

APPENDIX A.

DESIGNING CUSTOM SEED MIXTURES

SECTION I

READING & UNDERSTANDING SEED LABELS

**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 try to obtain non-certified seed that may meet 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 for each class of seed.

12-5 (4-82)

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 Centers

**Information On A Seed Tag:**

- |  |
|--|
| <ol style="list-style-type: none"><li>1) Variety and kind<br/>(Species and Common name)</li><li>2) Lot number</li><li>3) Origin</li><li>4) Net weight</li><li>5) Percent pure seed</li><li>6) Percent germination (w/date of test)</li><li>7) Percent inert matter</li><li>8) Percent other crop seed</li><li>9) Percent weed seeds</li><li>10) Name of restricted noxious seed<br/>(number per pound of seed)</li><li>11) Prohibited noxious seeds are not allowed.</li><li>12) Name and address of company responsible for analysis (seller)</li></ol> |
|--|

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 will 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. Prohibited noxious weeds are not allowed in any lot of seed.

Restricted noxious weeds are allowed in seed but the amount of weed seed is restricted. Prohibited and 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 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 are not 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.

Germination tends to decrease in all seed as it ages and some species lose germination more rapidly than other species, even under ideal seed storage conditions. For example, winterfat and forage kochia are noted for having a very short seed life and may be viable for only 1-2 years. Most species maintain germination at constant levels for several years and then slowly begin to decline as time passes. The rate of decline in germination varies widely between species as well as between seed lots of the same species.

The germination test date should be current due to the natural decline in germination over time. 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 of 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 is in a particular lot of seed.

AOSCA recently published "Pre-Varietal Germplasm Certification Standards" for the certification of germplasm that have not been released as a cultivar (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 have not gone through the extensive testing required for a varietal release. This means that seed of plants released under the alternative release procedures can be made available 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 many native species. See Figure 4 for examples of the tags used for both varietal and pre-varietal certified seed.

## SECTION II

### PURE LIVE SEED (PLS) –WHAT IT IS AND HOW TO USE IT

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 and is a means of expressing seed quality. 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 the desired stand. Seeding rates based on a PLS basis, will insure that the same amount of viable seed per acre will be planted even though quality of different seed lots and total amount of material (bulk) seeded per acre may vary considerably. 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. Refer to Table 5 in the Practice Standard for Minimum Seed Quality Standards.

An example of how to calculate PLS is:

Creeping Red Fescue: Seed tag indicates this lot has 99.01% purity and 87% germination. The calculation would be:

$$\text{PLS} = \frac{(99.01) \times (87)}{100} \quad \text{PLS} = 86.14 \%$$

Once PLS is determined for the lot of seed, it can be used to compare the seed costs of two different priced lots of seed. For example, Dealer X has the same variety of creeping red fescue 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:

$$\text{Price/Pound (PLS)} = \frac{\text{price / pound bulk}}{\text{percent PLS}}$$

Dealer Y's Creeping red fescue 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 Creeping red fescue 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:**

$$\text{Bulk Price per pound (PLS)} = \frac{\$.90}{0.895}$$

$$\text{Price Per Pound (PLS)} = \$1.01$$

**Dealer X:**

$$\text{Bulk Price per pound (PLS)} = \frac{\$.70}{0.558}$$

$$\text{Price Per Pound (PLS)} = \$1.25$$

From these calculations, it is easy to see that the posted price is not always the least 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:

$$\text{Pounds Bulk Seeding Rate Per Acre} = \frac{\text{Pounds PLS Recommended Rate/Acre}}{\text{Percent PLS}}$$

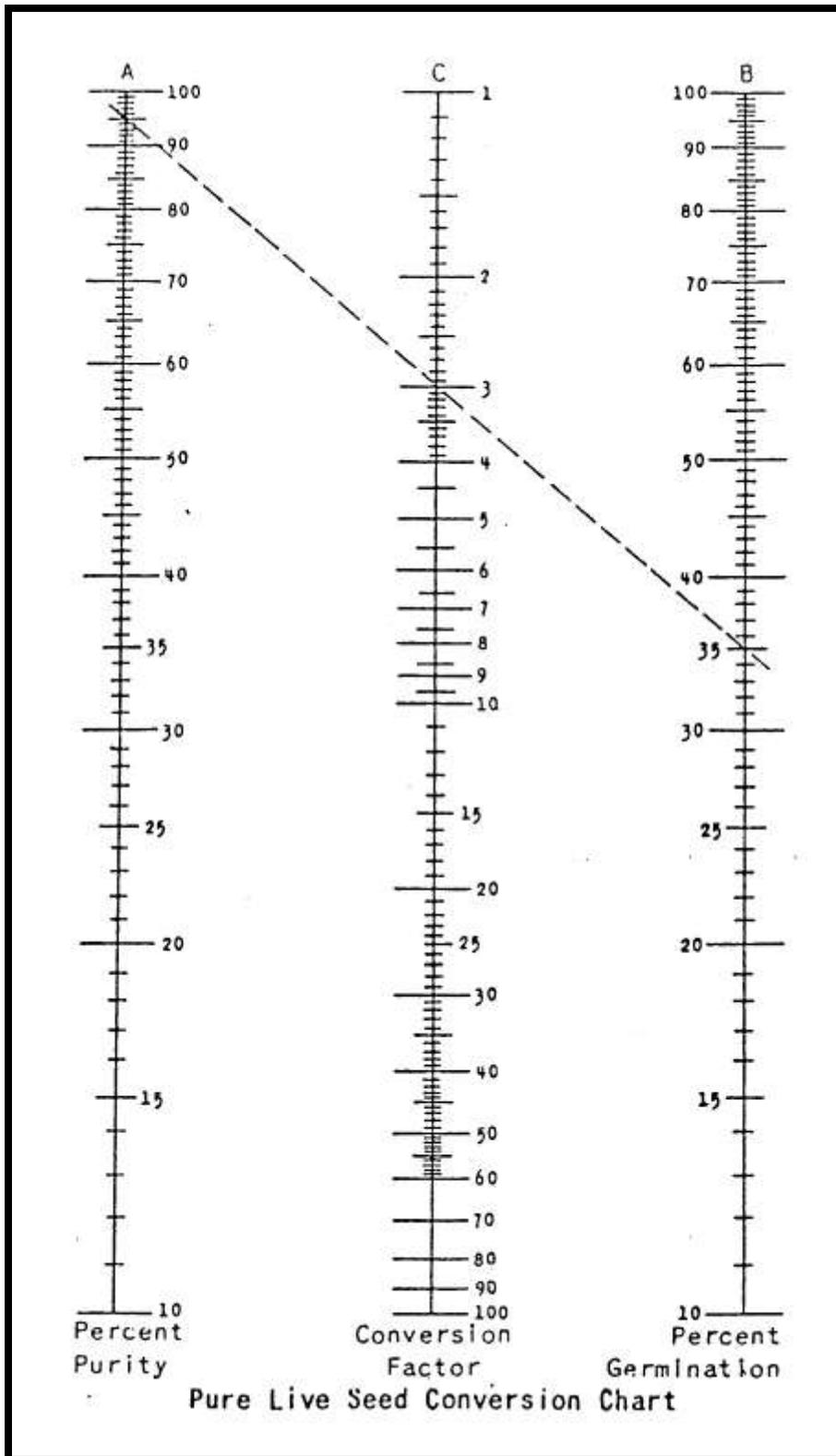
An example of how to use this formula is listed below. The NRCS recommended seeding rate for switchgrass is 5 pounds PLS per acre. The PLS is calculated to be 80.0 %. The bulk rate needed to seed the recommended PLS rate is determined by:

$$\text{Pounds Bulk Seeding Rate Per Acre} = \frac{5 \text{ lbs. PLS Recommended Rate/Acre}}{0.80 \text{ PLS}}$$

**Bulk Seeding Rate/Acre = 6.25 pounds**

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

*The chart on the following page can be used to convert any Lot of Seed to the bulk equivalent based on purity and germination.*



**To Use the Chart**

Locate the percent purity and percent germination from the seed lot on lines A and B.

Lay a straight edge between these two points.

The point of intersection with line C is the conversion factor for this lot of seed.

Example:

Purity 95% - line A

Germination 35% line B

line B

Conversion factor = 3.0 line C

It will take 3 pounds of this seed lot to equal 1 pound pure live seed (PLS).

If the PLS seeding rate is 5 lb./ac., then  $5 \times 3 = 15$  lb./ac. would be the bulk seeding rate for this seed lot.

### SECTION III

#### STEPS IN PLANNING A SEED MIXTURE

##### PLANNING A SEEDING MIXTURE

1. Select desired and adapted species to be used from Table 3. in Specifications Guide.
2. Determine species composition of mixture using information in the following Table 1.
3. Calculate PLS pounds/acre by species:  
$$\frac{(\text{PLS seeds/sq. ft.} \times 43,560)}{(\# \text{ seeds/pound})}$$
4. Calculate planting PLS pounds for each species:  
(PLS pounds/ac. x number of acres)
5. Order seed on a PLS basis.
6. For broadcast seedings, blend the species together into the seeding mixture prior to planting. If using a native grass drill, keep chaffy seeds, small seeds (smooth grass/forb seed), and large seeds separate. Each type of seed will be placed in a separate box on the drill, which the seeding rate can be calibrated independently.

##### Sample Seeding Mixture Rate Calculation

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 ‘**Rumsey**’ indiangrass. This lot of seed has a 90% PLS. The NRCS recommended seeding rate is 4 pounds PLS/acre. The remaining 15% of the mix is ‘**Covar**’ sheeps fescue. This lot of seed has an 85% PLS. The NRCS recommended seeding rate is 20 pounds PLS/acre.

- **Rumsey** (0.85%) x (4 Pounds PLS/Acre)  
= 3.4 Pounds PLS/Acre Mixed
- **Covar** (0.15%) x (20 Pounds PLS/Acre)  
= 3.0 Pounds PLS/Acre Mixed

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

- **Rumsey:**  $\frac{3.4 \text{ Pounds PLS/Acre}}{90\%}$   
= 3.7 Pounds Bulk Mixed/Acre
- **Covar:**  $\frac{3.0 \text{ Pounds PLS/Acre}}{85\%}$   
= 3.5 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

TABLE 1: Seeding Chart for Grasses &amp; Legumes

Common Name	Scientific Name	Max. % of mixture	Seeding rate (PLS) lb./ac.	Seeds/sq. ft.	# seeds/lb.
Beachgrass, American	<i>Ammophila breviligulata</i>	N/A	Veg. only	Veg. only	Veg. only
Bentgrass, Creeping	<i>Agrostis stolonifera</i> <i>var. palustris</i>	5	0.5-1.0	52-104	4,540,000
Bluestem, Big	<i>Andropogon gerardii</i>	75	2.0-4.0	7.5-15	165,000
Bluestem, Little	<i>Schizachryrium scoparium</i>	50	2.0-4.0	11-21	240,000
Bromegrass, Fringed	<i>Bromus, ciliatus</i>	---	---	---	---
Broomsedge	<i>Andropogon virginicus</i>	50	1.0-3.0	18-55	800,000
Bushclover, Hairy	<i>Lespedeza hirta</i>	20	1.0-2.0	2.6-5.2	113,636
Bushclover, Round Head	<i>Lespedeza capitata</i>	20	1.0-2.0	3.5-7.0	154,000
Cordgrass, Freshwater	<i>Spatina pectinata</i>	100	5.0-10	22-45	197,000
Cordgrass, Saltmeadow	<i>Spartina patens</i>	N/A	Veg. Only	Veg. Only	Veg. only
Cordgrass, Smooth	<i>Spartina alterniflora</i>	100	1.2-2.5	5-10	175,000
Deertongue Grass	<i>Dicanthelium clandestinum</i>	20	5.0-8.0	46-73	400,000
Dropseed, Poverty	<i>Sporobolus vaginiflorus</i>	---	---	---	---
Fescue, (Red, Chewings, Hard, Sheeps)	<i>Festuca rubra, longifolia, ovina</i>	60-85	15-20	211-282	615,000
Flatpea	<i>Lathyrus sylvestris</i>	15	5-10	1.0-2.0	8,000
Groundnut	<i>Apios americana</i>	---	---	---	---
Indiangrass, Yellow	<i>Sorghastrum nutans</i>	75	2.0-4.0	8.0-16	175,000
Lovegrass, Purple	<i>Eragrostis spectabilis</i>	3.0-5.0	0.5-1.0	17-34	1,500,000
Meadow Grass, Fowl	<i>Poa palustris</i>	25-50	1.0-3.0	23-69	1,000,000
Orchardgrass	<i>Dactylis glomerata</i>	85	8.0-10	117-147	640,000
Pea, Beach	<i>Lathyrus japonicus</i>	10-15	2.0-3.0	---	---
Pea, Partridge	<i>Chamecrista fasciculata</i>	20-30	2.0-4.0	3.0-6.0	64,000
Red Top	<i>Agrostis alba</i>	5	0.5-1.0	56-112	4,900,000

Table 1, cont.

Reed Grass, Blue Joint	<i>Calamagrostis canadensis</i>	5	0.5-1.0	46-92	4,000,000
Ryegrass, Perennial	<i>Lolium perenne</i>	10	10-15	53-79	230,000
Rye, Canada Wild	<i>Elymus canadensis</i>	20	5.0-10	13-26	121,000
Rye, Riverbank Wild	<i>Elymus riparius</i>	20	5.0-10	11-22	96,000
Rye, Virginia Wild	<i>Elymus virginicus</i>	20	5.0-10	8.0-16	73,000
Saltgrass, Alkali	<i>Puccinellia distans</i>	50	1.0-2.0	50-100	2,200,000
Switchgrass	<i>Panicum virgatum</i>	100	2.0-5.0	18-44	389,000
Trefoil, Showy-Tick	<i>Desmodium canadense</i>	20-30	1.0-3.0	---	---
Wild Indigo	<i>Baptisia tinctoria</i>	20-30	1.0-2.0	18-36	800,000
Wood Reed, Stout	<i>Cinna arundinacea</i>	10-15	1-2	48-96	2,100,000

## 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 noxious, and prohibited noxious 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 noxious weeds. Seed that is moved across state lines must meet the requirements of the state that is most restrictive. By monitoring the weed species in the lot, you can influence 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.

## REFERENCES

- Association of Official Seed Certifying Agencies. *Genetic and Crop Standards Manual*. Association of Official Seed Certifying Agencies, Boise, ID. 1999
- Dickerson, J. and B. Wark. *Vegetating with Native Grasses in Northeastern North America*. USDA NRCS, Ducks Unlimited Canada. 1999
- USDA Natural Resources Conservation Service. *Reading Seed Packaging Labels and Calculating Seed Mixtures*. USDA-NRCS Plant Materials Technical Note No. 4, Boise, ID. June 2001.
- USDA Natural Resources Conservation Service. *National Plant Materials Manual, Third Edition*. USDA Natural Resources Conservation Service, Beltsville, MD. June 2000.
- Smith, R. and S. Smith. *Native Grass Seed Production Manual*. USDA-NRCS, Ducks Unlimited Canada. 1996.



FOUNDATION TAG – WHITE

TESTED CLASS TAG - BLUE

REGISTERED TAG – PURPLE

SELECTED CLASS TAG - GREEN

CERTIFIED TAG – BLUE

SOURCE IDENTIFIED TAG – GOLD

**Figure 2:** 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.

## **Critical Area Planting Specifications 342-56**

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