

# Seed Source and Quality

## Importance of Seed Source

In prairie restoration, seed source is of critical importance. Remnant prairie serves as a template for species composition and abundance, but also may have unique genetic composition. Many seek to use the most appropriate genetic source for restoration. In all cases, a seed's source should not be confused with where the seed is produced or sold (i.e., location of a production field, nursery, or seed dealer); rather, source refers to the original remnant source of the seed used to establish the production field or nursery.

## Local Ecotype vs. Regional Sources

Prairie restorationists are often admonished to use “local ecotype” seed with little clarification as to what this means. The terms “local” and “ecotype” are commonly used to convey the idea that any remnant population may have specific genetic traits (genotypes) or adaptations that are unique to that population. Preserving this presumed inherent value of local gene pools of species in remnant communities is important. To help preserve this genetic material, using “local” seed (i.e., seed from the remnant itself or other very nearby remnants) is recommended for plantings adjacent to or within one-half mile of a remnant prairie (Reinartz 1997). The challenge of this approach is harvesting enough quality seed from a remnant in a single year to seed the new planting; therefore, the seeding may need to be done in phases over successive years.

There is an assumption that local seed is always best or better adapted to a proposed reconstruction site than “non-local” seed; however, this may not be true. A single local seed source may be adequate if a large, genetically diverse population is available and seed is collected from throughout the population. On the other hand, extremely small populations of only a few individuals may have lost genetic diversity over time with a loss of reproductive fitness and long-term survival.

More important than using seed from a local source, then, is actually matching the conditions of the site of the donor seed source to those of the reconstruction site. For example, harvesting seed from a wet pothole prairie to use on a nearby upland is not as suitable – in terms of both species and “ecotypes” – as using seed from a more distant, but upland remnant source with similar soils and climate and a more appropriate species composition.

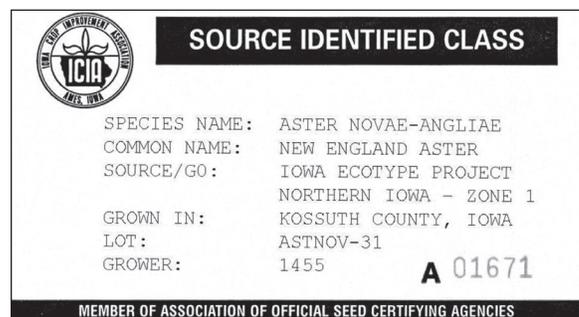
A regional source of seed pooled from several remnant populations is an appropriate source for most reconstructions. In the Midwest, remnant prairies are so scattered and isolated that there may be no “local” remnant sources of seed over large areas

of the landscape. Various agencies have defined seed-source regions based on geography, landforms, watersheds, species distribution, and political boundaries. Pooling seed collected from different populations in a defined area or region is a reasonable strategy for increasing the genetic diversity of the donor seed, a way of hedging your bet that the right combination of genetic material will be present to best occupy the reconstruction site over the long term. This may be particularly important when donor populations are very small and isolated. Mixing populations from the extremes of a species geographic or habitat range, however, should be avoided.

An equal amount of seed, or seedling grown transplants, from each population should be planted in the nursery population so that all populations contribute roughly equal amounts to the next generation of seed. Admittedly, in the absence of species- and population-specific information on genetics and reproductive biology, the size and extent of a region and which populations should be mixed often becomes a matter of personal opinion for restoration practitioners.

## Source-Identified Seed

Because plant materials of known genetic origin were in immediate demand for restoration on disturbed sites in the West, the need for third-party verification of source led to the development of the source-identified seed program. Standards for source-identified, or “Yellow Tag” seed, were developed by the Association of Official Seed Certifying Agencies (AOSCA). The program is administered by AOSCA's affiliate state crop improvement associations. AOSCA source-identified seed



standards provide a “fast-track” alternative release procedure when 1) there are inadequate existing commercial supplies for a species, 2) propagation material from specific ecotypes is needed for ecosystem restoration, 3) there is a high potential for immediate use, and 4) there is limited potential for commercial production beyond specific plant community sites (Young 1995).

Source-identified seed may be from either a single remnant source or from several sources pooled together as a regional source. No intentional selection or testing of traits occurs. Original

collection sites are documented, and nursery and production fields established from original collections are inspected and certified annually. Commercially produced seed is marketed with an official AOSCA yellow certification tag identifying the source and the producer of the material.

Several Midwest states have source-identified seed programs in place, administered by their respective crop improvement association per AOSCA guidelines. Individual states differ in their application of source-identified program guidelines regarding native species, so it's important to check specific policies for the particular state in question. Several states have reciprocal agreements regarding isolation distances and proprietary rights – among them Iowa, Minnesota, Wisconsin, and Missouri.

### Cultivated Varieties of Native Species

The USDA Plant Materials Program has developed cultivated varieties, commonly known as cultivars, of several native grasses and some forb species. The traditional approach was to collect an entire plant, or seed from a plant, that exhibited a desired characteristic, such as vigor. These collections, or accessions, were propagated and evaluated in common gardens to further study their characteristics. A selection was made, often of only a few individuals or populations, for further breeding and increase. The goal was to select specific, desired traits such as good germination and establishment, high forage yield, height, vigor, and winter hardiness. However, while cultivars may be desirable in a pasture setting for forage production, they are not recommended for prairie restoration, particularly since they either 1) have been derived from distant, out-of-state sources, or 2) have been selectively bred for specific traits, often competitiveness and vigor, which has the effect of narrowing their genetic base. If cultivars must be used for reconstructions, two or three different varieties should be used to increase the genetic diversity of the planting.

More recently, USDA-PMC plant selections have reflected the trend toward broad-based regional genetic diversity. Badlands “ecotype” little bluestem, for example, is a composite of 68 accessions (collections) selected for disease resistance from an initial evaluation of 588 vegetative accessions collected from throughout North and South Dakota and Minnesota. This “selection” of a diverse assemblage of little bluestem populations may be a desirable and appropriate seed source for restorations in those states from which it was derived.

The USDA-NRCS has long recognized the limits of the successful transfer of plant materials to another location (Cooper 1957, McMillan 1959). Their recommendation has been to move cultivars (primarily in reference to warm-season grasses) not more than 300 miles north or 200 miles south of their origin. Plants

moved northward more than 300 miles generally will not produce seed and are prone to winter injury (Olson 1986, Jacobson 1986). Plants moved southward further than 200 miles are more prone to disease.

Cultivar material exists for limited number of native species. Many native species that are in demand for restoration can only be obtained through direct harvest from native stands or through the source-identified seed program described above.

### Seed Quality

Knowing the quality of the seed you purchase, produce or market, is critically important. Impure or trashy seed will not store as well as clean seed and can harbor the seed of noxious weeds or other undesirable species. Fortunately, seed quality has improved dramatically over the past few years as growers gain experience and acquire better equipment for producing, harvesting, and cleaning native species. Seed dispersal apparatus like awns on grass seed and hairy “parachutes” on forb seed are routinely removed. This means the seed lot can be cleaned to greater purity and viability and will flow more efficiently through the seeding equipment.

Quality native seed is sold on a pure live seed, or PLS basis. Three factors are used to calculate the percentage of pure live seed: purity, germination, and dormancy. These values must be determined by a certified seed analyst. Purity is a measure of pure, unbroken crop seed units as a percent by weight of the seed lot. Percent germination is determined by placing seed in a germination chamber for an approved time period. Many species,

<b>Lab. Number</b>	12-1641
<b>Date</b>	1/13/07
<b>Kind and Variety</b>	LITTLE BLUESTEM ( <i>SCHIZACHYRIUM SCOPARIUM</i> )
<b>Purity and Germination analysis of seed sample</b>	
<b>Pure seed</b>	58.85 %
<b>Inert matter</b>	41.14 %
<b>Other crop</b>	0.01 %
<b>Weed seeds</b>	0.00 %
<b>Germination</b>	65.00 %
<b>Hard seed</b>	%
<b>Total germ and hard seed</b>	%
<b>Dormant seed</b>	30.00 %
<b>Tetrazolium</b>	%
<b>Name and no. of noxious weed seeds per lb.</b> (All states noxious count unless otherwise indicated.)	NONE

particularly forbs, have dormancy mechanisms that require several weeks of cold-moist stratification to “break” dormancy,

allowing germination to occur. For most native species, no standard protocols exist for breaking dormancy for germination testing purposes. Therefore, any remaining non-germinated seed is tested biochemically with tetrazolium chloride (TZ), a clear compound that stains living tissue cherry red. The analyst determines the potential viability of stained seed – non-germinated seed considered viable by a TZ test is counted as dormant. A seed test showing a high percentage of dormancy is common in many native forb species and some grasses. This should be expected of natives, particularly in seed lots harvested within the past year. A high percentage of dormancy means much of that seed won't germinate until dormancy is broken, either artificially or by natural environmental conditions.

**Refer to Appendix D, Table 1D for sample seed test results for various species.**

### Calculating Pure Live Seed Amounts

Pure Live Seed (PLS) is a measure of the proportion of the viable seed of a species or variety per unit weight for a given lot of seed. PLS for forage crops and turf grass is normally calculated using percent purity and percent germination, only, as dormancy is not a significant issue for these types of species. Native species, however, may have a significant proportion of dormant, yet viable seed, particularly among forb species. The native seed trade recognizes this fact and uses three factors to calculate PLS. Therefore, purity, germination, and dormancy are used to calculate Pure Live Seed, or PLS, of any given native seed lot per below:

Pounds (#) PLS is calculated as:

$$\#PLS = (\#Bulk) \times (\%purity) \times (\%germination + \%dormant)$$

Where % is expressed as a proportion, i.e. 98% = 0.98

For example, a 50# bulk bag of seed that is 98% pure seed, with 52% germination and 27% dormant seed, really contains only 38# of pure viable seed (seed that potentially will germinate):

$$\#PLS = 50\# \text{ bulk} \times 0.98 \times (0.52 + 0.27) = 38\# \text{ PLS or } 50\# \text{ bulk} \times 0.7742$$

If however, you request 50# PLS bag of that same seed, you would receive a bag weighing 64.58# bulk.

$$\#bulk = \#PLS / [(\%purity) \times (\%germination + \%dormant)] \text{ or } 50\#PLS / 0.7742 = 64.58\# \text{ bulk}$$

### Literature Cited

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