

Calculating Seeding Rates for Conservation Plantings

Plant Materials Technical Note



Background

The amount of seed planted across the landscape is known as the seeding rate. Proper seeding rates are essential in conservation planting stand establishments. Low seeding rates yield a less dense established stand of desirable vegetation and greater weed competition. Although excessively high seeding rates can reduce weed pressure, they are not cost effective and reduce plant vigor due to competition for water and nutrients. Applying seed at the proper rate creates a balance between costs, weed suppression, and stand health.

Purpose

The purpose of this technical note is to provide information on proper seeding rate calculations, calculating seeding mixtures, and list of seed per pound of conservation plant species that occur in Texas.

Pure Live Seed (PLS) vs Bulk Seed

Not all seed will germinate and produce a healthy plant. In every bag of seed there exists a certain amount of pure living seed (which is capable of germinating and growing) along with non-viable seed and inert material such as bits of stalk, dust, pebbles, etc. The amount of pure living seed is referred to as pure live seed (PLS) while the combined amount of pure living seed, non living seed and inert material is referred to as bulk seed.

To assist in determining the percent pure and viable seed in a seed lot, many seed companies have seed tested to determine the percent purity and percent germination. The use of PLS guarantees that the same amount of viable seed per acre is planted even though different seed lots with varying seed quality is used.

Calculating PLS

PLS can be determined for any lot of seed which has a current (< 9 month old) seed test. The seed test documents percent germination, percent purity and percent dormant seed for a specific lot of seed tested. The percent PLS is determined by using the following equation:

$$\frac{(\% \text{Germination} + \% \text{Hard Seed})(\% \text{Purity})}{100} = \% \text{ PLS}$$

Definitions of Common Terms

The following definitions should assist in providing clarity relative to various terms associated with seeding rate calculations:

- Pure Seed - seeds of each kind and/or cultivar, or kind(s) and variety, under consideration, which are present in excess of 5% of the whole.
- Weed Seed – Seeds, florets, bulbletes, tubers or sporocaps of plants recognized as weeds by law, official regulation or by general usages.
- Germination – The maximum plant producing potential of a seed lot (i.e. the capability to germinate and produce a normal seedling under favorable conditions.)
- Dormant Seed – Viable seeds which fail to germinate when provided the specified germination conditions for the kind of seed in question. Dormant seeds have imbibed water and are swollen in size but have not germinated by the end of the test period. Many grasses and native species are known to have varying types and amounts of dormancy.
- Hard Seed – Seeds that remain hard at the end of the prescribed test period because they have not absorbed water due to an impermeable seed coat. Legumes are best known for hard seeds.
- Variety – A taxonomic subdivision of a species consisting of naturally occurring or selectively bred populations or individuals that differ from the remainder of the species in certain minor characteristics.

Calculating Seed Mixtures

Most conservation plantings consist of multiple plant species rather than one single plant species. When developing a conservation planting mix, the total mixture should not exceed 100 percent. In calculating the mixture seeding rate, the full seeding rate per specie is multiplied by the percent that specie is represented in the mix then multiplied by the number of acres to be planted. For example:

Plant Species	% Mix Planned	Seeding Rate	Acres	Total PLS #
Sand bluestem	40	6	1	2.4
Sand dropseed	40	1	1	.4
Bush sunflower	<u>20</u>	2.6	1	.52
	100			

Seeding Rate Calculation

There are two basic factors that must be determined in order to calculate a proper seeding rate. The first factor is determining the amount of desired seedling per square foot (density.) The second factor is the number of seed per pound of the species being planted.

A seeding rate is expressed in PLS pounds per acre and is based on planting a pre-determined number of live seed per square foot to achieve a specific plant density. For conservation planting purposes in Texas, seeding rates that achieve the desired plant density of 20 to 30 live seed per square foot is considered optimum. These figures are fairly standard except when calculating seeding rates for plant species with very large or very small seed sizes (e.g. eastern gamagrass vs. spike dropseed.) Under these situations seeding rates may be low as 5 PLS per square foot for large seeded species compared to over 200 PLS for small seeded species.



Eastern gamagrass seed



Spike dropseed seed

Example Seeding Rate Calculation

In calculating seeding rates, a constant mathematical factor (seed/acre factor) relating to seed per square foot must be determined. For 20 PLS seed per square foot, the constant factor is 871,200 seed per acre. (e.g. $(43,560 \text{ ft}^2/\text{ac})(20 \text{ PLS}/\text{ft}^2) = 871,200 \text{ seed}/\text{acre}$)

After the seed/acre factor is determined, the seeding rate is calculated by using the following equation: $(\text{Seed}/\text{acre factor}) / (\text{seed}/\text{pound}) = \text{pound}/\text{acre}$

Example calculation:

'Alamo' switchgrass has 427,365 seed/pound. Using the seeding rate calculation equation $\{(\text{Seed}/\text{ac factor}) / (\text{seed}/\text{pound}) = \text{pound}/\text{ac}\}$ it is determined that the proper seeding rate is 2.0 PLS pounds/ acre.

$(871,200 \text{ seed}/\text{acre}) / (427,365 \text{ seed}/\text{pound}) = 2.039$ or 2.0 PLS #/ac.

Considerations

Seed per pound varies not only among species but within the same species and within different years. Certain plant varieties are selected according to seed weight which can be related to seed fill. A good example of this is kleingrass. 'Verde' kleingrass was developed and selected for increases seed size from kleingrass accessions. 'Verde' kleingrass was a cooperative plant release by the James E. "Bud" Smith Plant Materials Center and the Texas Agricultural Experiment Station in 1982. When calculating a new seeding rate, it cannot be assumed that the number of seed per pound is consistent with other plant varieties. Seeding rate numbers should be based upon multiple years of evaluation. Following is a table with the average pure seed per pound of various conservation plant species commonly found in Texas.

Seed per Pound of Common Conservation Plants

**Compiled from records of the Former Soil Conservation Service Seed Laboratory, San Antonio Nursery

Common Name Of Seed	Scientific Name	Seeds Per Pound Of Pure Seed
GRASSES		
Bahiagrass	<i>Paspalum notatum</i>	239,000
Bahiagrass, Pensacola	<i>Paspalum notatum</i>	265,000
Bermudagrass	<i>Cynodon dactylon</i>	1,580,000
Bluegrass, Texas	<i>Poa archnifera</i>	1,847,000
Bluestem, Big (Grain)	<i>Andropogon gerardi</i>	191,000
Bluestem, Big - 'Earl'	<i>Andropogon gerardi</i>	145,000
Bluestem, Cane	<i>Andropogon barbinodis</i>	754,000
Bluestem, King Ranch (Processed Seed)	<i>Andropogon ischaemun</i>	835,000
Bluestem, Little (Combine Run)	<i>Andropogon scoparius</i>	255,000
Bluestem, Little (Grain)	<i>Andropogon scoparius</i>	379,000
Bluestem, Sand (Semi-processed)	<i>Andropogon hallii</i>	125,000
Bluestem, Seacoast	<i>Andropogon littoralis</i>	321,000
Bluestem, Silver	<i>Andropogon saccharoides</i>	506,000
Bristlegrass, Plains	<i>Setaria macrostachya</i>	293,000
Bristlegrass, Southwestern	<i>Setaria schaelei</i>	390,000
Buffalograss	<i>Buchloe dactyloides</i>	275,000
Buffelgrass	<i>Pennisetum ciliare</i>	867,000
Cottontop, Arizona	<i>Digitaria californica</i>	726,000
Cottontop, Arizona – Lasalle Germplasm	<i>Digitaria californica</i>	677,000
Cottontop, Texas	<i>Digitaria patens</i>	711,000
Cupgrass, Texas	<i>Eriochloa sericea</i>	558,500
Curlymesquite	<i>Hilaria belangeri</i>	269,000
Dallisgrass	<i>Paspalum dilatatum</i>	260,000
Dropseed, Giant	<i>Sporobolus giganteus</i>	1,417,000
Dropseed, Meadow Tall	<i>Sporobolus asper var. hookeri</i>	823,000
Dropseed, Mesa	<i>Sporobolus flexuosus</i>	3,329,000
Dropseed, Sand	<i>Sporobolus cryptandrus</i>	5,638,000

Common Name Of Seed	Scientific Name	Seeds Per Pound Of Pure Seed
Dropseed, Spike	<i>Sporobolus contractus</i>	2,885,000
Dropseed, Tall	<i>Sporobolus asper</i>	503,000
Galleta	<i>Hilaria jamesii</i>	159,000
Gamagrass, Eastern	<i>Tripsacum dactyloides</i>	7,500
Grama, Black	<i>Bouteloua eriopoda</i>	1,335,000
Grama, Blue	<i>Bouteloua gracilis</i>	711,000
Grama, Hairy	<i>Bouteloua hirsuta</i>	685,000
Grama, Red	<i>Bouteloua trifida</i>	3,155,000
Grama, Sideoats	<i>Bouteloua curtipendula</i>	193,600
Grama, Sideoats - 'Haskell'	<i>Bouteloua curtipendula</i>	579,000
Grama, Slender (Combine Run)	<i>Bouteloua filiformis</i>	184,000
Grama, Slender (Grain)	<i>Bouteloua filiformis</i>	981,000
Grama, Texas	<i>Bouteloua rigidiseta</i>	84,000
Indiangrass, Yellow - 'Lometa	<i>Sorghastrum nutans</i>	168,434
Indiangrass, Yellow (Processed)	<i>Sorghastrum nutans</i>	175,000
Indiangrass, Yellow (Grain)	<i>Sorghastrum nutans</i>	180,000
Lovegrass, Plains	<i>Eragrostis intermedia</i>	3,386,000
Lovegrass, Sand	<i>Eragrostis trichodes</i>	1,550,000
Lovegrass, Sandhill - 'Mason'	<i>Eragrostis trichodes var. pilifera</i>	2,014,852
Melic, Threeflower	<i>Melica nitens</i>	554,000
Millet, Foxtail	<i>Setaria italica</i>	232,000
Muhly, Bush	<i>Muhlenbergia porteri</i>	2,424,000
Muhly, Green	<i>Muhlenbergia racemosa</i>	1,608,000
Muhly, Red	<i>Muhlenbergia repens</i>	1,417,000
Muhly, Sandhill	<i>Muhlenbergia pungens</i>	747,000
Muhly, Spike	<i>Muhlenbergia wrightii</i>	1,635,000
Needlegrass, Green	<i>Stipa viridula</i>	179,000
Needlegrass, Needleandthread	<i>Stipa comata</i>	115,000
Needlegrass, Texas	<i>Stipa leucotricha</i>	68,000
Panicum, Blue	<i>Panicum antidotale</i>	651,000
Panicum, Halls	<i>Panicum hallii</i>	559,000

Common Name Of Seed	Scientific Name	Seeds Per Pound Of Pure Seed
Panicum, Kleingrass	<i>Panicum coloratum</i>	497,000
Panicum, Texas	<i>Panicum texanum</i>	103,000
Pappusgrass, Pink	<i>Pappophorum bicolor</i>	285920
Pappusgrass, Whiplash	<i>Pappophorum mucronulatum</i>	389,000
Paspalum, Brownseed	<i>Paspalum plicatulum</i>	282,000
Paspalum, Fringeleaf	<i>Paspalum ciliatifolium</i>	422,000
Paspalum, Hartweg	<i>Paspalum hartwegianum</i>	645,000
Redtop	<i>Agrostis alba</i>	6,038,000
Rescuegrass	<i>Bromus catharticus</i>	48,000
Rescuegrass (Australian Strain)	<i>Bromus catharticus</i>	43,000
Rhodesgrass (Processed)	<i>Chloris gayana</i>	1,337,000
Rhodesgrass (Combine Run)	<i>Chloris gayana</i>	1,405,000
Rhodesgrass (Grain)	<i>Chloris gayana</i>	2,327,000
Ricegrass, Indian	<i>Oryzopsis hymenoides</i>	141,000
Ryegrass, Italian	<i>Lolium multiflorum</i>	241,000
Ryegrass, Perennial	<i>Lolium perenne</i>	227,000
Ryegrass, Westerwold	<i>Lolium multiflorum var. woldicum</i>	194,000
Sacaton	<i>Sporobolus wrightii</i>	1,965,000
Sacaton, Alkali	<i>Sporobolus airoides</i>	1,355,000
Sacaton, Alkali - 'Saltalk'	<i>Sporobolus airoides</i>	1,669,812
Saltgrass, Inland	<i>Distichlis stricta</i>	518,000
Sprangletop, Green	<i>Leptochloa dubia</i>	538,000
Switchgrass	<i>Panicum virgatum</i>	278,000
Switchgrass - 'Alamo'	<i>Panicum virgatum</i>	427,365
Switchgrass, False	<i>Panicum plenum</i>	518,000
Texasgrass	<i>Vaseyochloa multinervosa</i>	198,000
Tobosa	<i>Hilaria mutica</i>	204,000
Trichloris, Fourflower	<i>Trichloris pluriflora</i>	1,258,000
Trichloris, Twoflower	<i>Trichloris crinita</i>	1,428,000
Tridens, Longspike	<i>Tridens strictus</i>	2,138,000
Tridens, Purpletop	<i>Tridens flavus</i>	451,000
Tridens, Rough	<i>Tridens elongatus</i>	444,000
Tridens, Texas	<i>Tridens texanus</i>	853,000
Tridens White	<i>Tridens albescens</i>	1,801,000

Common Name Of Seed	Scientific Name	Seeds Per Pound Of Pure Seed
GRASSES		
Uniola, Broadleaf	<i>Uniola latifolia</i>	94,000
Vine-mesquite	<i>Panicum obtusum</i>	144,000
Wheatgrass, Western	<i>Agropyron smithii</i>	126,000
Wildrye, Canada	<i>Elymus canadensis</i>	106,000
Windmillgrass, Hooded	<i>Chloris cucullata</i>	2,194,000
Windmillgrass, Shortspike	<i>Chloris subdolichostachya</i>	1,989,000
Windmillgrass, Tumble	<i>Chloris verticillata</i>	1,867,000
Witchgrass, Fall	<i>Leptoloma cognatum</i>	921,000
LEGUMES		
Acacia, prairie - Plains Germplasm	<i>Acacia angustissima</i>	22,600
Alfalfa, Common	<i>Medicago sativa</i>	268,000
Bluebonnet, Texas	<i>Lupinus subcamosus</i>	15,000
Bundleflower, Illinois	<i>Desmanthus illinoensis</i>	84,000
Bundleflower, Illinois - 'Sabine'	<i>Desmanthus illinoensis</i>	64,014
Bundleflower, velvet - Hondo Germplasm	<i>Desmanthus illinoensis</i>	59,474
Crotalaria, Sunn	<i>Crotalaria juncea</i>	11,000
Lespedeza, Common	<i>Lespedeza striata</i>	340,000
Lespedeza, Roundhead	<i>Lespedeza capitata</i>	151,000
Lespedeza, Rush	<i>Lespedeza hedysaroides</i>	303,000
Lupine, Arroyo	<i>Lupinus succulentus</i>	19,000
Lupine, Bicolor	<i>Lupinus bicolor</i>	78,000
Lupine, Blue	<i>Lupinus angustifolius</i>	2,900
Lupine, European Blue	<i>Lupinus hirsutus</i>	2,200
Lupine, European Yellow	<i>Lupinus luteus</i>	3,700
Lupinus, White	<i>Lupinus albus</i>	1,200
Partridgepea - 'Comanche'	<i>Chamaecrista fasciculata</i>	65,376
Prairieclover, Purple	<i>Petalostemon purpureus</i>	315,000
Prairieclover, Roundheaded	<i>Petalostemon multiflorus</i>	173,000
Rattlebox, Drummond	<i>Daubentonia drummondi</i>	4,400

Common Name Of Seed	Scientific Name	Seeds Per Pound Of Pure Seed
Sesbania, Hemp	<i>Sesbania exaltata</i>	45,000
Sweetclover, Annual Yellow	<i>Melilotus indica</i>	352,000
Sweetclover, Hubam	<i>Melilotus alba var. annua</i>	250,000
Sweetclover, Madrid	<i>Melilotus officinalis var.</i>	257,000
Vetch, Hairy	<i>Vicia villosa</i>	17,000
Wildbean, Trailing	<i>Strophostyles helvola</i>	11,000
Forbs		
bushsunflower, awnless	<i>Simsia calva</i>	330,966
Wright pavonia	<i>Pavonia lasiopetala</i>	35,866
Sunflower, Maximilian - 'Aztec'	<i>Helianthus maximiliani</i>	302364
Engelmann daisy	<i>Engelmannia pinnatifida</i>	58414

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