

TECHNICAL NOTE

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MIXING SEED WITH RICE HULLS

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Mixing Seed and Rice Hulls Using a Cement Mixer

Introduction

Many conservation practices include a vegetative component requiring establishment of permanent vegetative cover. Permanent vegetative cover is usually established by direct seeding. Occasionally there are situations where a single species may be seeded, but to obtain better ground cover more rapidly and to obtain a more diverse plant community, seed mixtures including grasses, forbs, legumes and even woody species are preferred.

Grass, forb, legume and woody seeds generally feed through a seed drill at variable rates because of differences in seed size and seed weight. Because of this weight difference, seed mixtures also tend to separate with heavy seed migrating to the bottom and light seed migrating toward the top of the mixture as the drill bounces across the field during the seeding operation.

When planting a mixture of different-sized seeds, it is recommended that a carrier such as rice hulls be used to facilitate the drilling operation. This technical note provides details on how to determine seed-rice hull mixtures.

Cracked grain, vermiculite, and granular clay products (kitty litter, “Shop Dry”) are other additives that can improve seed flow. Cracked grain is usually more expensive than rice hulls and can vary in size which complicates drill calibration. Vermiculite is inexpensive but not very good for improving seed flow and the dust can be hazardous to inhale. Granular clay products have proven useful for improving seed flow and virtually eliminate seed bridging, but not all seed vendors carry these products.

Rice hulls are excellent as a carrier because they facilitate the uniform distribution of different-sized seeds at accurate seeding rates and are inexpensive and easy to use. Rice hulls also keep mixtures in constant proportion by reducing seed separation during the drilling process. Rice hulls feed through a grain drill at the same rate as barley, which facilitates drill calibration, and they also prevent bridging of light, fluffy seed in the drill.

Rice hulls are cup-shaped and hold small-sized seeds together as the mixture feeds through the drill. Rice hulls must be clean and unbroken. It is highly recommended that U. S. #1 Grade rice hulls be used, as poorer quality rice hulls are often broken which reduces the cupping action to hold small sized seeds together.

Accompanying this technical note is an excel spreadsheet that will calculate seed and rice hull mixtures based on any seed mixture that you develop. Instructions for using the spread sheet are included. The spreadsheet uses the same calculations as outlined in this technical note.



Seed and rice hull mixture

Preliminary Steps

Why use rice hulls?

- keeps grass-legume-forb-shrub seed mixtures in constant proportion by preventing separation during drilling
- prevents bridging of light, fluffy seed
- allows use of a regular grain drill because the mixture feeds at the same rate as barley
- simplifies drill calibration
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Rice hulls must be clean and unbroken. Recommend #1 Grade

- rice hulls work like a cup to hold several small sized seeds together as they feed through the drill

- broken rice hulls significantly reduce this cupping action

Any change in drill row spacing will change the seeding rate

- The target seeding rate for pasture and rangeland seeding with a drill is 20 – 25 PLS seeds per square foot (double target rate for critical area seedings)
- If more than 1 drill is used, each drill must be calibrated

Steps in calculating and mixing rice hulls

1. Become familiar with drill being used. Consult with cooperator on drill settings for barley (may need to calibrate with barley, see Plant Materials Technical Note #19 for details)
2. Determine seed mixture, percent PLS, bulk seeding rate, and seeds per linear row foot
3. Obtain pounds per bushel data for each species and for rice hulls (see Table 1)
4. Determine volumes of seed and rice hulls
 - **If seed makes up more than 1/2 of the seed/rice hull volume, then 1 additional bushel of rice hulls will need to be added and drill will need to be set for 2 bushels of barley**
5. Mix seed for 1 acre, test drill calibration, and make adjustments

Example:

Objective: Seeding Mix:

‘Rush’ intermediate wheatgrass, 90% of mix, 75% PLS (full seeding rate 8 pounds PLS per acre)

‘Appar’ blue flax, 10% of mix, 85% PLS (full seeding rate 4 pounds PLS per acre)

Snake River Plains fourwing saltbush, 0.25 pounds PLS/ac, 60% PLS (0.25 pounds PLS per acre will provide approximately 400 plants per acre for wildlife habitat)

Use a grain drill with 7 inch row spacing.

1. **Become familiar with drill** (see Idaho Plant Materials Technical Note No. 19 Calibrating a seed drill for conservation plantings)

Cooperator has calibrated drill for barley in past and knows the settings

2. Determine amount of bulk seed (mixed) per acre

$$\text{Rush } \frac{8.0 \text{ pounds PLS/acre} \times 0.90 \text{ (mix \%)}}{75.0\% \text{ PLS}} = 9.60 \text{ pounds bulk mixed/acre}$$

$$\text{Appar } \frac{4.0 \text{ pounds PLS/acre} \times 0.10 \text{ (mix \%)}}{85.0\% \text{ PLS}} = 0.47 \text{ pounds bulk mixed/acre}$$

$$\text{SRP fourwing } \frac{0.25 \text{ pounds PLS/acre}}{60.0\% \text{ PLS}} = 0.42 \text{ pounds bulk mixed/acre}$$

Determine seeds per linear row foot

$$\text{row spacing factor} = \frac{522,720}{7 \text{ inch row spacing}} = 74674$$

(The row spacing factor converts square feet into linear feet based on the drill spacing and is calculated as shown above. There are 522,720 linear inches of row per acre at 12 inch spacing. See Plant Materials Technical Note No. 19 for further explanation of row spacing factor.)

Rush – 9.60 pounds bulk/acre @ 80,000 seeds per pound

$$\text{seeds per linear row foot} = \frac{9.60 \times 80,000}{74674} = 10.3 \text{ seeds per linear foot}$$

Appar – 0.47 pounds bulk/acre @ 278,000 seeds per pound

$$\text{seeds per linear row foot} = \frac{0.47 \times 278,000}{74674} = 1.7 \text{ seeds per linear foot}$$

SRP – 0.42 pounds bulk/acre @ 52,000 seeds per pound

$$\text{seeds per linear row foot} = \frac{0.42 \times 52,000}{74674} = 0.3 \text{ seeds per linear foot}$$

3. Obtain pounds per bushel data: (Table 1)

Rush	18.9 pounds per bushel
Appar	46.1 pounds per bushel
SRP	25.4 pounds per bushel
Rice hulls	9.0 pounds per bushel

4. Determine volumes of seed and rice hulls

Rush $\frac{9.60 \text{ pounds bulk per acre}}{18.9 \text{ pounds per bushel}} = 0.51 \text{ bushel}$

Appar $\frac{0.47 \text{ pounds bulk per acre}}{46.1 \text{ pounds per bushel}} = 0.01 \text{ bushel}$

SRP $\frac{0.42 \text{ pounds bulk per acre}}{25.4 \text{ pounds per bushel}} = 0.02 \text{ bushel}$

$0.51 + 0.01 + 0.02 = 0.54$ bushels of seed. Since this is greater than $\frac{1}{2}$ of the total volume, we must calculate the amount of rice hulls based upon a drill setting of 2 bushels barley per acre

$2.0 \text{ bushels} - 0.54 \text{ bushels seed} = 1.46 \text{ bushels rice hulls} \times 9 \text{ pounds per bushel} = 13.1 \text{ pounds rice hulls per acre.}$

Note: most seed mixtures will calculate to less than $\frac{1}{2}$ of a bushel and rice hulls will only need to be added to make up 1 bushel of seed and rice hulls per acre. The need to double the amount of rice hulls (and calibrate the drill to seed the equivalent of 2 bushels barley per acre) usually occurs when species with light bushel weights or those with low PLS are used in a mix.

5. Mix seed for 1 acre, test drill calibration, and make adjustments

- Blending of seed is very important. A cement mixer works extremely well. Mixing with a loader, shovel, etc over a clean, hard surface will also suffice, but requires more work to properly mix.
- Use high quality rice hulls

Example: for one acre mix:

Rush	9.60 pounds
Appar	0.47 pounds
SRP	0.42 pounds
Rice hulls	13.10 pounds

Test Drill Calibration

- Grain drills have 2 separate sides, calibrate each side
- If using a gang of drills, calibrate each drill

Charge drill and once seed begins flowing through the flutes, run drill over a hard surface and count seed from each species along a distance of 5 feet from 4 rows (2 each side) and average

$$\frac{\text{Number of seed per species}}{5 \text{ feet}} = \text{number seed per foot}$$

- Tractor should be moving at same rate of speed as when planting
- Make sure all drill flutes are feeding properly

Example:

- Note: target is: 20 - 25 PLS seeds/square ft or
10 - 12 PLS seeds/linear ft (6-7 inch row spacing)
- This translates to about: 22 - 28 Bulk seeds/square ft or
12 - 15 Bulk seeds/linear ft (6-7 inch row spacing)

Rush	10 Bulk seeds/linear ft of drill row at 7 inch row spacing
Appar	2 Bulk seeds/linear ft of drill row
SRP	0.3 Bulk seeds/linear ft of drill row



Calibrating a rangeland drill.

Conduct Test Run and Make Drill Adjustments

- If one species in the mix is consistently short, ensure that the seed and rice hulls are thoroughly mixed.

Other Considerations

- Rice hull mixtures work better in drills with metal flutes. Plastic flutes create static electricity and can cause seed/rice hull mixtures to hang-up and plug.
- Do not fill drill box to more than ½ full. Filling a drill to the top is a leading cause of mix separation and bridging of seed.
- Agitators in the seed box aid in maintaining a constant flow. Agitators tend to quit working rather easily without notice so it is important to keep an eye on the seed flow and periodically stir the seed mix. A stout stick or hoe can be used to stir the seed mix.
- Awn-tipped seed will cause bridging - increase rice hulls to 65 - 70 percent of mixture
- For seed with no bushel weight listed in table 1, weigh a bushel equivalent for that seed lot and use that figure to determine rice hull mixture.

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Table 1.
Pounds of Seed per Bushel for Recommended Releases ^{1/}

Common Name	Recommended Releases	Pounds per Bushel
RICE HULLS	U. S. # 1 Grade	9.0
GRASSES		
Bentgrass, Redtop	multiple turf grasses	14.0
Bluegrass, Big	'Sherman'	17.9
Bluegrass, Canby	'Canbar'	18.8
Bluegrass, Canada	Foothills Germplasm	20.9
	'Rubens'	N/A
Bluegrass, Kentucky	multiple – turfgrasses	14.0
Bluegrass, Sandberg	High Plains Germplasm	15.7
	Mountain Home Germ.	19.3
	Reliable Germplasm	18.0
Bluegrass, Upland	'Draylar'	21.5
Brome, Meadow	'Cache'	26.7
	'Fleet'	N/A
	'Paddock'	N/A
	'Regar'	23.6
Brome, Mountain	'Bromar'	23.1
	Garnet Germplasm	23.0
Brome, Smooth	'Lincoln'	N/A
	'Manchar'	20.6
Canarygrass, Reed	'Ioreed'	34.1
Dropseed, Sand	Common	33.0
Fescue, Arizona	'Redondo'	22.0
Fescue, Hard	'Durar'	25.0
Fescue, Idaho	Common	20.8
	'Joseph'	N/A
	'Nezpurs'	N/A
	Winchester Germplasm	N/A
Fescue, Red	multiple – turfgrasses	N/A
Fescue, Sheep	'Bighorn'	N/A
	'Covar'	24.8
Fescue, Tall	'Alta'	25.4
	'Fawn'	N/A
	'Forager'	N/A
	'Johnstone'	27.4
Foxtail, Creeping	'Garrison'	9.6

^{1/} For seed with no bushel weight data, weigh a bushel equivalent for that seed lot and use that figure to determine rice hull mixture. You may also use an average of bushel weights for a given species.

Table 1 continued.
Pounds of Seed per Bushel for Recommended Releases

Common Name	Recommended Releases	Pounds per Bushel
Hairgrass, Tufted	'Norcoast'	N/A
	'Peru Creek'	N/A
Junegrass, Prairie	'Barkoel	N/A
Needlegrass species	'Lodorm'	48.0
	Green Stipagrass	N/A
Needlegrass, Thurbers	Common	25.6
Orchardgrass	'Latar'	18.1
	'Paiute'	18.6
	'Potomac'	N/A
Ricegrass, Indian	'Nezpar'	56.5
	'Paloma'	N/A
	Ribstone Germplasm	N/A
	'Rimrock'	51.4
Ryegrass, Perennial	Common	24.0
Sandreed, Prairie	'Goshen'	43.7
Squirreltail, B.	Fish Creek	22.1
	Sand Hollow	25.2
	Toe Jam	22.6
	'Blackwell'	N/A
Switchgrass	'Dakotah'	59.0
	'Forestburg'	50.0
	'Sunburst'	N/A
Timothy	Common	45.0
	'Climax'	N/A
	'Mohawk'	N/A
Wheatgrass, Beardless	'Whitmar'	19.5
Wheatgrass, Bluebunch	'Anatone'	21.7
	'Goldar'	30.0
	'P7'	20.7
	'Douglas'	25.9
Whtgrs, Crested AGCR	'Ephraim'	28.8
	'Kirk'	N/A
	'Parkway'	26.6
	'Ruff'	N/A
	'Roadcrest'	28.0
	'Nordan'	26.0
Whtgrs, Crested AGDE	'Summit'	N/A
	'Hycrest'	25.0
Wheatgrass, Crested X	'CD II'	26.1

Table 1 continued.
Pounds of Seed per Bushel for Recommended Releases

Common Name	Recommended Releases	Pounds per Bushel
Wheatgrass, Intermediate	'Amur'	N/A
	'Oahe'	N/A
	'Reliant'	22.3
	'Rush'	18.9
	'Tegmar'	25.1
Wheatgrass, Newwhy	'Newwhy'	24.7
Wheatgrass, Pubescent	'Greenleaf'	N/A
	'Luna'	29.0
	'Manska'	21.2
Wheatgrass, Siberian	'P-27'	23.7
	'Vavilov'	24.4
Wheatgrass, Slender	'Pryor'	20.2
	'Revenue'	N/A
	'San Luis'	22.7
	'Secar'	20.3
Wheatgrass, Snake River	'Sodar'	21.1
Wheatgrass, Tall	'Alkar'	17.9
	'Jose'	18.3
	'Largo'	N/A
	'Platte'	N/A
	'Bannock'	16.8
Wheatgrass, Thickspike	'Critana'	18.5
	'Elbee'	N/A
	'Schwendimar'	15.0
	'Arriba'	20.0
	'Barton'	N/A
Wheatgrass, Western	'Flintlock'	N/A
	'Rodan'	18.7
	'Rosana'	19.5
	'Eejay'	N/A
	'Pearl'	N/A
Wildrye, Altai	'Prairieland'	19.1
	'Magnar'	18.5
	'Trailhead'	17.5
Wildrye, Basin	Washoe	18.5
	'Shoshone'	36.4
Wildrye, Beardless	'Arlington'	N/A
	Little Naches Germplasm	29.2
	Union Flat Germplasm	27.2
Wildrye, Blue	'Mandan'	25.3

Table 1 continued.
Pounds of Seed per Bushel for Recommended Releases

Common Name	Recommended Releases	Pounds per Bushel
Wildrye, Mammoth	'Volga'	16.3
Wildrye, Russian	'Bozoisky-Select'	23.6
	'Cabree'	N/A
	'Mankota'	19.0
	'Swift'	N/A
FORBS-LEGUMES		
Alfalfa	multiple varieties	60.0
Aster	Common	N/A
Balsamroot, Arrowleaf	Common	N/A
Burnet, Small	'Delar'	23.1
Clovers	Common	60.0
Clover, Alsike	'Aurora'	N/A
Clover, Red	'Big Bee'	N/A
	'Dollard'	N/A
	'Kenland'	N/A
	'Redman'	N/A
	'Reddy'	N/A
Clover, Strawberry	'Salina'	N/A
Clover, White	'Ladino'	N/A
	'Grassland Huia'	N/A
	'Kent Wild'	N/A
	'New York'	N/A
Flax, Blue	'Appar'	46.1
Flax, Lewis	Maple Grove Germplasm	38.8
Globemallow	Common	23.5
Milkvetch, Cicer	'Lutana'	65.3
	'Monarch'	N/A
	'Windsor'	N/A
Penstemon species	'Bandera'	27.5
	'Cedar'	N/A
	Clearwater Selection (Venus)	30.6
	Old Works fuzzy tongue	40.1
	Richfield Select. (firecracker)	34.8
Prairie Clover	Antelope Germplasm	63.8
Prairie Coneflower	Stillwater Germplasm	33.1
Sagewort, Louisiana	'Summit'	N/A
Sainfoin	'Eski'	N/A
	'Remont'	28.6
Sweetclover	Common	60.0
	'Madrid'	N/A
Sweetvetch, Utah	'Timp'	50.0

Table 1 continued.
Pounds of Seed per Bushel for Recommended Releases

Common Name	Recommended Releases	Pounds per Bushel
Trefoil, Birdsfoot	Common	62.0
	'Empire'	N/A
	'Maitland'	N/A
Yarrow	Eagle Germplasm	37.0
	Great Northern Germplasm	20.6
	Yakima Germplasm	36.0
SHRUBS		
Bitterbrush, Antelope	'Fountain Green'	N/A
	'Lassen'	N/A
	Maybell Source	32.5
Cinquefoil	Common	N/A
Kochia, Forage	'Immigrant'	13.6
Rabbitbrush, Green	Common	N/A
Rabbitbrush, Rubber	Common	N/A
Rose, Woods	Common	N/A
Sagebrush, Basin Big	Common	N/A
Sagebrush, Black	'Pine Valley Ridge'	N/A
Sagebrush, Mountain Big	'Hobble Creek'	N/A
Sagebrush, Wyoming Big	'Gordon Creek'	N/A
Saltbush, Fourwing	'Rincon'	16.5
	Snake River Plains Germ.	25.4
	'Wytana'	22.7
Saltbush, Gardner	Common	N/A
Shadscale	Common	20.9
Snow Buckwheat	Umatilla	43.9
Winterfat	'Hatch'	N/A
	Northern Cold Desert Germ.	29.1
	Open Range Germ.	33.1