also may be processed by local feed manufacturing plants.)

B. Local and/or terminal elevators

C. Direct to export

D. Farmers' markets

IX. Classes of elevators

A. Country

1. Independent--Elevator operated and controlled by individuals within the community

2. Cooperative--Elevator owned cooperatively by farmers of the area

3. Line--Elevator owned and operated by a central headquarters or chain

B. Terminal--Elevator operated by grain dealers or merchants who buy grain for storage and later sell to millers and processors or export

(Note: Because of the large storage capacity and investment powers, the terminal elevator operators/owners are able to utilize the futures market for hedging. The practice of buying and selling in futures is used by all elevator operators as they purchase grain.)

X. Job opportunities in crop marketing

A. Elevator operator or manager

B. Elevator employee

C. Seed grader or tester

D. Broker

E. Processing foreman or manager

F. Insurance representative

G. Truck driver

XI. Functions of product standards

A. Eliminate abuse in market

B. Provide foundation for market system

C. Protect farmer, buyer and consumer

(Note: Product standards facilitate marketing of products since the buyer does not actually have to see the product to know exactly what the product is like; standards also protect the consumer from getting substandard or inferior products.)

XII. Factors affecting grades of grain, hay, fruit and vegetables

A. Grains

1. Size of kernels
2. Color of kernels
3. Shape of kernels
4. Decay
5. Foreign material
6. Insect damage
7. Disease damage
8. Maturity
9. Moisture content
10. Mechanical damage

B. Hay

1. Protein content
2. Color
3. Maturity
4. Leafiness
5. Texture

C. Fruits and vegetables

1. Proper size
2. Uniform, natural color
3. Uniform shape
4. Appearance (should look fresh and firm)
5. Decay

6. Sunscald
7. Insect damage
8. Disease damage
9. Bruises
10. Maturity

XIII. Marketing strategies that most farmers and ranchers use

A. Buy and sell at current cash prices

B. Buy and store or store and sell

C. Deliver and defer price

D. Forward contract (fix the price before delivery)

E. Hedge (fix the price with a futures contract)

F. Sell (buy) on the cash market and speculate in the futures market

XIV. USDA Agricultural Marketing Service (AMS) (Transparency 2)

A. Marketing programs

1. Food Purchasing

   (Note: AMS purchases food for distribution to schools, institutions and other eligible outlets by USDA's Food and Nutrition Service.)

2. Government Food Quality Assurance Program

   (Note: AMS has specifications to allow the needs of several federal agencies to be met by current food industry production practices.)

3. Grade Standards

   (Note: AMS maintains grade standards for cotton, dairy products, fruits, beef, veal, calf, lamb, pork, mohair, poultry, rabbits, shell eggs, tobacco, vegetables and wool. The standards describe the entire range of quality for each product and are the basis for the quality grades.)

B. Marketing services

1. Grading and Acceptance Services

   (Note: Grading services for the products mentioned under "Grade Standards" are available on request for a fee paid by the users. Grading provides buyers and sellers with an impartial appraisal of the quality of the commodities being sold, and assists farmers in receiving fair prices for their products.)

2. Market News Service

(Note: Market news reporters gather data on qualities and quantities of products sold, prices paid, demand, movements and trends. Satellite communication, earth stations and microcomputers are used to disseminate 700 - 900 market news messages and reports daily, which are made available to the agricultural industry, as well as the print and electronic news media. Automatic telephone recordings are also used to provide current market information.)

3. Market Research and Development

(Note: AMS researchers explore new techniques and methods for improving marketing, including handling, processing, packaging, storage and distribution of agricultural products. Researchers also work with local governments and food industry groups to identify existing problems, to design improved facilities and to assist in the development of modern, efficient wholesale food distribution centers and farmers markets. AMS supports marketing studies at the state level through a matching funds grant program.)

C. Regulatory functions

1. Commodity Research and Promotion Programs

(Note: Commodity research and promotion programs enable farmers to solve production and marketing problems, finance their own coordinated programs of research, create producer and consumer education and develop promotion programs to improve, maintain and develop markets for their commodities.)

2. Fair Trade Practices

(Note: To promote fair play in marketing, AMS administers four major regulatory laws: the Perishable Agricultural Commodities Act, the Federal Seed Act, the Plant Variety Protection Act and the Agricultural Fair Practices Act.)

3. Marketing Agreements and Orders

(Note: Marketing agreements and orders are designed to help stabilize markets for a number of farm commodities, chiefly milk, fruits, vegetables, and certain specialty crops like nuts, raisins and dates. These programs are initiated and designed by farmers and administered by AMS. A marketing order may be issued by the Secretary of Agriculture only after public hearings, and after producers vote at least two-thirds approval through a referendum.)

4. Egg Products Inspection and Shell Egg Surveillance

(Note: Mandatory inspection is continuous in all plants processing.)

XV. Steps of marketing channel (Transparency 3)

A. Assembling--Bringing together crops for shipment

B. Grading--Sorting the crop for uniform quality and size

C. Processing--Putting crop into usable form for consumer

D. Transporting--Moving the crop to market

E. Storing--Storing of crop for future use or until a higher price can be obtained

F. Financing--Loaning as a form of credit to a farmer until the crop can be sold or processed

G. Risk-taking--Assuming risk until the crop has been sold or processed

XVI. Hedging--The process of shifting the risk from prices which change in either direction

(Note: Hedging is distinct from speculation in commodity futures; the speculator seeks to make money from price changes; the hedger seeks to avoid losing money from adverse price changes. Thus, the hedger minimizes price risk; the speculator assumes that risk. Confusion between hedging and speculation in commodity futures contracts is widespread. Some people think that losing money on the futures side of a hedge is a waste. Rather, it should be considered an insurance premium. The purpose of hedging is to break even, to avoid a loss, not to make money on the hedge.)

Example: Hedging using the cash and futures market

	Cash Market	Futures Market
On day of purchase	Purchased 50,000 bushels of wheat at $2.00 per bushel	Sold 50,000 bushels of wheat at $2.10 per bushel
On day of cash sale	Sold 50,000 bushels of wheat at $1.95 per bushel	Purchased 50,000 bushels of wheat at $2.05 per bushel
Result	The farmer lost 5 cents per bushel on cash market	However, he gained 5 cents on the futures market

(Note: When cash grain was purchased, futures were sold. When cash grain was sold, futures were purchased. The cash market declined as he feared it might, and he lost 5 cents a bushel when he finally sold his grain. However, the futures market also fell, and there was a net gain of 5 cents a bushel on his futures transactions. This was a perfect hedge, since the loss on one market was exactly offset by the gain on the other.)

XVII. Characteristics of the futures market

A. Enables a producer to guarantee a price for a product

B. Insures against downward price movement, but also prevents gains from an upward price movement

C. Involves a promise to deliver or receive a commodity at some specified date in the future for a specified price

D. Products are not usually delivered--offsetting contracts are simply bought or sold to cancel the original contract

Example: If you sold your wheat on the March futures, then you would simply buy back that contract when you sold your wheat for cash

E. Prices for the futures market are determined through highly competitive bidding

F. Trading is accomplished through a broker who has the legal right to represent his clients

G. Contracts may be bought and sold at any time

H. A margin or percentage of the contract is used to guarantee the broker that the person buying or selling a futures contract will be able to pay for losses that might incur

(Note: If the market moves against the person buying or selling futures, then the broker will issue a margin call and the person will be required to deposit additional margin money. When using options, however, the initial investment is the only cost.)

XVIII. Hedging versus speculation

A. Hedging--A person who hedges owns the product or is prepared to accept delivery of the product and is trading on the futures market to protect against an unfavorable price movement

B. Speculating--A person who speculates does not own the product and attempts to make money by anticipating the rise and fall of the market; the speculator assumes the risk the hedger is trying to avoid

XIX. Advantages and disadvantages of using the futures market (as a true hedge)

A. Advantages

1. Forces farmers to closely monitor crop prices

2. Nullifies the effect of price increases and decreases

3. Protects against decline of value of farmer's inventory

4. Offers a means of stabilizing profit margins

5. Gives farmers the flexibility of management action

B. Disadvantages

1. Forces farmers to closely monitor crop prices (time consuming)

2. More paperwork

3. Cash outlay required

XX. Ways of using futures market

A. Price crop any time prior to harvest

B. Set price of product without taking immediate delivery

C. Fix price of grain in storage for deferred delivery

D. Speculation purposes

XXI. Leading grain futures markets

A. Chicago

B. Minneapolis

C. Kansas City

XXII. Sources of crop market information

A. Radio and television stations

B. Newspapers

C. U.S. Department of Agriculture

D. Magazines

E. Local elevators or markets

F. Feed stores

G. U.S. Department of Commerce

H. University Extension Service reports

I. State Department of Agriculture reports

J. Subscription services

XXIII. Major U.S. agricultural exports

A. Grain and cereal preparation

B. Corn

C. Wheat and wheat flour

D. Soybeans

E. Meat and meat preparations

F. Tobacco

G. Cotton

XXIV. U.S. agricultural exports (Transparency 4)

A. U.S. is the world's largest exporter of agricultural products

B. One out of three U.S. acres is farmed for export

C. U.S. agricultural exports consist mostly of crops and their products

D. U.S. exports of high value agricultural products (such as manufactured foods) have grown from 39% of farm trade in 1926-30 to about 51% in 1986-88

E. Each dollar earned from agricultural exports stimulates another $1.52 of output in the U.S. economy (Transparency 4)

(Note: The $40 billion of export sales in 1989 generated an additional $61 billion in supporting activities required to produce and transport products for export. Approximately 85% of this additional economic activity is earned by the nonfarm sector.)

F. U.S. agricultural exports generated 1.06 million full time civilian jobs in 1989

XXV. U.S. agricultural imports (1989)

A. U.S. consumers spent more than $6.5 billion on noncompetitive imported commodities

(Note: Noncompetitive commodities are those which cannot be produced profitably in the U.S., such as coffee and cocoa.)

B. U.S. consumers spent $15.6 billion on competitive imports

(Note: Competitive commodities compete directly with U.S. products and include meat, dairy products, fruits, nuts, vegetables, sugar and wine.)

TYPES OF MARKETS

Direct purchase

Central or terminal market

Auction

Cooperative markets

USDA AGRICULTURAL MARKETING SERVICE

Marketing Programs

Food Purchasing

Government Food Quality Assurance Program

Grade Standards

Marketing Services

Grading and Acceptance Services

Market News Service

Market Research and Development

Regulatory Functions

Commodity Research and Promotion Programs

Fair Trade Practices

Marketing Agreements and Orders

Egg Products Inspection and Shell Egg Surveillance

STEPS OF MARKETING CHANNEL

Assembling

Grading

Processing

Transporting

Storing

Financing

Risk-taking

FARM EXPORTS STIMULATE ADDED ECONOMIC ACTIVITY

Billion dollars, 1989

	Value of direct agricultural exports	Value of additional economic output related to farm exports[1]	TOTAL
Farm	19	10	29
Other manufacturing	2	19	21
Food processing	13	5	18
Other services	0	20	20
Transportation and trade	6	7	13
Total	40	61	101

[1]Additional economic output includes the business activity needed to produce the supporting goods and services for export

Source: Compiled from Economic Research Service data

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ASSIGNMENT SHEET #1--CALCULATE NET PRICE FOR GRASS SEED SOLD

Name ____ Score_________________________________

Determine the net price you will receive for selling 25% of your total bluegrass seed crop to the local warehouse. You have a total of 281,728 lbs of seed that has been in the local warehouse for 4 months. You have decided to sell at today's price of $.54/lb. The following charges will be deducted from your check for the percentage of crop you are selling.

Hauling--$.01/lb

Cleaning--$.12/lb

Storage and insurance--$.20/cwt/month

Bags--$612.24

Idaho Commodity Indemnity Fund--$41.08

Green Gem Grass Association Dues--$99.44

Calculate the total amount that you will receive for this sale and the net price per pound (after deductions). Show all your work.

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ANSWERS TO ASSIGNMENT SHEET

Assignment Sheet #1

281,728 lbs x 25% = 70,432 lbs sold

70,432 lbs x $.54 = $38,033.28

Less deductions:

Hauling: 70,432 x .01 = $704.32

Cleaning: 70,432 x .12 = $8,451.84

Storage and insurance: 704 cwt x .20 x 4 = $563.20

Bags: $612.24

Idaho Commodity Indemnity Fund: $41.08

Green Gem Grass Association Dues: $99.44

Total deductions: $10,472.12

	38,033.28
	- 10,472.12
Amount received:	$ 27,561.16

Net price per pound: $\frac{27{,}561.16}{70{,}432} = \$.39/\text{lb}$

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UNIT TEST

Name ______________________________________ Score________________________________

1. Match terms associated with crop marketing and exporting to the correct definitions. Write the correct numbers in the blanks.

_____a. Activity involved in buying or selling a product

_____b. Final buyer or user of product

_____c. Difference between cash price and futures price

_____d. To bring commodities into one country from another

_____e. Promise to deliver or accept delivery of a specific grade of commodity at a specified time, place and price

_____f. Agricultural product

_____g. Place at which an exchange of commodities occurs between a buyer and a seller

_____h. A system of taxes placed by a government on imports

_____i. A contract entered into for protection of an investment

_____j. A contract to deliver or accept delivery of a specified quantity and grade of a commodity at a specific future month

_____k. Difference between the amount consumers pay for the final product and the amount producers receive

_____l. To send commodities from one country to another for purpose of sale

_____m. Principle in economics which states that the quantity of an economic good purchased will vary inversely with its price

_____n. An agreement to sell a specified quantity of a product for a specified price and at a specified time in the future

_____o. An exchange where futures contracts for commodities are bought and sold

1. Market
2. Marketing
3. Cooperative marketing
4. Consumer
5. Forward contract
6. Futures contract
7. Futures market
8. Contract
9. Basis
10. Commission
11. Hedge
12. Speculate
13. Marketing margin
14. Law of demand
15. Commodity
16. Export
17. Import
18. Tariff

_____p. Attempt to make a profit by predicting what the market will do and buying or selling based on that prediction

_____q. Process whereby farmers pool their crops for shipment to market to increase bargaining power

_____r. A fee given to an agent in exchange for a service, usually a service provided in selling a product

2. Distinguish between supply (S) and demand (D) by placing the correct letters in the blanks provided.

_____a. Schedule of different quantities of a commodity that buyers will purchase at different prices at a given time and place

_____b. Schedule of different quantities of a commodity that will be offered for sale at different prices at a given time and place

3. Select from the following list factors that distinguish between supply and demand curves. Write an "X" in the blank before each correct answer.

_____a. Demand curve always slopes upward

_____b. Supply curve always slopes upward

_____c. Demand curve always slopes downward

_____d. Supply curve always slopes downward

4. Select from the following list factors causing shifts in demand of a commodity. Write an "X" in the blank before each correct answer.

_____a. Expectations of sellers

_____b. Cost of product

_____c. Population increase or decrease

_____d. Expectations of buyers

_____e. Changes in taste and preferences of consumers

_____f. Difference in income and purchasing power

5. List and describe two of the four types of markets.

a.____

____

____

b. ____

____

____

6. Name three standard and grade acts that have affected the crops market.

a.____

b. ____

c.____

7. Select from the following list factors that influence time to market. Write an "X" in the blank before each correct answer.

_____a. Price at harvest time

_____b. Futures

_____c. Price at planting time

_____d. Cost of storage

_____e. Cost of fertilizer

_____f. Carry-over

_____g. Storage facilities

_____h. Shipping cost

8. List three sources for marketing crops.

a.____

b. ____

c.____

9. Match the classes of elevators to the correct descriptions. Write the correct numbers in the blanks.

_____a.	Elevator operated by grain dealers or merchants who buy grain for storage and later sell to millers and processors or exports	1. Terminal
_____b.	Elevator operated and owned from a central headquarters or chain	2. Independent
_____c.	Elevator owned cooperatively by farmers of the area	3. Cooperative
_____d.	Elevator operated and controlled by individuals within the community	4. Line

10. List five job opportunities in crop marketing.

a.____

b. ____

c.____

d. ____

e.____

11. List three functions of product standards.

a.____

b. ____

c.____

12. Select from the following lists factors affecting grades of grain, hay, fruit and vegetables.

Grain

_____a. Maturity at harvest

_____b. Moisture content

_____c. Bruises

_____d. Pest damage

_____e. Presence of foreign material

_____f. Size, color and shape of kernels

Hay

______a. Size and shape

______b. Color

______c. Protein content

______d. Sunscald

______e. Leafiness

______f. Maturity at harvest

Fruits and vegetables

______a. Proper size and shape

______b. Uniform, natural color

______c. Protein content

______d. Bruises

______e. Leafiness

______f. Sunscald

13. List four of the six basic marketing strategies that most farmers and ranchers use.

a.____

b. ____

c.____

d. ____

14. List four programs, services or regulatory functions of the USDA Agricultural Marketing Service.

a.____

b. ____

c.____

d. ____

15. Match the steps of marketing channel to the correct descriptions. Write the correct numbers in the blanks.

_____a.	Putting crop into usable form for consumer	1.	Assembling
_____b.	Storing of crop for future use or until a higher price can be obtained	2.	Grading
_____c.	Moving the crop to market	3.	Processing
_____d.	Bringing together crops for shipment	4.	Transporting
_____e.	Sorting the crop for uniform quality and size	5.	Storing
_____f.	Assuming risk until the crop has been sold or processed	6.	Financing
_____g.	Loaning as a form of credit to a farmer until the crop can be sold or processed	7.	Risk-taking

16. Discuss hedging as it relates to crop marketing.

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17. List three characteristics of the futures market.

a.____

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b. ____

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c.____

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18. Discuss the difference between hedging and speculation.

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19. List three advantages and one disadvantage of farmers' use of the futures market as a true hedge.

Advantages

a.____

b. ____

c.____

Disadvantage ____

20. Select from the following list ways of using the futures market. Write an "X" in the blank before each correct answer.

_____a. Speculate

_____b. Set price of product without taking immediate delivery

_____c. Fix price of grain in storage for deferred delivery

_____d. Increase sales

_____e. Price crop any time prior to harvest

_____f. Decide how many areas to plant

21. Name three leading grain futures markets.

a.____

b. ____

c.____

22. List six sources of crop market information.

a.____

b. ____

c.____

d. ____

e.____

f. ____

23. List four major U.S. agricultural export commodities.

a.____

b. ____

c.____

d. ____

24. Select from the following list statements describing U.S. agricultural exports. Write an "X" in the blank before each correct answer.

_____a. 45% of U.S. acres are farmed for export

_____b. U.S. agricultural exports generated one billion civilian jobs in 1989

_____c. U.S. is the world's largest exporter of agricultural products

_____d. One out of three U.S. acres is farmed for export

_____e. U.S. exports of high value agricultural products consisted of 51% of the farm trade from 1926-30

_____f. U.S. agricultural exports generated 1.06 million full time civilian jobs in 1989

_____g. Each dollar earned from agricultural exports stimulates another $2.51 of output in the U.S. economy _____h. U.S. agricultural exports consist mostly of crops and their products

_____i. Each dollar earned from agricultural exports stimulates another $1.52 of output in the U.S. economy

25. Discuss U.S. agricultural imports.

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ANSWERS TO TEST

1.

a.	2	g.	1	m.	14
b.	4	h.	18	n.	5
c.	9	i.	11	o.	7
d.	17	j.	6	p.	12
e.	8	k.	13	q.	3
f.	15	l.	16	r.	10

2. a. D b. S

3. b, c

4. b, c, d, e, f

5. Answer should include two of the following:

   Direct purchase--Product is obtained directly from the farmer by the processing plant or by the consumer
   Central or terminal market--Products are shipped to a common location where products and buyers are brought together
   Auction--Products are brought together by farmers where they are sold through competitive, verbal bidding
   Cooperative markets--Farmers band together to combine their products and market them collectively

6. Answer should include three of the following:

   Agricultural Marketing Act; Grain Standards Act; Standard Containers Act; Agricultural Adjustment Act; Pure Food and Drug Act

7. a, b, d, f, g

8. Direct to export; Home farm use; Local and/or terminal elevators

9. a. 1 b. 4 c. 3 d. 2

10. Answer should include five of the following:

    Elevator operator or manager; Elevator employee; Seed grader or tester; Broker; Processing foreman or manager; Insurance representative; Truck driver

11. Eliminate abuse in market; Provide foundation for market system; Protect farmer, buyer and consumer

12. Grain: a, b, d, e, f
    Hay: b, c, e, f
    Fruits & vegetables: a, b, d, f

13. Answer should include four of the following:

    Buy and sell at current cash prices; Buy and store or store and sell; Deliver and defer price; Forward contract (fix the price before delivery); Hedge (fix the price with a futures contract); Sell (buy) on the cash market and speculate in the futures market

14. Answer should include four of the following:

    Food Purchasing; Government Food Quality Assurance Program; Grade Standards; Grading and Acceptance Services; Market News Service; Market Research and Development; Commodity Research and Promotion Programs; Fair Trade Practices; Marketing Agreements and Orders; Egg Products Inspection and Shell Egg Surveillance

15.

a.	3	e.	2
b.	5	f.	7
c.	4	g.	6
d.	1		

16. Answer could include the following information:

    Hedging--The process of shifting the risk from prices which change in either direction; Note: Hedging is distinct from speculation in commodity futures; the speculator seeks to make money from price changes; the hedger seeks to avoid losing money from adverse price changes. Thus, the hedger minimizes price risk; the speculator assumes that risk. Confusion between hedging and speculation in commodity futures contracts is widespread. Some people think that losing money on the futures side of a hedge is a waste. Rather, it should be considered an insurance premium. The purpose of hedging is to break even, to avoid a loss, not to make money on the hedge

17. Answer should include three of the following characteristics:

    Enables a producer to guarantee a price for a product; Insures against downward prices movement, but also prevents gains from an upward price movement; Involves a promise to deliver or receive a commodity at some specified date in the future for a specified price; Products are not usually delivered--offsetting contracts are simply bought or sold to cancel the original contract; Prices for the futures market are determined through highly competitive bidding; Trading is accomplished through a broker who has the legal right to represent his clients; Contracts may be bought and sold at any time; A margin or percentage of the contract is used to guarantee the broker that the person buying or selling a futures contract will be able to pay for losses which might incur

18. **Hedging**--A person who hedges owns the product or is prepared to accept delivery of the product and is trading on the futures market to protect against an unfavorable price movement; **Speculating**--A person who speculates does not own the product and attempts to make money by anticipating the rise and fall of the market; the speculator assumes the risk the hedger is trying to avoid

19. Answer should include three advantages and one disadvantage:

    Advantages: Forces farmers to closely monitor crop prices; Nullifies the effect of price increases and decreases; Protects against decline of value of farmer's inventory; Offers a means of stabilizing profit margins; Gives farmers the flexibility of management action;
    Disadvantages: Forces farmers to closely monitor crop prices (time consuming); More paperwork; Cash outlay required

20. a, b, c, e

21. Chicago; Minneapolis; Kansas City

22. Answer should include six of the following:

    Radio and television stations; Newspapers; U.S. Department of Agriculture; Magazines; Local elevators or markets; Feed stores; U.S. Department of Commerce; University Extension Service reports; State Department of Agriculture reports; Subscription services

23. Answer should include four of the following:

    Grain and cereal preparation; Corn; Wheat and wheat flour; Soybeans; Meat and meat preparations; Tobacco; Cotton

24. c, d, f, h, i

25. Answer should include information from the following:

    U.S. consumers spent more than $6.5 billion on noncompetitive imported commodities (Noncompetitive commodities are those which cannot be produced profitably in the U.S., such as coffee and cocoa); U.S. consumers spent $15.6 billion on competitive imports (Competitive commodities compete directly with U.S. products and include meat, dairy products, fruits, nuts, vegetables, sugar and wine)