BUL 983

Potato Seed Certification and Selection in Idaho

K.M. Duellman
Assistant Professor, Extension Specialist (Seed Potato), University of Idaho

M.K. Thornton
Professor of Plant Sciences and Parma Research and Extension Center Chair, University of Idaho

A.A. Westra
Area Manager, Idaho Crop Improvement Association

This publication replaces CIS 974 (2000) by W.H. Bohl, P. Nolte, and M.K. Thornton

Contents

University of Idaho Extension

Introduction

THE SELECTION OF HIGH-QUALITY SEED POTATOES is essential to produce a profitable commercial potato crop. The best assurance to minimize risk of seed-related problems is to use only certified seed. This publication details the certification process for seed potatoes and describes the aspects of seed selection to consider before purchasing seed potatoes for commercial potato production.

Seed Potato Certification in Idaho

Certified Seed

Certified seed potatoes, by definition, are those that meet the standards of an official seed certification agency. In Idaho, seed potato certification is conducted by the Idaho Crop Improvement Association (ICIA). Seed potatoes that have been certified in Idaho are produced, inspected, and graded according to ICIA certification standards. These standards are available for inspection at https://www.idahocrop.com/standards.

The number of times a seed grower may replant seed potatoes to produce certified seed is restricted under what is called a "limited generation system." Idaho uses a "field year" (FY) system that indicates how many field generations a seed lot is removed from laboratory-grown, pathogen-tested parental stock. For example, FY1 is the first year a seed lot is planted in a field. Designations for the number of generations that seed has grown in the field differ among states (Table 1). It is important to check this table when purchasing seed to be sure you are getting the field year you want.

Additionally, each generation has fixed tolerances for factors such as the percentage of varietal mix or certain

Table 1. Field planting equivalency table for limited generation certified seed potatoes.[1] In Idaho, seed potatoes can be increased in the field no more than seven years. (Prepared by the Certification Section of the Potato Association of America, *Revision Date: 04/2019*)

Agency	Year in the Field[2,3]							
	1	2	3	4	5	6	7	8
Alaska	G1	G2	G3	G4	G5	G6	G7	G8
California	G1	G2	G3	G4	G5	----	----	----
Colorado	G1	G2	G3	G4	G5	G6	----	----
Idaho[6]	FY1	FY2	FY3	FY4	FY5	FY6	FY7	----
Maine[6]	FY1	FY2	FY3	FY4	FY5	----	----	----
Michigan[6]	FY1	FY2	FY3	FY4	FY5	FY6	----	----
Minnesota	G1	G2	G3	G4	G5	G6	C	----
Montana	N	G1	G2	G3	G4	G5	----	----
Nebraska/Wyoming	N	G1	G2	G3	G4	G5	----	----
Nevada	N	G1	G2	G3	G4	G5	----	----
New York[4]	(U)G1	(U)G2	(U)G3	G4	G5	G6	----	----
North Dakota	N	G1	G2	G3	G4	G5	C	----
Oregon	N	G1	G2	G3	G4	G5	----	----
Utah	N(G1)	G2	G3	G4	G5	G6	----	----
Washington	N	G1	G2	G3	G4	G5	----	----
Wisconsin[5]	FY1	FY2	FY3	FY4	FY5	FY6	C	----
Canada	PE	E1	E2	E3	E4	F	C	----

[1]The purpose of this table is to express equivalency of terms used by various certification agencies for seed potatoes harvested from a series of successive field plantings. For specific criteria relating to disease tolerances and other requirements, refer to the certification regulations of the agency in question. In Idaho, seed can be increased no more than seven years in the field.

[2]The first field planting utilizes laboratory-tested stocks which may be tissue-cultured plantlets, greenhouse-produced minitubers, stem cuttings, or line selections. Contact agencies for details as to the types of stocks planted in their programs.

[3]Terms used by agency for seed potatoes for a particular year in the field: C = certified, E = elite, F = foundation, G = generation, N = nuclear, PE = pre-elite.

[4]If lots originate at Cornell-Uihlein Farm, the first three generations (G1–G3) are also designated by a (U) to denote source.

[5,6]FY = Foundation Year (Wisconsin), FY = Field Year (Idaho, Maine, Michigan).

diseases which, if exceeded, results in a seed lot being downgraded to a higher field year number (Table 2). Commercial growers most commonly purchase FY4–FY7 seed. Seed potatoes classified as FY1–FY3 are typically sold to other seed growers for further increase as certified seed.

Certification Process

The Idaho seed potato certification program is a process that consists of a series of sequential steps, each of which must be successfully met for final certification to occur. These steps include the use of approved planting stocks, field inspections, storage inspections before and after harvest, postharvest testing, and a grade inspection at the shipping point. Seed lots failing to meet ICIA certification standards at any point in this process are downgraded (by class and/or grade) or rejected, as appropriate.

Planting Stocks

Growers wishing to produce certified seed potatoes either start with parental stock from the laboratory (not common), greenhouse-produced minitubers, or certified seed purchased from other seed growers, which as mentioned, is typically FY1–FY3. The certification process is initiated by submitting an

Table 2. Percentage of factors allowed during first and second (first/second) field inspections in Idaho.[1]

Factor[2]	Field Year					
	FY1	FY2	FY3	FY4	FY5	FY6/7
Varietal mixture	0.00/0.00	0.00/0.00	0.02/0.01	0.10/0.05	0.25/0.10	0.50/0.20
Well-defined mosaic	0.00/0.00	0.00/0.00	0.5/0.25	1.00/0.50	1.50/0.75	2.00/1.00
Potato leafroll	0.00/0.00	0.00/0.00	0.03/0.02	0.05/0.03	0.10/0.08	0.20/0.20
Blackleg[3]	0.00/0.00	0.10/0.10	0.50/0.50	1.00/1.00	2.00/2.00	--[4]
PVX	0.00/NA	0.50/NA	2.00/NA	NA/NA	NA/NA	NA/NA
Total virus[5]						2.00/1.00

[1]This table is adapted from the Idaho Crop Improvement Association Potato standard found online at https://www.idahocrop.com/standards. Field inspections of FY1 and FY2 seed lots are advisory and all factors are required to be rogued when found in order to maintain the tolerance of 0.00%.

[2]Factors evaluated during field inspections are based on visible symptoms. Some factors may be present in a seed potato lot and not exhibit symptom expression in plants or tubers at the time of a regular inspection.

[3]Determination of blackleg disease is based on a visual plant symptom of an inky black stem originating from the seed tuber.

[4]Visible blackleg has no tolerance in FY6 and FY7 and therefore is not a disqualification factor.

[5]Total virus is the combined percentage of potato leafroll, calico, well-defined mosaic, and all other viral viroid and phytoplasmas (including *Candidatus* Liberibacter). This does not include Potato Virus X (PVX).

"application for certification" that consists of a list of the seed lots being produced, documentation of the seed stocks used to plant these seed lots, and maps showing the location of the fields where these seed lots are planted. Physical isolation of seed lots from each other and from commercial potatoes during the growing season is required. The application is reviewed by ICIA to ensure that the planting stocks meet minimum requirements for recertification (that is, to be planted for further seed production). The maps are also reviewed for field cropping and disease history.

Field Inspections

The ICIA visually inspects seed fields a minimum of twice during the growing season; not uncommonly, more than two field inspections per year occur. Conformity with disease and varietal mixture tolerances (Table 2) is confirmed by estimating the percentage of factors observed in sequential plant counts (min. 200 plants per acre). In addition, when found during a field inspection, certain diseases, such as mosaic, leaf roll, and bacterial ring rot are confirmed by laboratory testing.

Storage Facilities

Storages are inspected by the ICIA before harvest to verify the location and cleanliness of each facility. Individual seed lots stored in the same facility must be properly separated. Growers are required to submit maps of their storages for ICIA and federal-state inspectors indicating the amount and placement of each seed lot in the facility. Any subsequent movement of seed potatoes must be to an approved facility and must be reported to ICIA.

Postharvest Inspection

During the growing season, certain diseases and disorders cannot be detected reliably during field inspections due to factors such as a lack of symptom expression of some diseases (under certain circumstances) or to events occurring after inspections have been conducted. As a result, seed growers are required to submit representative samples of each seed lot for postharvest testing. ICIA standards currently require postharvest testing for bacterial ring rot and selected viruses such as Potato virus Y (PVY). Postharvest testing for PVY is performed by planting a representative sample of tubers from each seed lot during the off-season (referred to as winter grow out) in a conducive location such as Hawaii. A leaf from every emerged plant is then collected and submitted to a laboratory for PVY testing. Plants produced during the winter grow out are also subject to inspection for other diseases and herbicide damage. For postharvest

testing of bacterial ring rot, a separate sample of tubers from each seed lot is laboratory tested.

Certification Completion

Seed lots that have passed all inspection and testing requirements described above are eligible to complete certification. The last step in the certification process is a federal-state inspection performed at the shipping point (as potatoes are about to be shipped from the seed storage facility) to verify that the seed lot meets Idaho seed potato grades. The grades, available at https://www.idahocrop.com/standards, are based on the US #1 seed potato grade and include tolerances for size, shape, and defects. Also included are tolerances for some specific diseases, including a zero tolerance for bacterial ring rot. Upon meeting this final requirement of Idaho seed potato grades, an official certification tag is affixed to the container. The final grade of the seed is indicated by the tag color, blue being the highest grade. **Seed that does not bear an official tag (or other official certificate) is not certified seed**.

Potato Seed Selection

One of the most important steps in deciding what seed to buy begins by developing a good relationship with a reputable seed potato grower. Insight into the quality of a prospective seed lot can be gained by visiting the seed grower's farm during the growing season to look at the overall operation as well as the individual field(s) where seed lots are being grown. A visit after harvest to observe the seed lot in storage can also be quite informative.

Equipment and Storage Facilities

Seed-handling equipment should be clean and in good repair. The area around the storage facility should be free of cull piles and other potato debris, which can be sources of disease.

The storage facility should also be in good repair to protect the seed potatoes from fluctuations in temperature, humidity, and light. Large fluctuations in storage conditions may lead to increased physiological aging and potentially decreased seed performance. Indications of physiologically aged seed may include seed pieces that produce more sprouts that emerge more quickly and produce more and smaller tubers than physiologically young seed that typically produces fewer stems and fewer, larger tubers. Proper ventilation and humidity are also important. Many seed producers have temperature-recording charts to keep accurate records of storage conditions. These records should be reviewed prior to purchase.

Sprouting and Mechanical Damage

Sprouted seed potatoes may suffer performance problems. Broken sprouts may produce excessive and weaker stems. Mechanical damage to the seed such as bruising is an indication of rough handling during harvest and transport, which can cause physiological aging and increased levels of disease.

Diseases

The presence of several important tuber-borne diseases can be determined by visual inspection and confirmed when needed by a simple test. Time spent performing these inspections and tests before the seed lot is purchased and planted may save the commercial and seed grower a lot of time and trouble after planting.

Fusarium Dry Rot

Severe infestations of Fusarium dry rot can be detected visually. Seed inspected at the shipping point containing more than 2% serious damage by dry- or moist-type Fusarium dry rot will not be certified. Dry rot lesions are fawn to dark chocolate brown, and the rotted tissue remains relatively firm. As lesions age, the tissues assume a dry, corky appearance and may contain areas that are yellow, pink, or orange (Figure 1). Seed lots without severe visual symptoms may still have the potential to develop this disease.

However, dry rot potential can be determined by a simple "bag test." Randomly select 40–60 tubers from the seed lot in question. Cut 20–30 of them with a clean, sharp, disinfested knife, making seed pieces similar in size as those made by your seed cutter. Place the cut seed pieces in a large paper bag (like the bags from a grocery store), fold the top of the paper sack over, and shake vigorously for one minute. Place the paper bag inside a large plastic trash bag, then fold over the trash bag's top without sealing it (some air must be able to enter the plastic bag). Keep the plastic bag at approximately 68°F for 3–4 weeks. Cut the remaining 20–30 tubers in the same manner,

Figure 1. Tuber with severe Fusarium dry rot. Cavities often form where the decayed tissue has assumed a dry, brown crumbly appearance. Orange, white, yellow, or pink fungal growth may be associated with the decayed tissue. Image courtesy Melinda A. Lent.

but after placing them in another paper bag, add the seed piece treatment you intend to use on the seed at planting. Once again, shake the bag vigorously for one minute, place the paper bag in the plastic trash bag, and store as described above. After the incubation period, examine the seed for Fusarium dry rot decay. If the nontreated seed pieces have the decay, check to see if the seed piece treatment prevented the growth of the pathogen on the treated seed pieces. Keep in mind that a seed piece treatment will not stop the growth of a preexisting Fusarium dry rot infection; it will only prevent the development of new infections on healthy seed pieces. The bag test can also help determine if your seed piece treatment will effectively protect against the strain of the pathogen in the seed lot you intend to purchase, since some isolates of the pathogen may be resistant or insensitive to a particular fungicide.

Soft Rot

Soft rot is caused by several species of pectolytic bacteria in the genera *Pectobacterium* (formerly *Erwinia caratovora*) and *Dickeya* (formerly *Pectobacterium chrysanthemi* and *Erwinia chrysanthemi*). Rotted areas of infected tubers are cream to dark tan, sometimes having a distinct, dark border between healthy and infected tissue (Figure 2). In the absence of secondary rotting organisms, soft rot has no odor; however, a foul

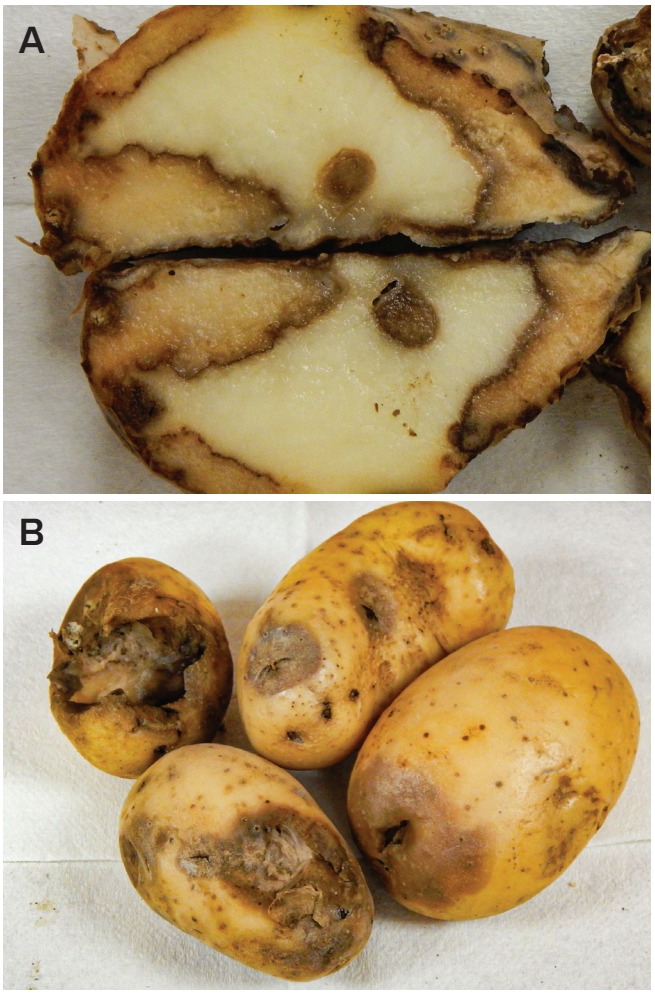

Figure 2. Soft rot. **A**, Rotted tissues are cream to dark tan, often (but not always) with a distinct, dark border between healthy and infected tissues. **B**, On the outside of the tuber, the soft rot areas can appear dark and water soaked. A foul odor may develop as the pathogen and secondary invaders break down the tissue. Images courtesy Melinda A. Lent.

odor often accompanies advanced decay due to such secondary organisms. Rotted tissue is soft and mushy and can be easily rinsed away with water. Some soft rot may be found in most seed lots, but the level of infestation should not exceed 1 percent. More than this amount could be an indication of potential problems for seed piece decay or black leg if the seed were planted.

Rhizoctonia Canker and Black Scurf

Black scurf affects tubers and looks like soil that cannot be washed off (Figure 3). This black material is the survival structure (known as sclerotia) of the fungus *Rhizoctonia solani*. On seed potatoes, sclerotia of the pathogen should not cover more than 10% of

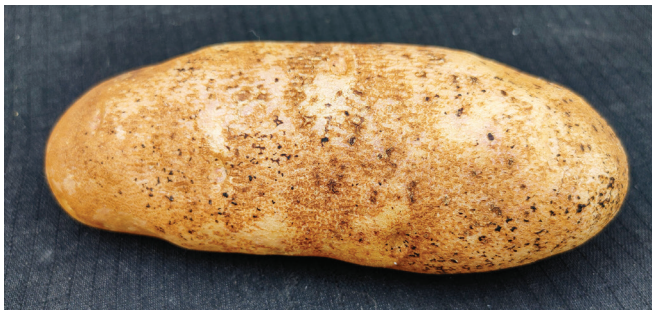

Figure 3. Black scurf. The dark brown to black spots on the surface of the tuber that look like soil particles that will not wash off are actually the survival structures (sclerotia) of the pathogen that causes black scurf. Image courtesy Kasia M. Duellman.

the tuber surface. Sclerotia are seldom responsible for more than cosmetic damage to the infected tuber but are a source of inoculum for the more damaging canker form of *Rhizoctonia*, which has the potential to cause significant losses in yield and quality. Rhizoctonia cankers may girdle and kill underground stems, sprouts, stolons, and roots, potentially resulting in poor stands, lower than expected stem or tuber numbers, or both.

Bacterial Ring Rot

Seed certification standards have a zero tolerance for bacterial ring rot caused by the organism *Clavibacter sepedonicus* (formerly *Clavibacter michiganensis* subsp. *sepedonicus* and *Corynebacterium sepedonicum*). In Idaho, if bacterial ring rot is found on a seed farm, none of the contact seed lots are eligible for recertification (though they can still be sold as certified seed to a commercial grower if the bacterial ring rot pathogen is not found in such contact seed lots). In this way, a seed potato grower conducts a mandatory complete flush out of all old seed. In addition, potatoes cannot be grown for seed production in the field(s) for two consecutive growing seasons after the bacterial ring rot disease or pathogen was confirmed.

The pathogen is readily moved from infected tubers to healthy ones via seed cutting equipment and pick-type planters. Advanced infections are characterized by cracking of the tuber skin (Figure 4). Less severe symptoms may be detected by cutting the stem end of at least 100 randomly selected tubers to look for internal vascular discoloration. Tubers with internal symptoms should be sent to a laboratory to confirm

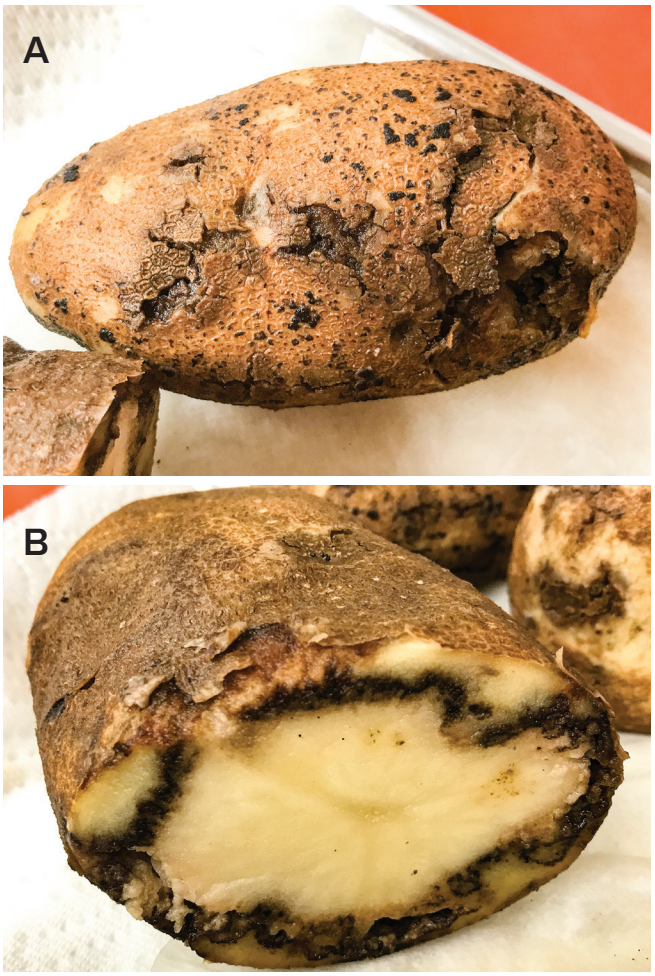

Figure 4. Bacterial ring rot. Advanced symptoms can include tuber cracking (**A**) and deteriorated, dark brown vascular tissue (**B**). Other diseases can exhibit similar symptoms, so a laboratory test is needed to confirm the cause. Images courtesy Kasia M. Duellman.

presence of the bacterial ring rot pathogen because not all tubers with vascular ring discoloration are infected with bacterial ring rot. Other factors, such as freezing, physiological responses to environmental stresses, and infection by certain fungi or viruses may cause vascular ring discoloration. This approach of cutting the stem ends of selected tubers can augment the intense screening efforts already in place for bacterial ring rot and the pathogen that causes it. The pathogen can also reside in potatoes without causing symptoms, in what is called latent infections. Because such latent infections are not readily detected with visual inspections, ICIA requires laboratory testing of representative samples to ensure a high probability that the seed lot is free of the pathogen.

Silver Scurf and Black Dot

Silver scurf is caused by the fungus *Helminthosporium solani* and black dot is caused by the fungus *Colletotrichum coccodes*. Symptoms of both diseases can look similar, often presenting as silver patches on the surface of the tuber (Figure 5). Silver scurf does not usually cause yield losses, but its presence may result in cosmetic defects, leading to reduced quality in fresh-packed potatoes. Transmission of the disease can occur through seed. Therefore, examination for silver scurf symptoms is recommended to decrease the likelihood of this disease becoming a problem in the commercial potato crop. Though black dot is typically considered a minor problem, it often occurs in conjunction with other diseases and the pathogen is implicated in the "early die" complex. Contaminated tubers can introduce the pathogen to a previously clean field.

Late Blight

Late blight is caused by the pathogen *Phytophthora infestans*. Symptoms on tubers can manifest as reddish-brown to copper granular lesions under the skin (Figure 6). Other symptoms associated with late blight include dark lenticels and irregularly sunken areas, varying from brown to purple, apparent on the tuber surface. If late blight has been reported in the area where seed potatoes were grown, it is important to determine whether the seed harbors the disease because infected seed tubers are one of the most important sources of late blight epidemics, along with cull piles and volunteer potato plants. Infected tubers effectively introduce inoculum into a production area that did not have the disease in the previous season.

For conventional growers, late blight can be successfully managed using fungicides. Some strains of the pathogen are resistant to metalaxyl/mefenoxam (a very effective fungicide against susceptible strains of the late blight pathogen) and this information may be available from laboratory tests if the pathogen was collected from the area and analyzed. However, for organic growers, there are few options for managing late blight. The spores of this highly destructive pathogen can be dispersed for several miles via wind and thunderstorms, and under some circumstances crop destruction may be the only solution for the organic grower to reduce risk of airborne dispersal to neighboring potato (and tomato) crops. Because late blight can move quickly across a region, it requires the entire community to be vigilant and responsive to keep it in check.

Figure 5. Silver scurf infection causes raised silvery patches on the tuber skin. Under conditions of high humidity and appropriate temperatures, the silver scurf pathogen can produce spores that can be blown to healthy potatoes in storage and cause new infections. Image courtesy Melinda A. Lent.

Figure 6. Late blight. Note the reddish-brown granular appearance of the lesion just under a thinly peeled section of tuber. Image courtesy Phillip S. Wharton.

Soilborne Viruses

Soilborne viruses such as Tobacco rattle virus and Potato mop top virus are becoming more prevalent across the United States. Tobacco rattle virus is moved from infected tubers to healthy plants by stubby root nematodes, while Potato mop top virus is vectored by the powdery scab pathogen (*Spongospora subterranea*). Symptoms can include internal defects such as spraing (dark arcs or streaks) or other necrotic lesions inside the tuber (Figure 7). Check for these symptoms by selecting a random sample of at least 100 tubers and cutting each tuber into quarters. If found, a laboratory test will be needed to confirm the cause, as there are other disorders and diseases that can cause internal brown lesions. Planting infected tubers in fields that also contain the vectors (stubby root nematodes for Tobacco rattle virus or *Spongospora subterranea* for Potato mop top) can lead to increased problems with tuber symptoms over time.

Figure 7. Soilborne viruses. Symptoms of necrotic arcs, also called spraing, due to Potato mop top virus. Image courtesy Melinda A. Lent.

Certification Records

Before making a final decision on a seed lot purchase, examine the seed certification records. Idaho seed certification records can be obtained from the grower. Examine the summer field inspection reports and results of the winter grow-out test (available in early February). Request a copy of the North American Certified Seed Potato Health Certificate from the seed grower, which includes documentation of field inspections and postharvest testing results. This certificate also documents the farm history of detections of bacterial ring rot and late blight.

Finally, a buyer should make sure the seed is tagged with the official certification tag (blue, green, or yellow) that has been placed after the shipping point grade inspection. "U.S. No. 1 Seed Potatoes" are indicated by a blue tag that contains the variety name, field year designation, weight, seal number, grower or shipper, certification number, inspector's name, and date of inspection (with buyer's name and truck/trailer license numbers as optional). Requirements and tolerances for each type of tag (blue, green, or yellow) are available at https://www.idahocrop.com/standards. Affix the tag to the trailer with a metal, tamper-proof seal that has "ICIA" and a serial number embossed on it. The tag is the best way to ensure a buyer is receiving the seed that was agreed to for purchase.

ALWAYS read and follow the instructions printed on the pesticide label. The pesticide recommendations in this UI publication do not substitute for instructions on the label. Pesticide laws and labels change frequently and may have changed since this publication was written. Some pesticides may have been withdrawn or had certain uses prohibited. Use pesticides with care. Do not use a pesticide unless the specific plant, animal, or other application site is specifically listed on the label. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

Trade Names—To simplify information, trade names have been used. No endorsement of named products is intended nor is criticism implied of similar products not mentioned.

Groundwater—To protect groundwater, when there is a choice of pesticides, the applicator should use the product least likely to leach.

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, Barbara Petty, Director of University of Idaho Extension, University of Idaho, Moscow, Idaho 83844. The University of Idaho has a policy of nondiscrimination on the basis of race, color, religion, national origin, sex, sexual orientation, gender identity/expression, age, disability or status as a Vietnam-era veteran.

UI PEER REVIEWED

BUL 983 | Published September 2022 | **© 2022 by the University of Idaho**