University of Idaho
College of Agricultural and Life Sciences

ANNUAL CEREAL FORAGE PRODUCTION

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BARLEY AGRONOMY PROGRAM MISSION

Provide research and Extension programming on sustainable irrigated and dryland barley production strategies with an emphasis on nutrient management for yield, end-use quality, plant health, and soil and water quality.

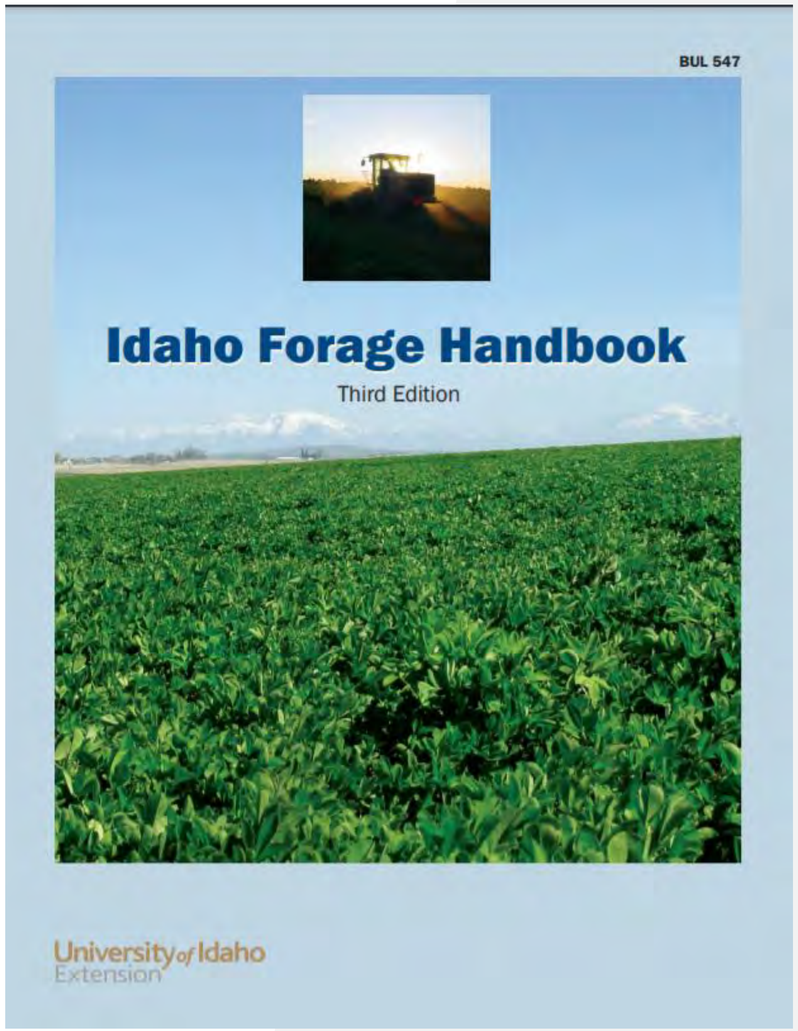
Malt, Feed, Food, Forage

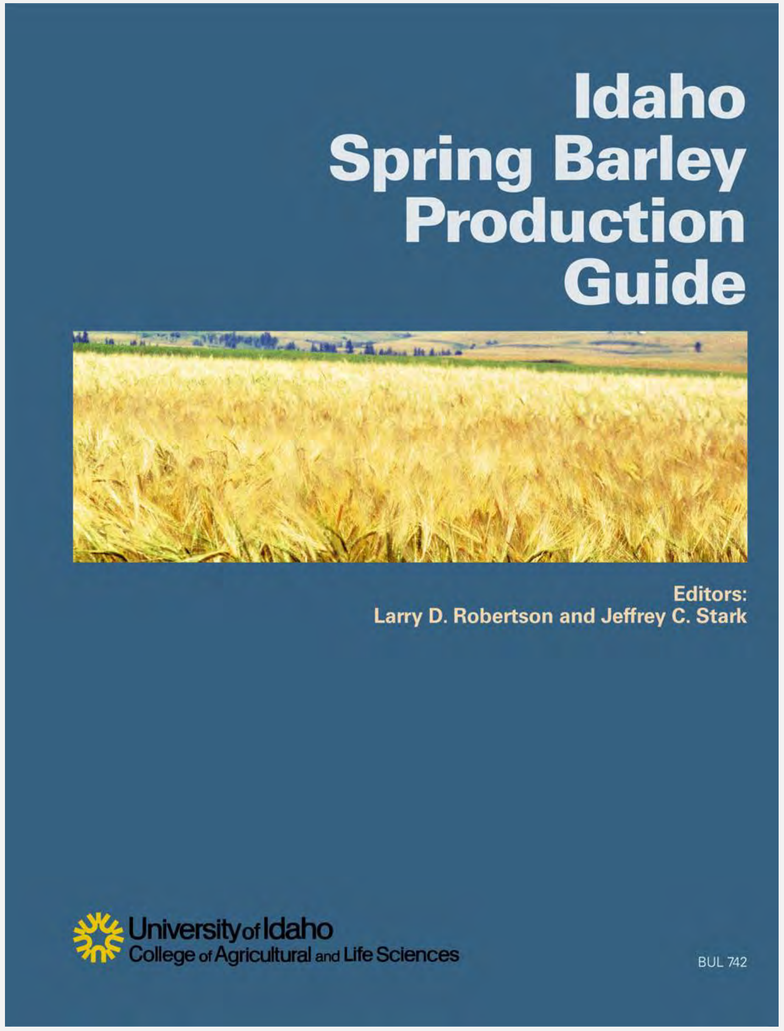
Photo Credit: Jared Spackman

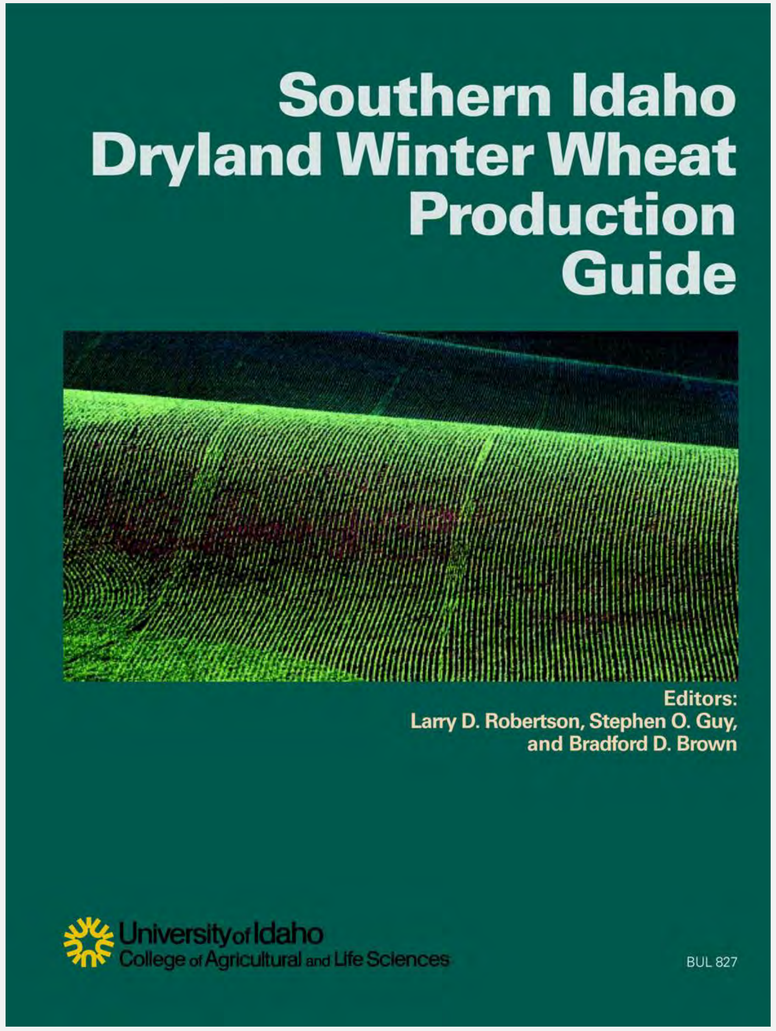
OVERVIEW

- Current Studies
  - Small Grain Grower Survey
  - Acidic Soils of Southern Idaho
  - Nitrogen Rate by Variety
  - Cutting Timing by Variety
    - Bulk Density
    - Irrigation Water

GOAL: UPDATE BARLEY AND WHEAT PRODUCTION GUIDES







Complete Small Grain Management Survey for $30 Gift Card

Seeding rate
Plant growth regulators
Irrigation
Crop Rotation
Nutrient management
Soil and Tissue sampling
Precision Agriculture/Crop Sensing
Weed, Pest and Disease
Management

University of Idaho Extension

IDAHO BARLEY COMMISSION

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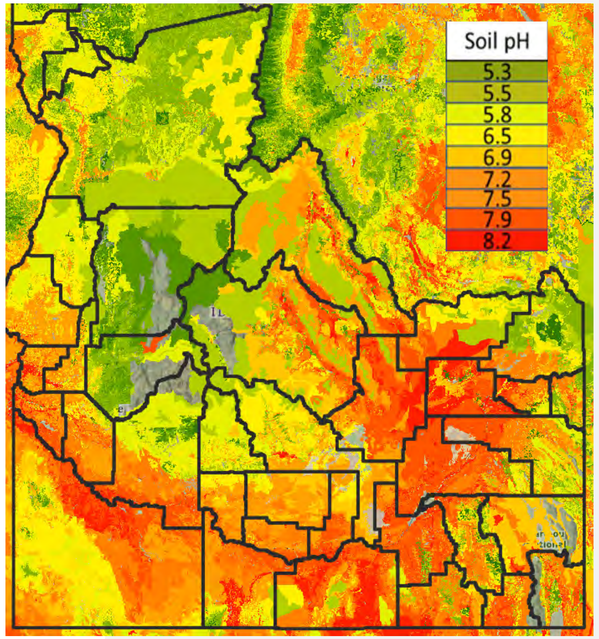
Developing Calibrated Lime Recommendations for Southern Idaho



Aluminum toxicity symptoms

Normal root tip

Deformed root tip

IDAHO WHEAT

SPRING ANNUAL FORAGE STUDIES

OBJECTIVE 1:

Determine the timing of cutting that optimizes yield and quality for multiple cutting events for barley and oats.

OBJECTIVE 2:

Determine the optimal fertilizer N rate to optimize forage barley and oat quality and yield.

University of Idaho Extension

Collaborators: Jacob Bevan
Joseph Sagers
Reed Findlay
Greg Blaser

STUDY LOCATIONS

	Aberdeen	Rexburg	*Blackfoot*
Soil	Declo Loam	Ririe Silt Loam	
Elevation (ft)	4403	4878	*4498*
Mean annual precip. (in)	8 – 12	12 – 15	*11.5*
Mean annual air temp. (F)	45 – 55	43 – 46	*47*
Frost free period	100 – 140	80 – 100	*100*
Previous crop	Mechanical Fallow	Spring Wheat	

FORAGE BARLEY VARIETIES

Photo Courtesty: https://bigskyseeds.net/wp-content/uploads/2014/09/Haybet-Forage-Barley-heads.jpg

Haybet

ARS – Montana State University

Betzes/Strip Tease (1987)

2-row hooded spring hay barley

Awnless (beardless)

Similar to Horsford

Photo courtesy: https://hearneseed.com/hayes-beardless-barley/

Hays

Montana State University

Haybet/Baronese (2003)

2-row hooded spring hay barley

Awnless (beardless)

Photo Courtesy: https://greatbasinseeds.com/product/lavina-barley/

Lavina

Montana State University

Haybet/Baronese (2007)

2-row hooded spring hay barle

Awnless (beardless)

FORAGE OAT VARIETIES

Photo Courtesy: https://greatbasinseeds.com/product/otana-oats/

Otana

Montana-Idaho (1976)

CI5345/Zanster

Tall

Susc. BYDV, stem rust

Photo Courtesy: https://greatbasinseeds.com/product/monida-oats/

Monida

Idaho-Montana (1984)

Otana/Cayuse

Medium Tall

Susc. Crown rust, stem rust

Photo Courtesy: https://circlesseeds.com/project/oats-products/

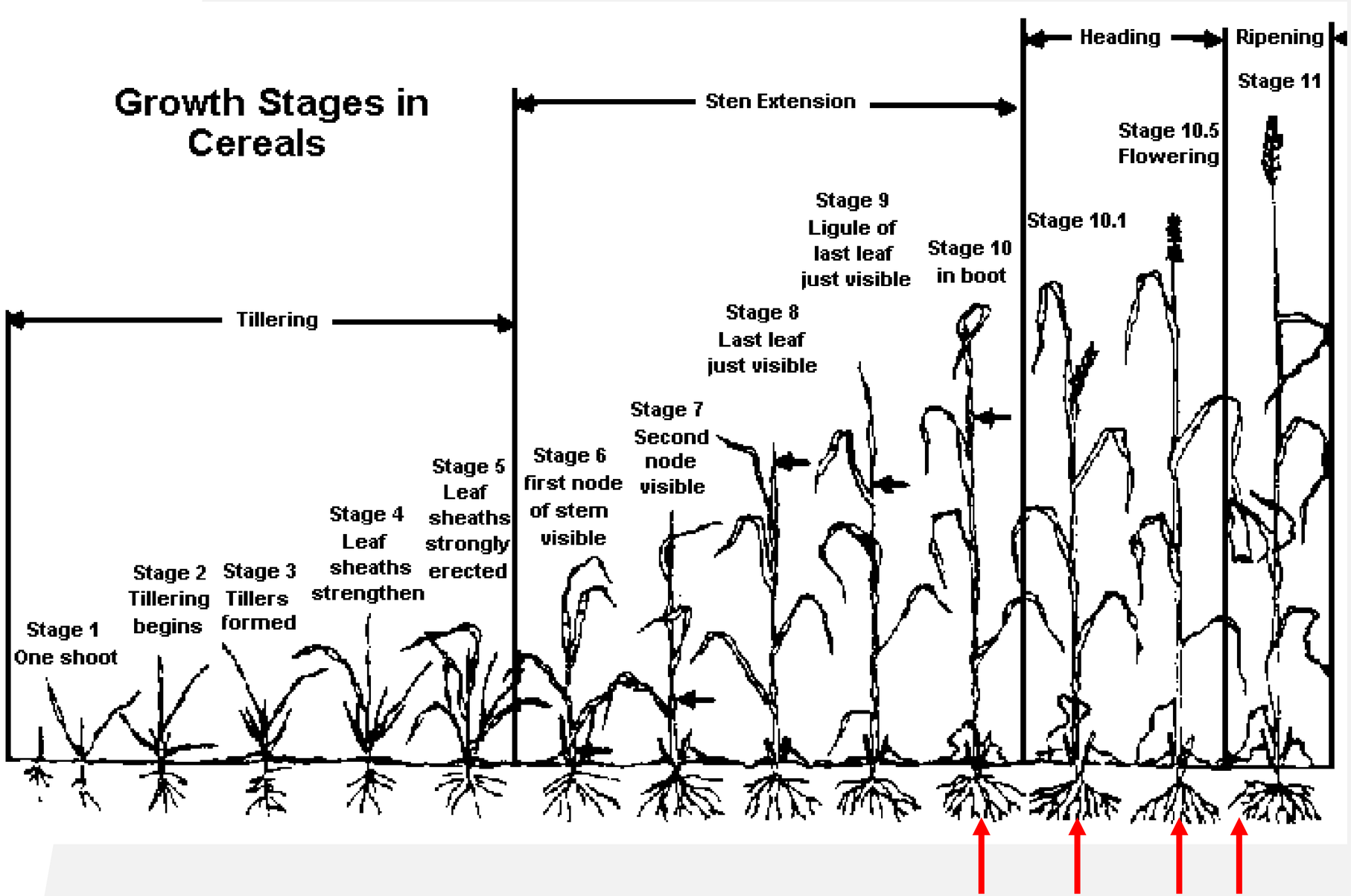
Ajay

Idaho AES (1991)

74Ab1952/74Ab2608

Short

CUTTING TIMING STUDY



60 lb N/ac as urea at planting

NITROGEN RATE STUDY

N Rate (lb/ac)
0
35
70
105
140

1.1 million seeds/ac

Initial Soil Test Results at Aberdeen

SOIL TEST DATA	Sample 1		12-24	24-36
Ammonium - N, ppm	3.2	VL	2.0	2.0
Nitrate - N, ppm	10	L	7	6
Phosphorus, ppm	15	M	10	5
Potassium, ppm	201	M	161	140
Calcium, meq/100g	8.6	M	9.6	12.0
Magnesium, meq/100g	2.3	M	3.1	4.3
Sulfate - S, ppm	4	VL	9	15

ppm= mg/L for solutions

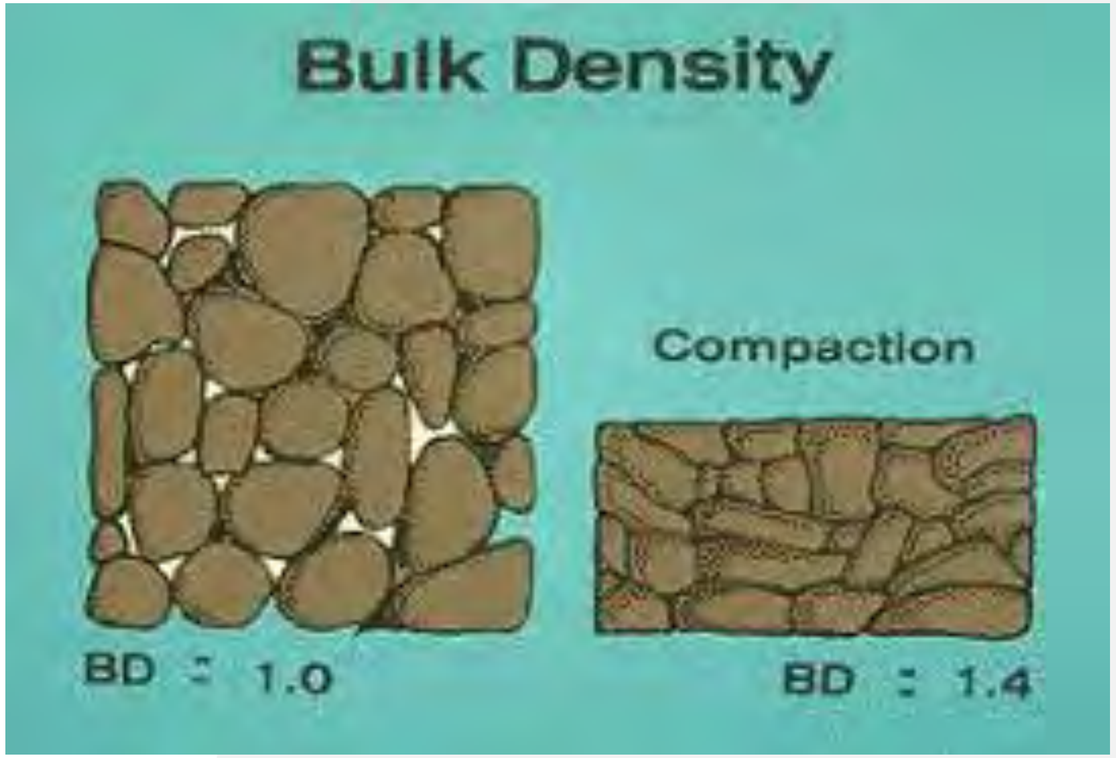
ppm= g/m^3

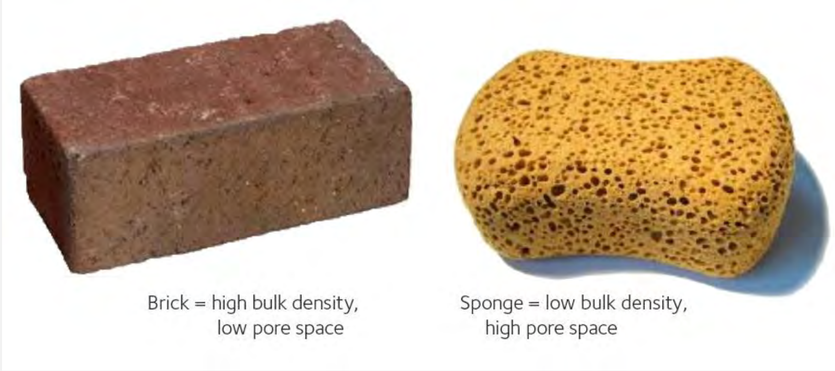
ppm= mg/Kg for soil

To Convert ppm to lb/ac

1) Area
2) Bulk density
3) Depth

Bulk Density Affects Available Nutrient Calculations





$$\text{Bulk Density} = \frac{Dry\ weight\ of\ soil}{Volume\ of\ soil}$$

Bulk Density Affects Available Nutrient Calculations

$$\frac{1\ mg\ NO_3-N}{1\ kg\ soil}\times\frac{1\ lb\ NO_3-N}{453592\ mg\ NO_3-N}\times\frac{1350\ kg\ soil}{1\ m^3}\times\frac{4046.86\ m^2}{1\ ac}\times 0.3\ m = 3.6\ \frac{lb\ NO_3-N}{ac}$$

Reported soil test value in ppm or mg/kg

Conversion factor of mg to lb

Assumed bulk density of the soil

Surface area converted from m^2 to acres

Soil sampling depth

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Magnesium, meq/100g	2.3	M	3.1	4.3
Sulfate - S, ppm	4	VL	9	15

Lb N/ac using a bulk density value of 1.35 Mg/m3			
0-12”	12-24”	24-36”	**0-36”**
11.5	7.2	7.2	**25.9**
36	25.2	21.6	**82.8**
			108.7

Initial Soil Test Results at Aberdeen

SOIL TEST DATA	Sample 1		12-24	24-36
Ammonium - N, ppm	3.2	VL	2.0	2.0
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Potassium, ppm	201	M	161	140
Calcium, meq/100g	8.6	M	9.6	12.0
Magnesium, meq/100g	2.3	M	3.1	
Sulfate - S, ppm	4	VL	9	

Lb N/ac using a bulk density value of 1.35 Mg/m3			
0-12”	12-24”	24-36”	**0-36”**
11.5	7.2	7.2	**25.9**
36	25.2	21.6	**82.8**
			108.7

	Lb N/ac using the measured bulk density			
	0-12”	12-24”	24-36”	**0-36”**
Bulk Density Mg/m^3	**1.72**	**1.75**	**1.75**	
NH_4-N	14.6	9.3	9.3	**33.2**
NO_3-N	45.9	32.7	28	**106.6**
				139.8

Initial Soil Test Results at Rexburg

Ammonium - N, ppm	**3.2**	VL	**2.6**
Nitrate - N, ppm	**5**	VL	**8**
Phosphorus, ppm	**34**	H	**12**
Potassium, ppm	**199**	M	**121**
Calcium, meq/100g	**10.2**	H	**10.2**
Magnesium, meq/100g	**1.6**	L	**1.9**
Sulfate - S, ppm	**5**	L	**6**

	Lb N/ac using the measured bulk density		
	0-12”	12-24”	**0-24”**
Bulk Density Mg/m^3	**1.6**	**1.72**	
NH_4-N	13.7	11.9	**25.6**
NO_3-N	21.3	36.7	**58**
			83.6

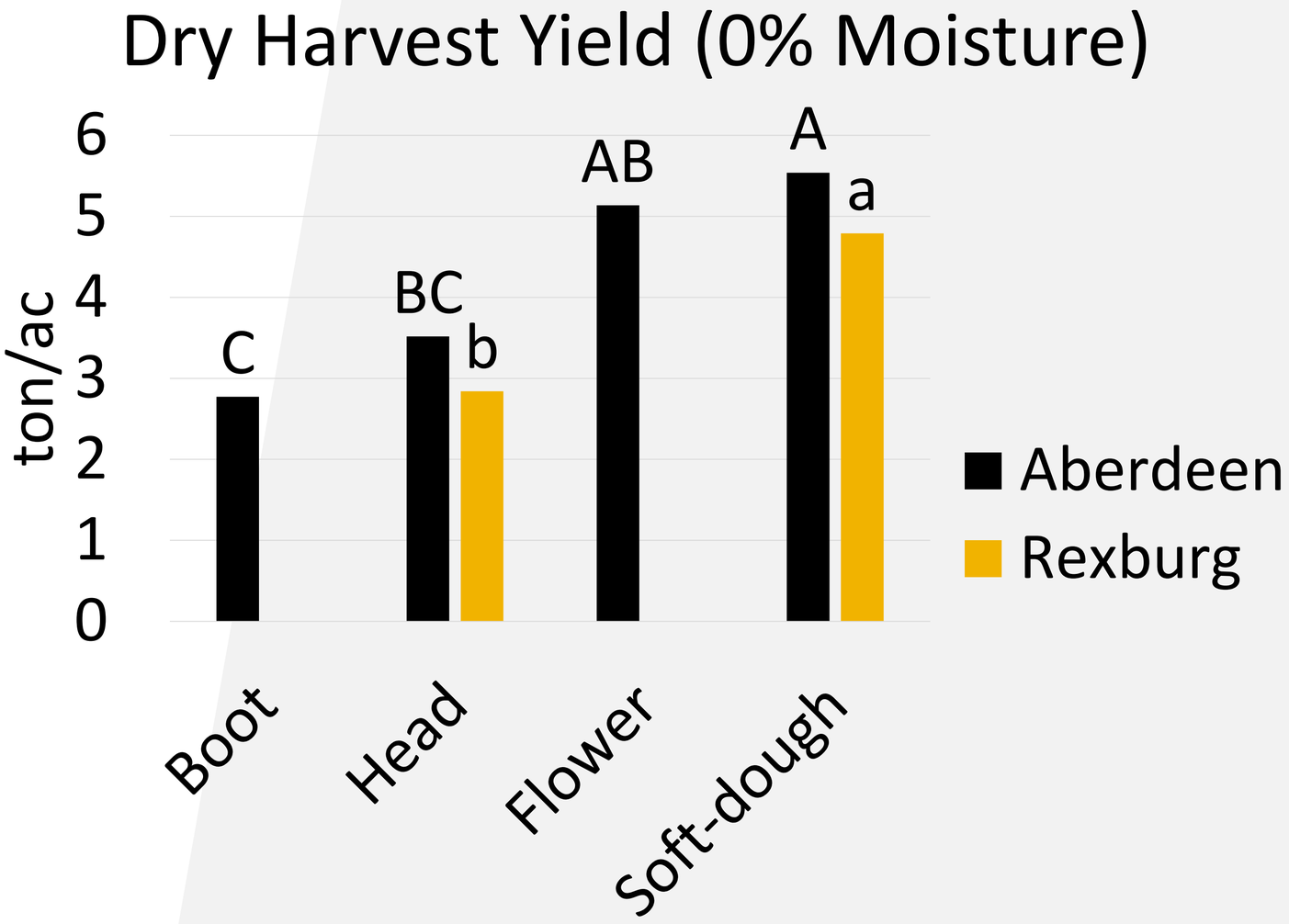
Season Average Irrigation Water Nutrient Content

	Aberdeen
	Lb/acre foot
pH	8.1
Sulfate-Sulfur	70.0
Calcium	119.4
Magnesium	64.2
Sodium	98.7
Nitrate-Nitrogen	15.4
Potassium	16.1
Phosphorus	0.1
Boron	0.3

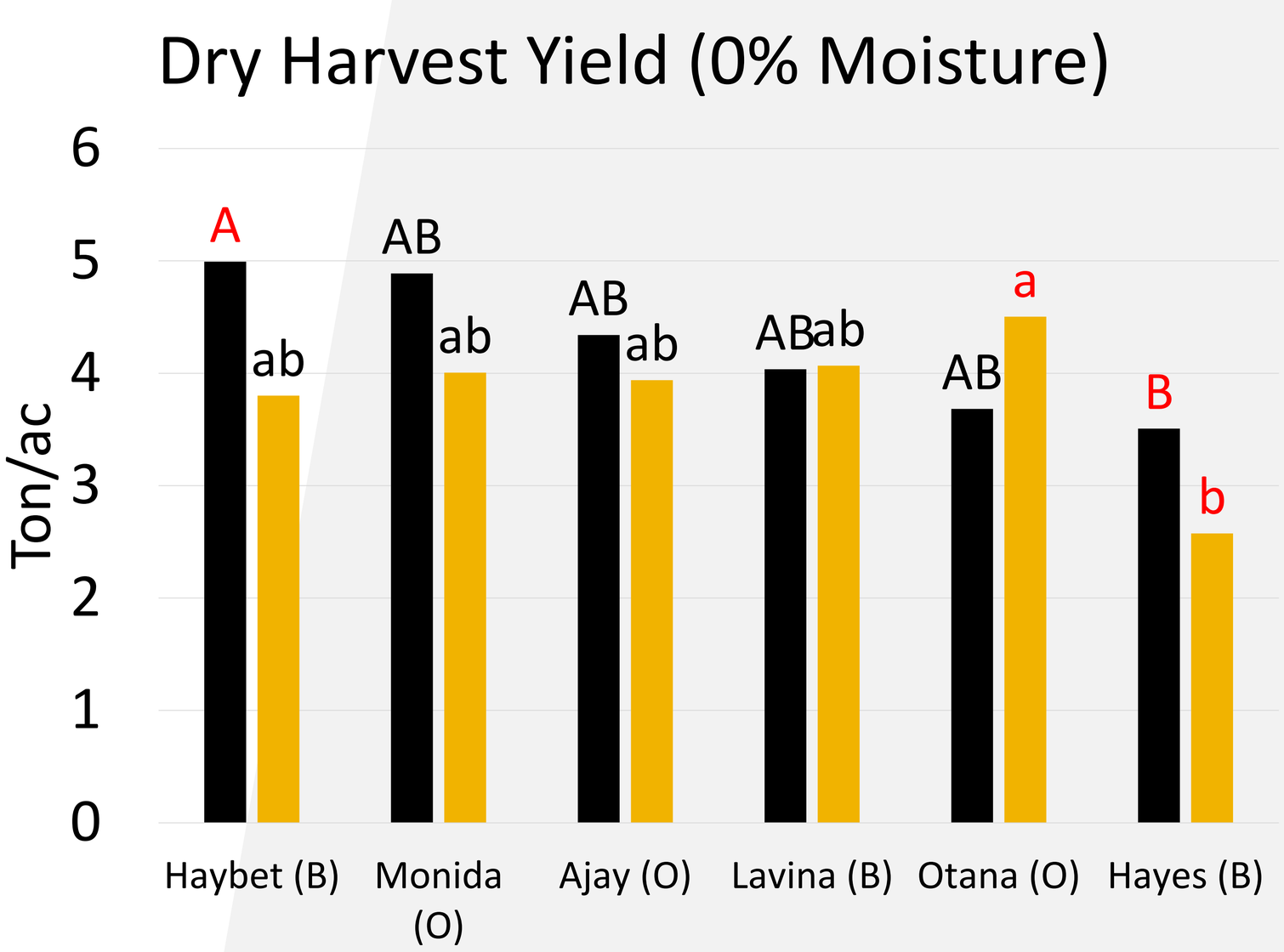
YIELD – CUTTING TIMING

Dry Harvest Yield (0% moisture) P>F		
	Aberdeen	Rexburg†
Cut Time (C)	0.0055	0.0049
Variety (V)	0.0202	0.0309
C*V	0.0585	0.2958
†Only heading and soft-dough		

YIELD – CUTTING TIMING



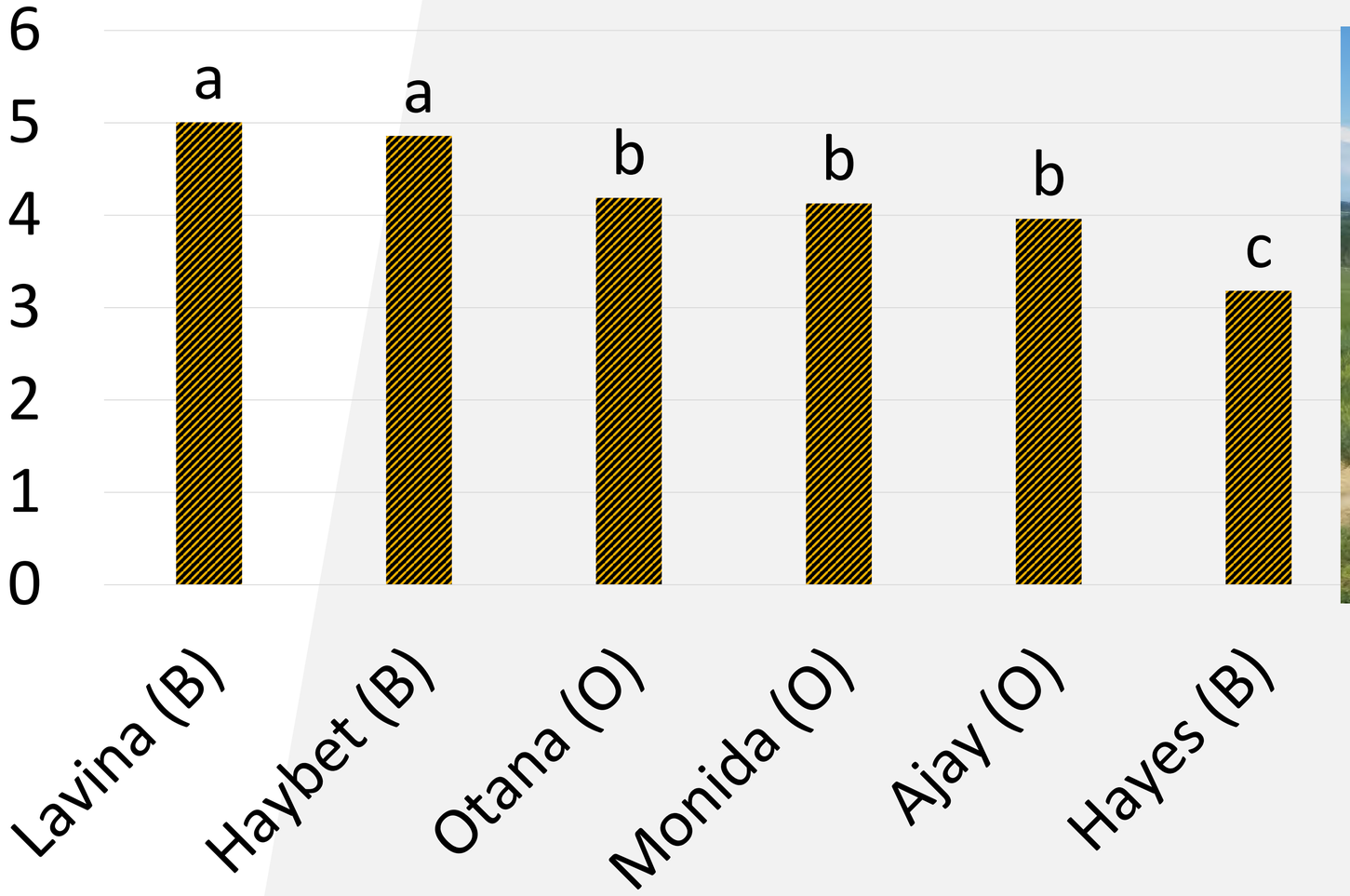
YIELD – CUTTING TIMING



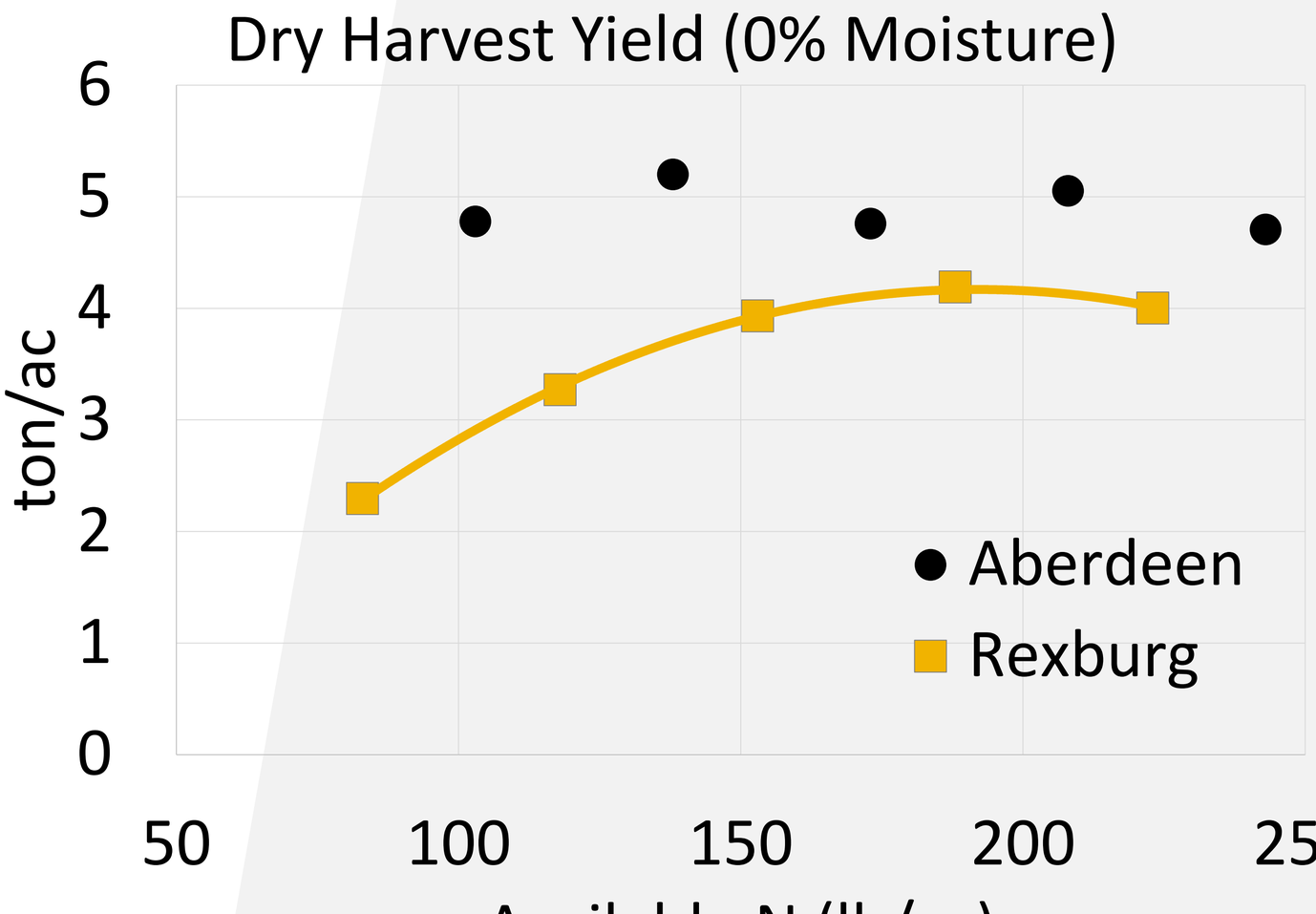
YIELD – N RATE

Dry Harvest Yield (0% moisture) P>F	
N rate	0.0007
Location	0.0119
Variety	<0.0119
Location*Nrate	0.0009
Nrate*variety	0.2492
Location*Nrate *Variety	0.0638

YIELD – N RATE


Dry Harvest Yield (0% Moisture)
6
5
4
3
2
1
0
a
a
b
b
b
c
Lavina (B)
Haybet (B)
Otana (O)
Monida (O)
Ajay (O)
Hayes (B)

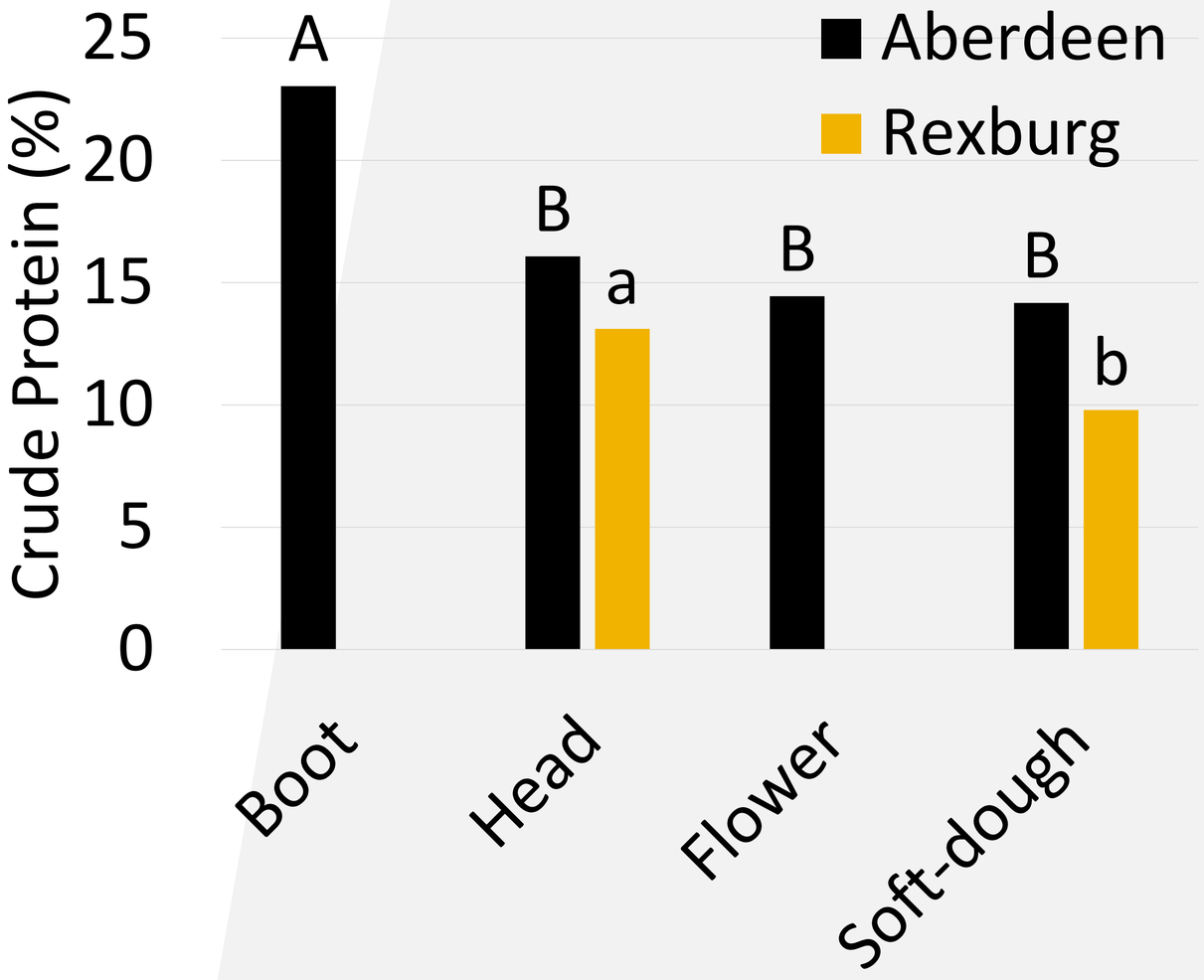
YIELD – N RATE

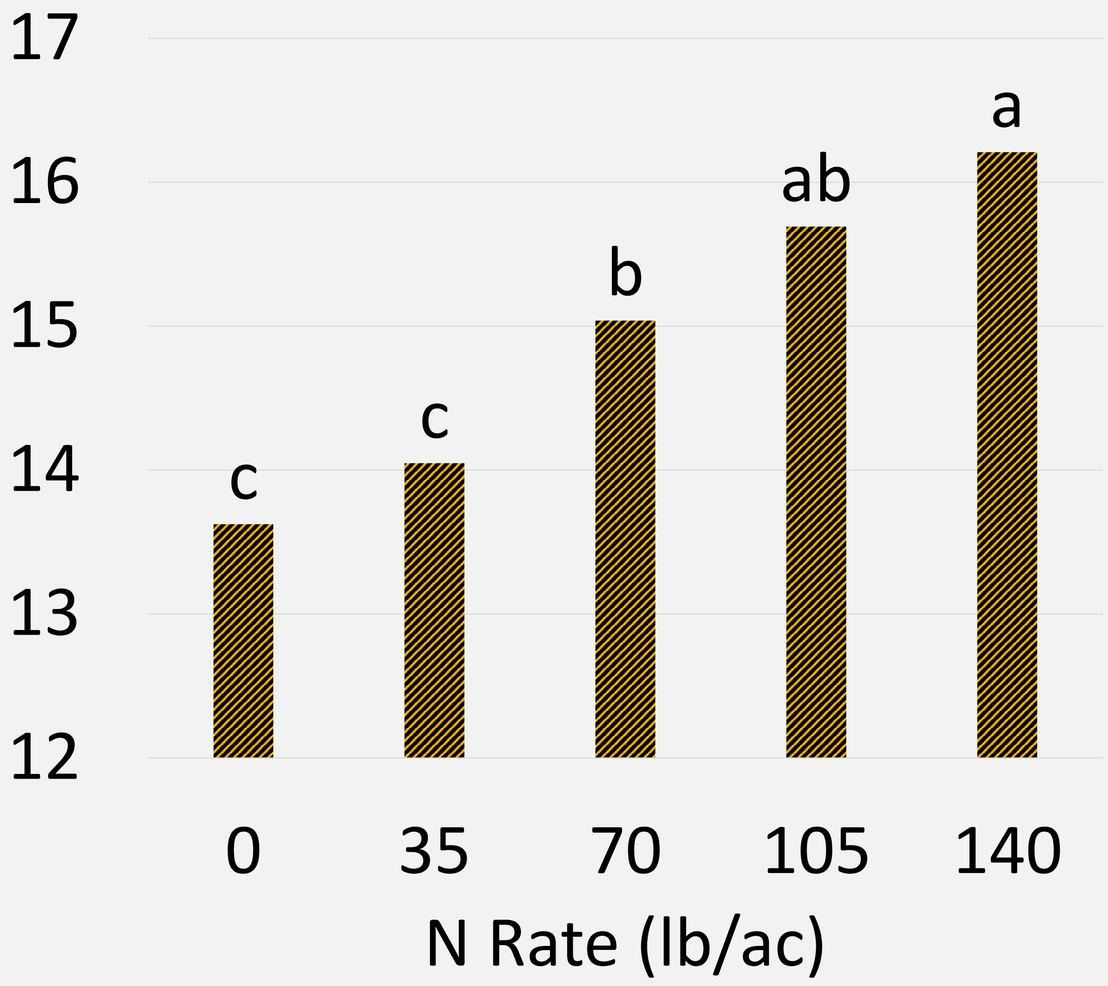

Dry Harvest Yield (0% Moisture)
ton/ac
0
1
2
3
4
5
6
50
100
150
200
250
Available N (lb/ac)
(Fertilizer N + Residual soil N 0-2')
Aberdeen
Rexburg

CRUDE PROTEIN

	Crude Protein (0% moisture) P>F	
	Aberdeen	Rexburg†
Cut Time (C)	<0.001	0.0067
Variety (V)	0.6893	0.6017
C*V	0.1989	0.3706
†Only heading and soft-dough		

CRUDE PROTEIN





CRUDE PROTEIN

Class	% CP
Pregnant cow, midgestation	7.0
Pregnant cow, last 3rd gestation	7.9
Lactating cow, 1st 90 days	9.6
Heifers, midgestation	9.1
Heifers, last 3rd gestation	9.1
Lactating heifers, 1st 90 days	10.9

National Research Council's nutrient requirements for beef cattle, cows and first-calf heifers require certain percentages of crude protein (CP) and TDN in their diets (Table 1).

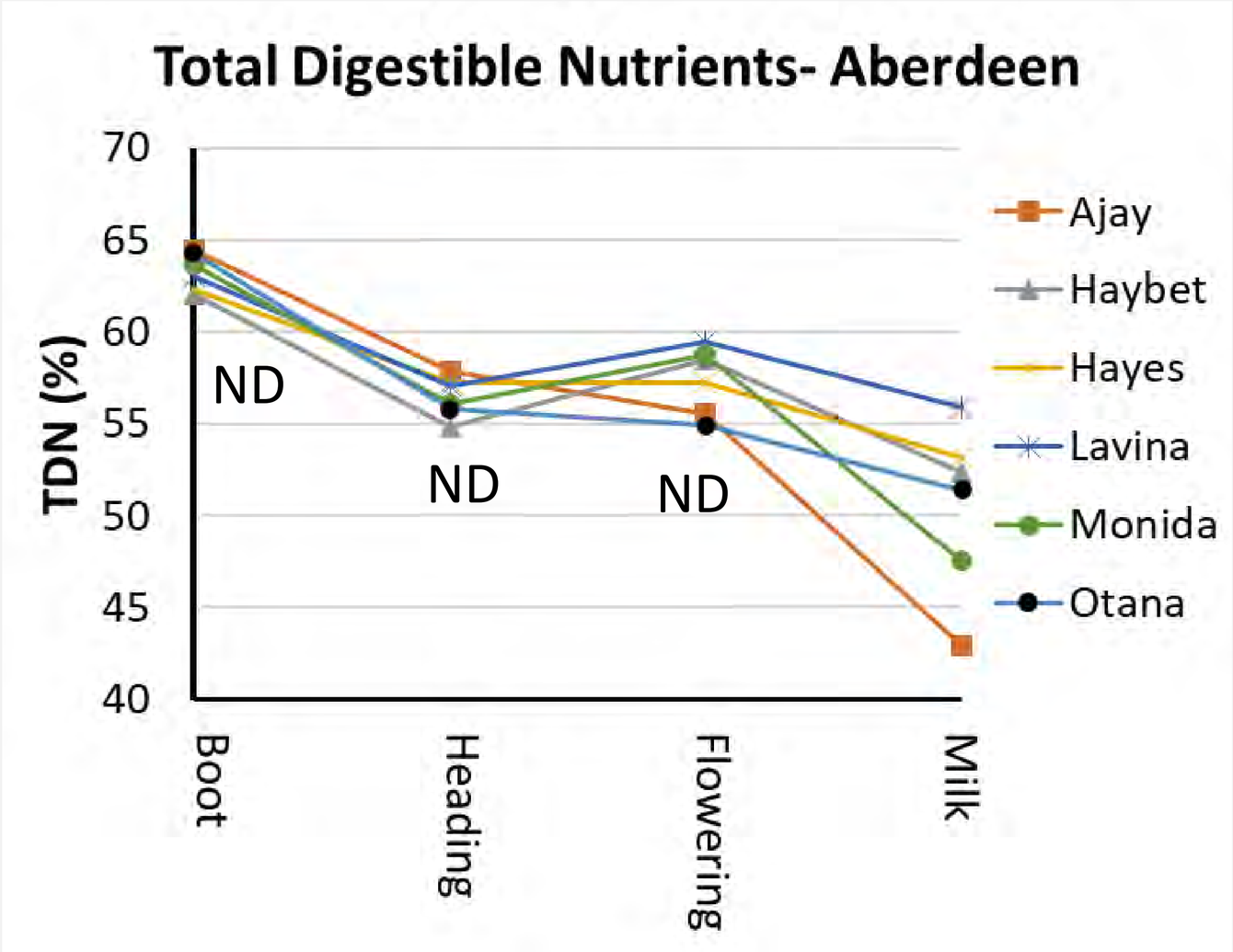
Crude protein was high enough to support each class of cattle nutrient requirements

BUL 1013. **Spring Annual Forage Hay Production in North-Central Idaho**
Doug Finkelnburg, James Church, Kenneth Hart

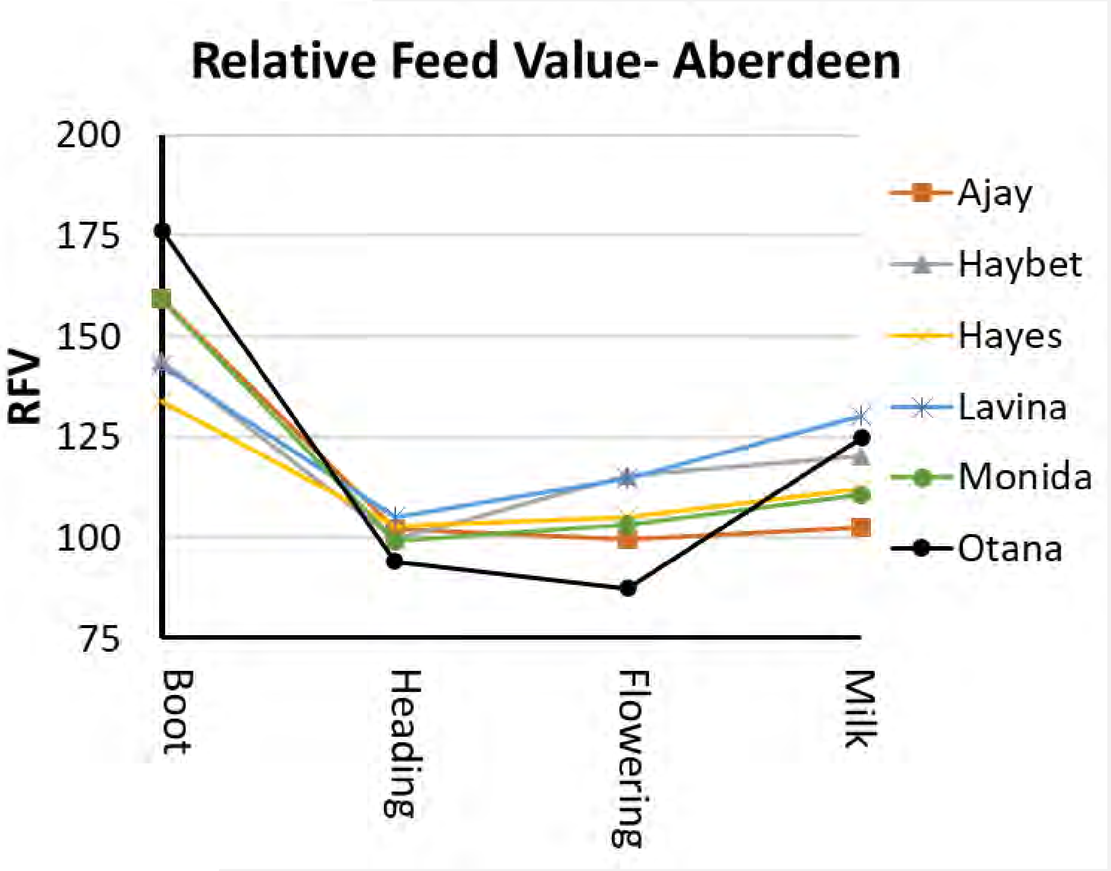
TOTAL DIGESTIBLE NUTRIENTS (TDN)

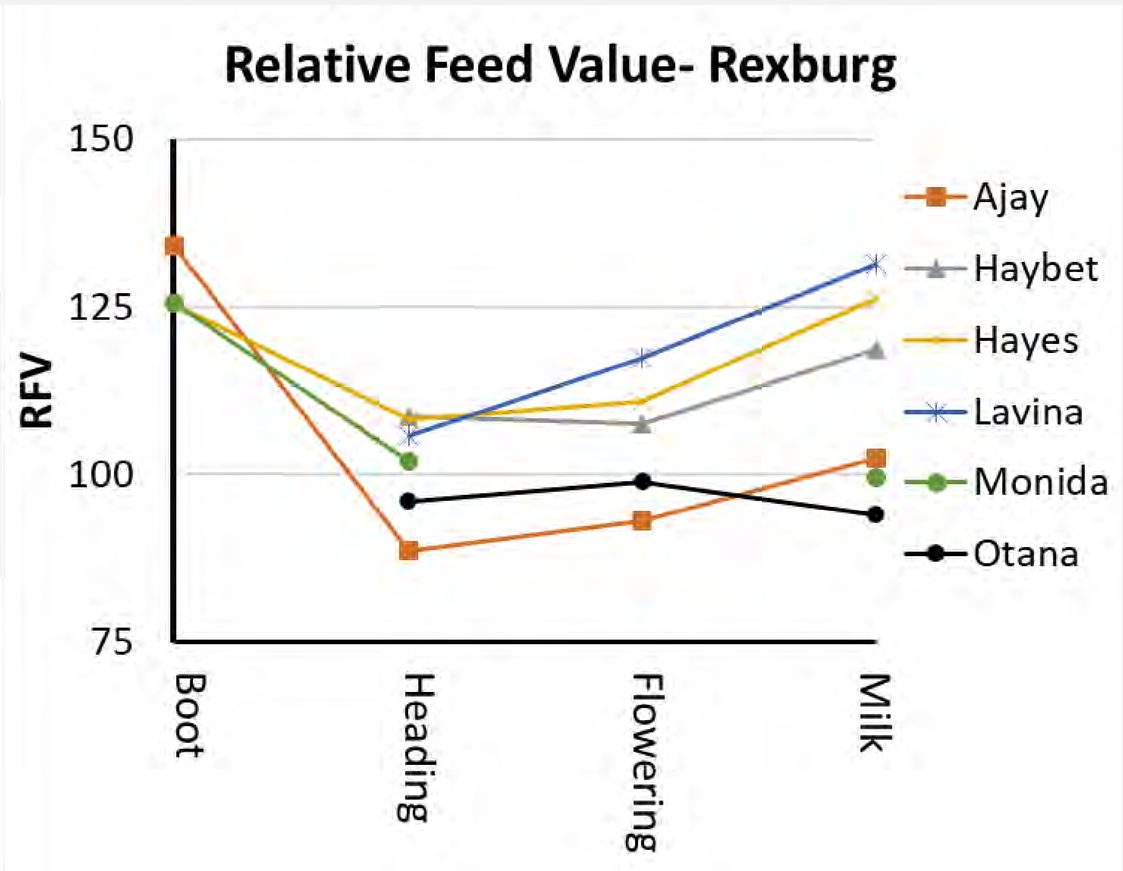
Class	% CP	% TDN
Pregnant cow, midgestation	7.0	49
Pregnant cow, last 3rd gestation	7.9	54
Lactating cow, 1st 90 days	9.6	57
Heifers, midgestation	9.1	56
Heifers, last 3rd gestation	9.1	59
Lactating heifers, 1st 90 days	10.9	63

Forage N	TDN (%)
Aberdeen	55
Rexburg	57



RELATIVE FEED VALUE (RFV) CUTTING TIMING

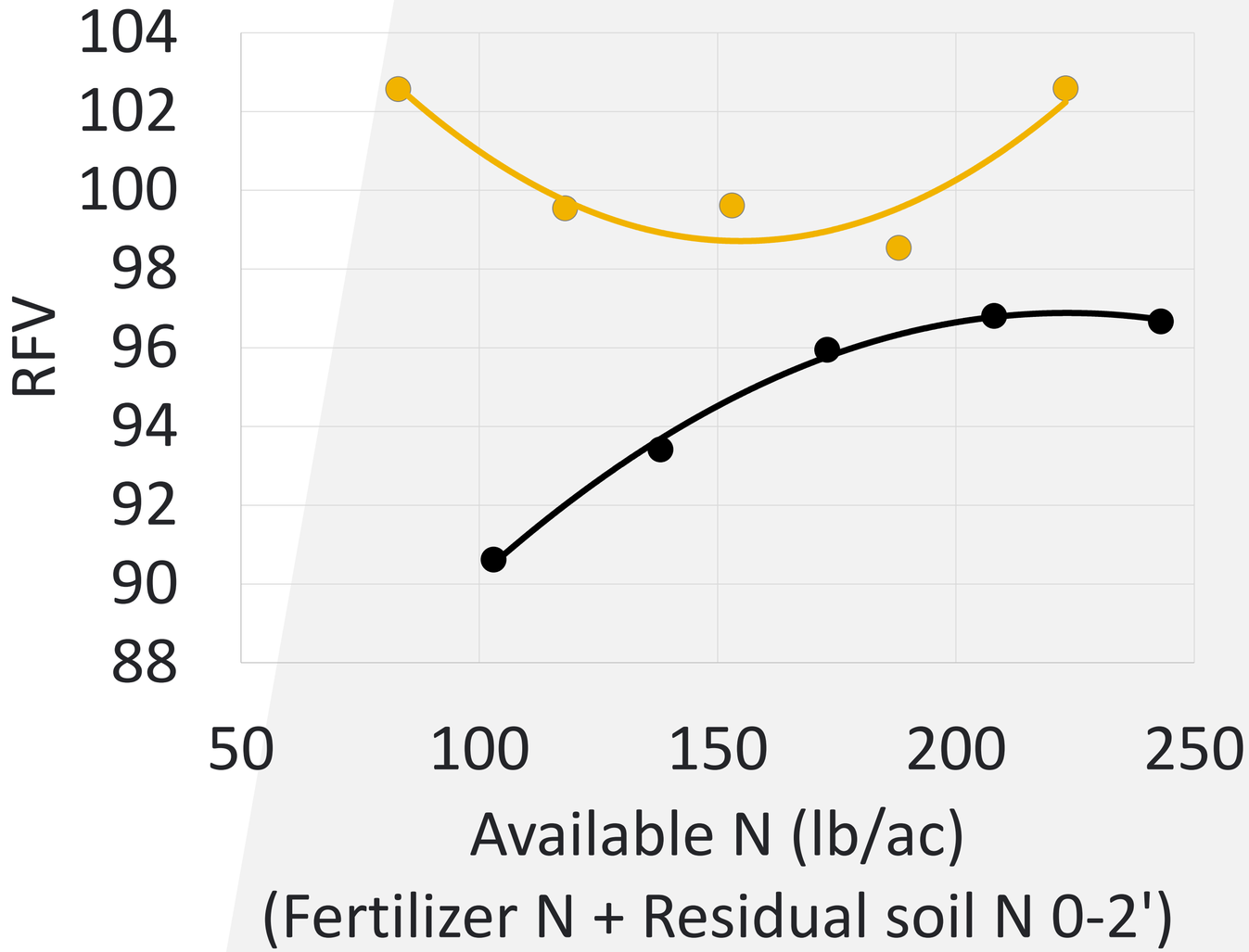


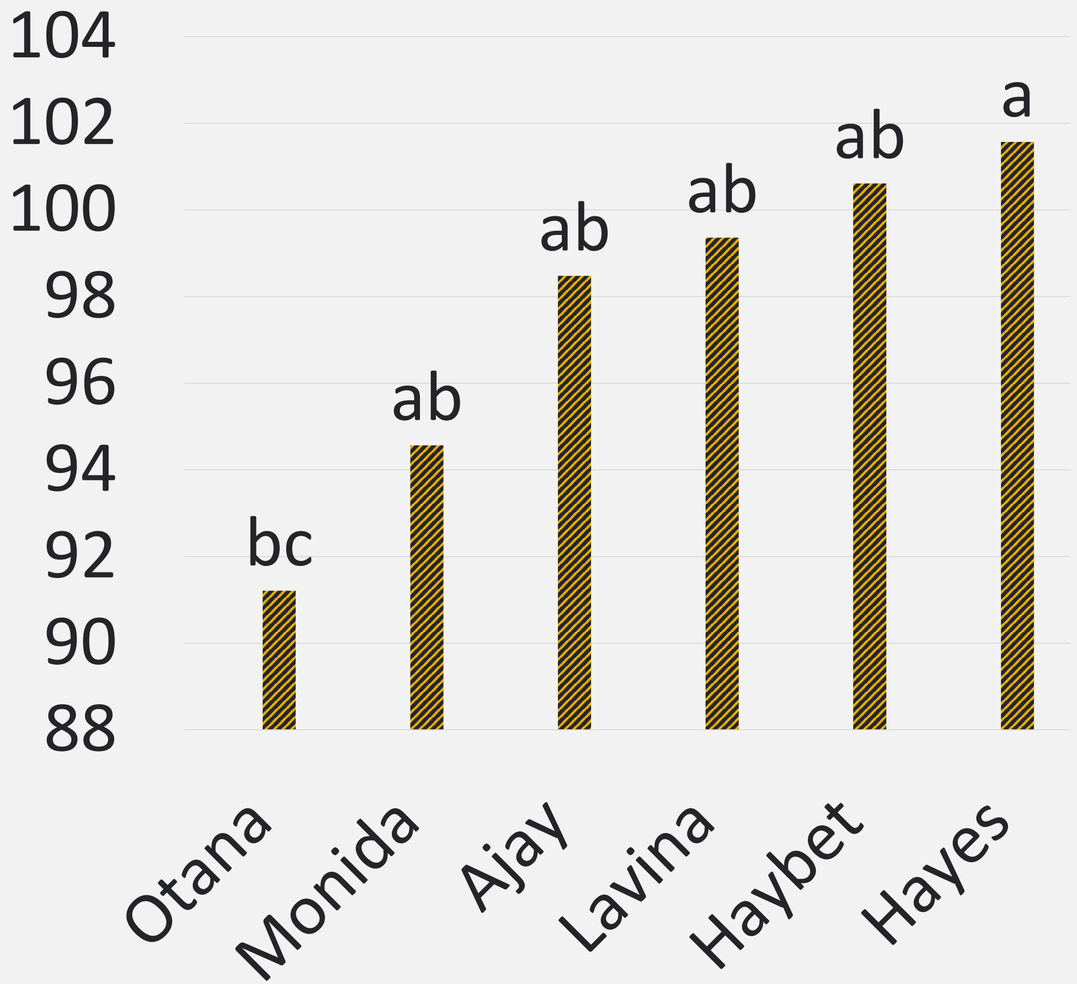


RFV=100 is equivalent to full bloom alfalfa

RFV 150 – 200 desirable for high quality lactating dairy cow forages.

RELATIVE FEED VALUE (RFV) FORAGE N





CRUDE PROTEIN- DOUG FINKLNBERG RESULTS

Table 2. Spring annual forage results from Idaho and Lewis Counties, ID.*

Entry	Forage Type	Yield Dry Ton/Acre	CP %	TDN** %	RFV***
Otana	Oats	3.17 a****	9.1 abc	55.9 de	90 cd
Proleaf 234	Oats	3.04 a	9.0 bc	55.0 e	87 d
Everleaf 114	Oats	2.85 ab	9.5 ab	57.6 abc	97 b
Proleaf 234/Flex	Oats/Pea	2.84 ab	9.8 a	57.7 abc	86 d
Everleaf 126	Oats	2.82 ab	9.1 bc	56.6 cd	94 bc
Stockford	Barley	2.53 bc	8.8 c	57.1 bc	106 a
NZA 4.14	Oats	2.49 bc	9.3 abc	58.1 ab	98 b
Stockford/Flex	Barley/Pea	2.40 c	9.1 bc	58.4 a	105 a
Average		2.77	9.2	57.1	95

*Trials ran between 2018 and 2020 (April and May plantings) at two locations and during five site-years, as conditions allowed. Entries were replicated at least three times per trial. Samples were run at Dairyland Labs using NIR and Wet Chemistry analysis.

**Total Digestible Nutrients

***Relative Feed Value

****Within-column means, followed by the same letters, are not different, according to a least significant difference test.

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FALL FORAGE STUDY AND FIELD DAYS

Variety	Cereal Type
Progas	Hybrid Rye
Aviator	Hybrid Rye
SH-05	Hybrid Rye
Evina	Wheat
Hoodie	Barley
Forerunner	Triticale

Forage Field Day

Aberdeen: May 19

Rexburg: May 20

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QUESTIONS?

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FUTURE IDEAS OF STUDY INVESTIGATING DUAL USE OF ANNUAL FORAGES FOR EITHER FORAGE OR GRAIN?

MIXING BARLEY WITH A LEGUME FOR HIGHER PROTEIN?

SPRING VS WINTER VARIETIES?

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- www.uidaho.edu/extension/teaching-evaluation