

TECHNICAL NOTES

US DEPT. OF AGRICULTURE
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NATURAL RESOURCES CONSERVATION SERVICE
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PLANT MATERIALS No. 29

READING SEED PACKAGING LABELS and CALCULATING SEED MIXTURES

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Reading Seed Packaging Labels and Calculating Seed Mixtures

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Introduction:

Certified seed is the progeny of seed that has been handled to maintain genetic identity and purity and has been approved by a certifying agency. Certified seed should be your first choice for any seeding project. If Certified seed is not available, then look for non-certified seed that meets certification standards for purity, germination, weed seed, and noxious weed seed. Be extremely careful in choosing a particular seed lot to ensure that it meets quality standards.

Seed lots vary widely in quality. The key to getting the best quality is to look at the information on the seed tag. Law requires that each lot offered for sale must be truthfully labeled. This applies to a single species or a mixture, certified or non-certified.

The Federal Seed Act and State Seed laws dictate the information found on the seed tag (Figure 1). All state certification agencies comply with the minimum requirements and standards of the Association of Official Seed Certification Agencies (AOSCA). Additional information can vary slightly from state to state. If the seed is Certified, it will also have a certification tag (Figure 4) which establishes that the seed meets standards set out for each class of seed.

Species		Acc. No.	
Common Name		Year Grown	
Weight		Origin	
Purity	%	Germination	%
Other Crop Seeds	%	Hard Seeds	%
		Total Germination	
Inert Matter	%	and Hard Seeds	%
Weed Seeds	%	Date of Test	
Noxious Weed Seed			
This seed was produced, collected or purchased by the U. S. Government for use in conservation plantings ABERDEEN PLANT MATERIALS CENTER, SOIL CONSERVATION SERVICE U. S. Dept. of Agriculture, Aberdeen, Idaho			

Figure 1: Example of a seed tag used at the USDA – Natural Resources Conservation Service, Plant Materials Center, Aberdeen, Idaho.

INFORMATION FOUND ON A SEED TAG

- 1) Variety and kind (Species and Common name)
- 2) Lot number
- 3) Origin
- 4) Net weight
- 5) Percent pure seed
- 6) Percent germination (and date of test)
- 7) Percent inert matter
- 8) Percent other crop seed
- 9) Percent weed seeds
- 10) Name of restricted noxious seed (number per pound of seed)
- 11) **Prohibited noxious seeds are not allowed.**
- 12) Name and address of company responsible for analysis (seller)

Variety and kind (species and common name), lot number, origin, and net weight are all obtained from the grower, seed conditioner (seed cleaner), or seed dealer. The remaining information is obtained from the Seed Analysis Report (Figures 2 and 3), which is completed by an official seed laboratory (government or commercially run) authorized by the state Department of Agriculture.

The seed lab performs a number of tests on a representative sample from each lot submitted by state or certification officials, growers, seed conditioners, or seed dealers. The tests are conducted under controlled conditions based on the "Rules for Testing Seed adopted by the Association of Official Seed Analysts."

It is your right to receive a copy of the Seed Analysis Report, which will list all seeds found in the test sample. With the report in hand, you'll be able to make a more informed decision on using a particular seed lot or which lot you want to seed.

Purity Test

A purity test separates pure seed, inert matter, other crop seed, and weed seed.

Purity: Expresses the composition of the seed lot and its degree of contamination by unwanted components. Purity + inert matter + weed seed + other crop seed must add up to 100%.

Inert Matter: Includes dirt, plant parts, and certain types of damaged seeds. Most grass seed should contain no more than 15% inert matter. Even low percentages of inert matter containing pieces of stem or unthreshed seed clusters can block passage through a drill.

Note: Purity and inert matter of grass, forb, and shrub seed will vary by species.

Other Crop Seeds: Seeds of species normally grown for crops that occur in amounts of 5% or less. If the types of other crop seed are a concern, you may

request a complete seed analysis report for the lot, which lists other crop species and the number of seeds per pound of each crop.

Weed Seeds: Total amount of common and restricted weed seed found in the lot.

Note: The number of noxious weed seeds per pound is listed separately.

Prohibited and Restricted Weeds

During the purity test, the seed lot sample is examined for the presence of Restricted and Prohibited Noxious Weed seed. Each state has its own list of Prohibited and Restricted Noxious Weeds. Weeds defined as noxious and the number of seeds per pound allowed for restricted noxious weeds vary from state to state, but any seed lot must meet the regulations of the state where it is sold. These lists are assembled from input provided by seed growers, crop improvement associations, seed dealers, and others. They are part of each states' seed laws. They do not necessarily include all weeds that every group considers noxious.

By the Federal Seed Act and state laws, seed lots can not be sold when they contain any prohibited noxious weed seeds. The analysis must indicate that no prohibited noxious weed seeds are present. Seed lots may contain only a small percentage of Restricted Noxious Weed seeds.

The name and number of seeds per pound of any restricted noxious weeds must be listed on the label. This means that any one of the weed seeds on the Restricted List can be included in a Certified seed lot up to the maximum number of seeds allowed by law. Each state requires similar information. The main differences are in the Prohibited and Restricted Weed lists from state to state.

You should identify your particular state's requirements so you know what you are legally entitled to or legally obligated to do. By law, seed that comes from a state that has less restrictive weed lists must meet the more restrictive requirements of the receiving state. Contact the State Department of Agriculture or the crop improvement association in your state for specific information.

Common Weeds

"Common" weed seeds are those weeds that are not on the Prohibited or Restricted Noxious Weed lists. Common weed seed should not total more than 0.5% by weight. This will vary according to state seed laws.

The major problem with common weeds is that you don't know what they are because they aren't listed on the tag. The only way you'll know what they are is from the Seed Analysis Report. In general, the fewer weed seeds the better. Some weeds are worse than others in pasture and rangeland plantings so use caution when purchasing seed with weed seed present. Even with only a few seeds per pound, you can have more than enough weed seed to infest thousands of acres.

Germination Test

A germination test samples for total viability, including the sum of all seeds (of a "kind" listed on the label) actually germinating using standard laboratory methods + hard seed and/or dormant seed.

% Germination: A germination test determines the capability of a seed lot to produce normal seedlings under favorable controlled conditions. Total germination is the percent germination added to the percent hard and/or dormant seed. Anything under 100% total germination represents the presence of dead seed and/or seed that doesn't produce a shoot or root.

Germination may also be estimated by the use of a tetrazolium chloride test (TZ test) in which seeds are stained with a dye to determine viability. Viable seed with live (respiring) tissues will stain a red color. However, not all states recognize the use of a TZ test for all species.

Dormant Seed: Includes hard seed, refers to the portion of the seed sample that doesn't germinate during the seed test. Reasons for dormant seed are: 1) the seed coat is impervious to water, and/or 2) internal structures within the seed prohibit oxygen exchange. Hard seed may germinate at a later date and produce a viable plant, or it may germinate and succumb to competition, or it may never germinate at all.

The higher the germination percentage, the better. Germination of most grass species is normally above 80% and should not be lower than 60%. Germination of some native grasses, forbs, and shrubs may be lower, but can vary widely according to species.

The germination test date should also be current. Grass, forb and legume seed should be updated every 9-18 months depending on state laws. Flower, shrub and tree seed should be updated every 9 months.

Certified Seed

The use of Certified seed helps protect the buyer. It is the best quality because it must meet specific standards of high genetic purity, germplasm identity, high germinating ability, and minimum amounts of other crop seed, weed seed, and inert matter. A clear understanding of certified seed standards for each individual state is critical in order to know what can be found in a lot of seed.

AOSCA has recently published "Pre-Varietal Germplasm Certification Standards" for the certification of germplasm accessions that have not been released as a variety. These standards offer a reliable way for the seed industry to offer Certified seed of, races or ecotypes to the buyer that still have genetic identity but haven't gone through the extensive testing require of a varietal release. This means that seed of plants released under the alternative release procedures can get to the user in the field much faster. It also means that the full range of adaptation and many performance traits may not be fully known. These new alternative release

procedures are now commonly being used for native species. See Figure 4 for examples of the tags used for both varietal and pre-varietal certified seed.

Calculating Seed Mixtures

All NRCS recommendations for calculating seed mixtures are expressed in pounds of Pure Live Seed (PLS). PLS is defined as the percentage of pure seed that will germinate expressed as a percentage of a given weight of seed. It provides a common basis for comparing seed lots that differ in purity and germination. It is also used to adjust seeding rates to achieve maximum production after seeding. The basic formula to calculate PLS is:

$$\text{PLS} = \frac{\text{percent purity} \times \text{percent germination}}{100}$$

The information necessary to complete this calculation is found on the seed tag or the Seed Analysis Report. An example of how to calculate PLS is:

'Goldar' bluebunch wheatgrass: Seed tag indicates this lot has 99.01% purity and 87.00% germination. The calculation would be:

$$\text{PLS} = \frac{(99.01)(87.00)}{100} \qquad \text{PLS} = 86.13 \%$$

Once PLS is determined for the lot of seed, it can be used to compare the seed costs of two different priced seed. An example is Alfalfa. Dealer X has the same variety of alfalfa as Dealer Y, but it is \$0.20 cheaper than Dealer Y's seed. Which is a better deal? The way to calculate this is to use the following formula:

$$\text{Price per pound (PLS)} = \frac{\text{price per pound}}{\text{percent PLS}}$$

Dealer Y's Alfalfa seed is selling for \$.90 per pound. The seed analysis report lists the purity as 99.5% and the germination as 90.0%. Dealer X's Alfalfa seed is selling for \$.70 per pound. The seed analysis report lists the purity as 93.0% and the germination as 60.0%. Using this information, the actual price per pound of Pure Live Seed is:

Dealer Y	Dealer X
Price per pound (PLS) = $\frac{\$.90}{0.895}$	Price per pound PLS = $\frac{\$.70}{0.558}$
Price per pound (PLS) = \$1.01	Price per pound PLS = \$1.25

From these calculations, it is easy to see that the posted price is not always the cheapest price or the best buy.

Adjusting Seeding Rates

In order to seed the recommended PLS seeding rate, the bulk rate of seeding needs to be determined. This is the rate at which the drill will be set. This rate will always be greater than the pure live seed rate. The formula to calculate the bulk seeding rate is:

$$\text{Pounds bulk seeding rate per acre} = \frac{\text{pounds PLS recommended rate per acre}}{\text{percent PLS}}$$

An example of how to use this formula is listed below. The NRCS recommended seeding rate for 'Hycrest' crested wheatgrass is 5 pounds PLS per acre. The PLS is calculated to be 80.0%. The bulk rate needed to seed the recommended PLS rate is determined by:

$$\text{Pounds bulk seeding rate per acre} = \frac{5 \text{ pounds PLS recommended rate per acre}}{0.80 \text{ PLS}}$$

$$\text{Bulk seeding rate per acre} = 6.25 \text{ pounds}$$

Based on these calculations, the drill box setting would be as close to 6.25 pounds per acre as the model of drill will allow.

Seeding Rates for Mixtures

Where a seed mix will be used, the percent of each species desired in the mixture needs to be determined. This calculation is: (the percent desired in seed mix) X (pounds PLS recommended per acre) = Pounds PLS mix per acre.

An example: Of the desired seed mix, 85% will be 'Goldar' bluebunch wheatgrass. This lot of seed has a 90% PLS. The NRCS recommended seeding rate is 8 pounds PLS/acre. The remaining 15% of the mix is 'Delar' small burnet. This lot of seed has an 85% PLS. The NRCS recommended seeding rate is 20 pounds PLS/acre.

$$\begin{aligned} (\text{Goldar } 85\%) (8 \text{ pounds PLS/acre}) &= 6.8 \text{ pounds PLS/acre mixed} \\ (\text{Delar } 15\%) (20 \text{ pounds PLS/acre}) &= 3.0 \text{ pounds PLS/acre mixed} \end{aligned}$$

Next, determine the amount of bulk seed (mixed) per acre. This will use the same formula as explained above:

$$\text{Goldar } \frac{6.8 \text{ pounds PLS/acre}}{90\%} = 7.6 \text{ pounds bulk mixed/acre}$$

$$\text{Delar } \frac{3.0 \text{ pounds PLS/acre}}{85\%} = 3.5 \text{ pounds bulk mixed/acre}$$

Finally, multiply the pounds of bulk seed per acre for each species by the acres to be seeded to obtain the total bulk seed required for the entire seeding project acreage.

Recommendations

Use the information on the seed label and in the Seed Analysis Report to determine the quality of the seed you are purchasing. This will ensure that genetic identity and mechanical purity needed to help ensure a successful, weed-free, uniform seeding.

Purity and germination percentages found on the seed tag determine Pure Live Seed from which the bulk-seeding rate is calculated. The seed tag and Seed Analysis Report also will list the weeds including common, restricted, and prohibited found in the seed lot. Remember that weeds listed as common, restricted, and prohibited vary by state and no seed can be sold if it contains prohibited weeds. Seed that is moved across state lines must meet the most restrictive state's requirements. By monitoring the weed species in the lot, you can control what weeds are seeded in a planting.

The cheapest seed is not always the most economical. By comparing the purity and germination percentage between seed lots or mixes, you can see clearly which lots or mixes will produce the most potential seedlings after planting. All seeding recommendations are given in Pure Live Seed rates.

Refer to the "Oregon and Washington Guide for Conservation Seedings and Plantings" (USDA NRCS, Portland, Oregon, April 2000), for PLS rates recommended in Oregon. These rates must be converted into bulk seeding rates before placing the seed in a drill to begin seeding. The drill must also be set up based on bulk seeding rates not Pure Live Seed rates. Always place your order to the seed dealer as PLS seeding rate and check to make sure the dealer has mixed the seed correctly.

Literature Cited

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Idaho Crop Improvement Association. 1998. *Idaho Rules of Certification*. Idaho Crop Improvement Association, Meridian, ID. March 1998.

Association of Official Seed Certifying Agencies. 2001. *Genetic and Crop Standards Manual*. Association of Official Seed Certifying Agencies. San Antonio Texas.

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STATE OF IDAHO — DEPARTMENT OF AGRICULTURE
IDAHO STATE SEED LABORATORY
 2240 Kellogg Lane • Boise, Idaho 83712
 Telephone: 334-2388

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 XXXXXXKXXXXXXXXXXXX
 XXXXXXKXXXXXXXXXXXX
 XXXXXXKXXXXXXXXXXXX



Test Number 96-08536	Date Received 03/05/96	Date Reported 04/01/96	Sampler
Lot PMC-95-2-B-10 BIN 10	Sender's Identification Bluebunch wheatgrass, Goldar		
Grower Name and Number		Container	
TO Plant Materials Center Soil Conservation Service Box 296 Aberdeen, ID 83210-0296			TEST REQUESTED PURITY GERMINATION IDAHO NOXIOUS

TEST RESULTS

KIND OF SEED	Purity Based On 7.0000 Grams				Germination Based On 400 Seeds				Date of Germination 04/01/96	
	% Pure Seed	% Other Crop	% Inert Matter	% Weed Seed	% Germ	% Hard Seed	% Dormant Seed	% Tetrazolium	% Hard Seed	
Bluebunch wheatgrass (Pseudoregneria spicata) Goldar	95.75	0.11	3.88	0.26	77	0				

INERT MATTER CONTAINS Ergot, Stems, Chaff

CROP SEEDS	No. Per Pound	% By Weight	WEED SEEDS	No. Per Pound	% By Weight
Slender Wheatgrass Elymus trachycaulus	130		Flixweed Descurainia sophia Meadow salsify Tragopogon pratensis Downy brome Bromus tectorum L. Vervain Verbena sp. *** IDAHO NOXIOUS *** NONE FOUND	130 65 194 518 74.56 GRAMS EXAMINED ***	

REMARKS:

Test results indicate this sample does not qualify as Foundation.
 ICIA will determine final class on all certified samples.

Richard C. Lawson
 Richard C. Lawson, Chief
 Bureau of Seed Analysis & Control

Information contained in this report is based upon the sample as received from the sender. The State Department of Agriculture makes no warranty as to the variety of this seed. The Noxious exam conducted is Idaho State only unless otherwise specified.

Figure 2: Example of a Seed Analysis Report issued by the State Of Idaho Department of Agriculture, Idaho State Seed Laboratory for 'Goldar' bluebunch wheatgrass. Note common weed seeds listed with the number of seeds per pound found.



STATE OF IDAHO — DEPARTMENT OF AGRICULTURE
IDAHO STATE SEED LABORATORY
 2240 Kellogg Library • Boise, Idaho 83712
 Telephone: 334-2368

CECIL D. ANDRUS
 Governor
 RICHARD M. RUSH
 Director

FINAL REPORT

Test Number 90-0874	Date Received 03/23/90	Date Reported 03/28/90	Sampler	Sample Received As UNCERTIFIED
Lot SFP-BL-B-6 BIN 6	Sender's Identification Indian Ricegrass, Nezpar, Blend			Class
Grower Name and Number			Container	Pounds
TO Plant Materials Center Soil Conservation Service Box AA Aberdeen, ID 83210				TEST REQUESTED PURITY IDAHO NOXIOUS TETRAZOLIUM

TEST RESULTS

KIND OF SEED	Purity Based On 7.0000 Grams				Germination Based On Seeds				Date of Germination
	% Pure Seed	% Other Crop	% Inert Matter	% Weed Seed	% Germ	% Hard Seed	% Dormant Seed	% Tetrazolium	% Hard Seed
Indian Ricegrass (Oryzopsis hymenoides)	93.89	0.00	5.74	0.37				87	0

INERT MATTER CONTAINS Broken Seed, Stones, Stems

CROP SEEDS	No. Per Pound	% By Weight	WEED SEEDS	No. Per Pound	% By Weight
			Mustard, Blue	648	
			Chorispora tenella		
			Mallow, Common	259	
			Malva neglecta		
			Witchgrass	65	
			Panicum capillare		
			Barnyardgrass	194	
			Echinochloa crusgalli		
			Doct, Curly	65	
			Rumex crispus		
			*** IDAHO NOXIOUS ***	70.55	GRAMS EXAMINED ***
			Cress, Hoary	6	
			Cardaria araba		

REMARKS:
Purity - 13.50
72 Germ - 20.00
Total 33.50

Richard C. Lawson
 Richard C. Lawson, Chief
 Bureau of Seed Analysis & Control

Certification Grade based on Laboratory Test. Final and official certification Grade to be determined by Idaho Crop Improvement Assoc. Inc.

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Figure 3: Example of a Seed Analysis Report issued by the State Of Idaho Department of Agriculture, Idaho State Seed Laboratory for 'Nezpar' Indian ricegrass. Note common weed seeds and one noxious weed species detailed on the Sheet.

FOUNDATION SEED



KIND: OREGON-SPRINGMANN
 VARIETY: INDIAN
 CERT. NO.: G-1299, LOT 895A
 BANNING: DVE LICENSED VARIETY

MEMBER OF ASSOCIATION OF OFFICIAL SEED CERTIFYING AGENCIES

TESTED CLASS SEED



Species Name: *Festuca Truncata*
 Common Name: *Autumn Bluegrass*
 County/State/Elevation: *Sagehen/Utah/5500-6000 ft*
 Germplasm ID/Gen: *Fountain Green/530*
 Cert. # WC-114 Lot # PT015
 Slope: North, 3-10 deg. Sub: Gravely Clay Loam

MEMBER OF ASSOCIATION OF OFFICIAL SEED CERTIFYING AGENCIES

REGISTERED SEED



KIND: ...
 VARIETY: ...
 CERT. NO.: ...

MEMBER OF ASSOCIATION OF OFFICIAL SEED CERTIFYING AGENCIES

SELECTED CLASS SEED



Species Name: *Artemisia tridentata wyomingensis*
 Common Name: *Wyoming Blue Big Sagebrush*
 County/State/Elevation: *Salt Lake/Utah/4700 ft*
 Germplasm ID/Gen: *Cedar Creek/531 "Natural"*
 Cert. # S-273 Lot # UC-515
 Slope: N, 0-5 deg. Sub: Sandy sand

MEMBER OF ASSOCIATION OF OFFICIAL SEED CERTIFYING AGENCIES

CERTIFIED SEED



KIND: ...
 VARIETY: ...
 CERT. NO.: ...

MEMBER OF ASSOCIATION OF OFFICIAL SEED CERTIFYING AGENCIES

SOURCE IDENTIFIED SEED



Species Name: *Artemisia tridentata wyomingensis*
 Common Name: *Blue Big Sagebrush*
 County/State/Elevation: *Wasatch/Wyoming/8500-9000 ft*
 Germplasm ID/Gen: *---*
 Cert. # WC-124 Lot # 841
 Slope: South, 20s Sub: Medium (Sandy Loam)

MEMBER OF ASSOCIATION OF OFFICIAL SEED CERTIFYING AGENCIES

- FOUNDATION TAG – WHITE
- REGISTERED TAG – PURPLE
- CERTIFIED TAG – BLUE
- TESTED CLASS TAG - BLUE
- SELECTED CLASS TAG - GREEN
- SOURCE IDENTIFIED TAG – GOLD

Figure 4: Examples of different certification tags that can be found on a seed bag. These certification tags will be in addition to the actual seed tag that lists the purity, germination percentage, variety, lot number, origin, net weight, percent inert matter, weed seed, noxious weed seed and the seller's name and address.