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# UPLAND SEEDING

## TECHNICAL GUIDANCE DOCUMENT



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### INTRODUCTION

Seeding is a restoration strategy that is used to restore a variety of upland plant community types including dry prairie, mesic prairie, and oak savanna. Diversity levels for upland plant communities can vary significantly, depending on project goals. Projects designed mainly for nesting cover of grassland birds or soil stabilization typically use lower diversity mixes dominated by native grasses. Projects designed to benefit a wider variety of wildlife species (grazers, birds, insects, etc.) throughout the year, promote ecological resiliency and productivity, tend to use high-diversity mixes. Upland seeding can be conducted by broadcast seeding or with seed drills. The choice of seeding methods depends on the season of planting, the seedbed, and the type of seed to be planted. Broadcast seeding involves spreading seed by hand or by mechanical equipment on the soil surface. This is followed by packing the seedbed to achieve good seed-to-soil contact.



*Advantages of broadcast seeding include:*

- Prevents the row effect left by seed drills.
- Can be conducted with seed that has not been cleaned (wild harvested). This is a common practice for the Fish and Wildlife Service and Minnesota Department of Natural Resources, which harvest seed from remnant communities or established prairies to be spread on new restoration sites. It is common to conduct a seed test for purity and germination when using wild-harvested seed to determine seeding rates.
- Does not require the soil to be tilled before planting and therefore is useful in areas where there is a risk of erosion or germination of weeds and invasive species.
- Can be conducted in the spring, fall, or winter.

*Limitations of broadcast seeding include:*

- When using seed mixes that contain a variety of seed sizes, smaller seeds tend to settle to the bottom of broadcast equipment (Fuge 2000). To achieve uniform coverage it is often necessary to separate out smaller seeds and plant them separately.
- Broadcast seeding is not recommended in areas that will likely be flooded or have flowing water that will prevent establishment.
- Results are sometimes less predictable than drill seeding and not encouraged by some programs.

Broadcast seeding is conducted with agricultural broadcast seeders, ATV mounted seeders, and Vicon-type seeders adapted to spread mixes of a variety of seed sizes. Helicopters and airplanes have been used for broadcast seeding in areas with wet or otherwise inaccessible conditions. Sand, vermiculite or other inert carriers are mixed with seed to make broadcast seeding easier. Packing is conducted with cultipackers and drum or helicoil packers (Fuge 2000).

### **Drill Seeding**

Seed drills plant seeds in shallow slits in the soil surface are created by the machinery. Grasses are planted deeper than forb seed that is dropped on the surface and then packed. Seed drills are commonly used on upland sites, particularly in situations where additional soil disturbance may cause erosion or weed germination.



*Advantages of drill seeding include:*

- Results are predictable if equipment is calibrated correctly.
- Seed placed below the surface is protected and has good seed-to-soil contact, resulting in high germination rates, requiring less seed than when broadcast seeding.
- Soil does not have to be tilled before planting (particularly with no-till drills). This is useful in areas where there is a risk of erosion or the germination of weeds and invasive species.
- Existing, desirable vegetation is not disturbed.

*Limitations of drill seeding include:*

- Seed drills are limited to areas where heavy equipment can be used.
- Very clean seed is needed to avoid clogging the drill.
- A relatively firm bed for planting is required; site preparation work may be needed (i.e. cultipacking).
- Seed drills can favor the germination of grasses over forbs, influencing diversity.
- Seed drills cannot be used for winter seeding.

Equipment and materials for drill seeding include: Truax, Tye, Nesbit, Great Plains, and John Deere Rangeland seeders. Native seed drills have been constructed to accommodate different shapes and sizes of seed and use small plows or disks to open furrows. Seed drills also cover the seed with soil and pack with rubber rollers to ensure good seed-to-soil contact (Fuge 2000).

Seed drills can be rented from many Soil and Water Conservation Districts (SWCDs) for a reasonable fee and many native plant nurseries and commercial seed farms do custom seeding for a fee.

Brillion and Trillion type seeders are hybrids between broadcast seeders and seed drill; they drop seed on the soil surface and use rollers to accomplish seed-to-soil contact. These types of seeders work well on fields that were previously in soybeans or fields with annual grain stubble.

## **APPLICATION**

**Broadcast Seeding (fields previously in agriculture)** – Both fall and spring plantings are common for upland sites. Spring plantings are conducted between mid-April and late June. Fall planting of uplands can be done between mid-October and freeze-up of the soil surface, though project location and seasonal conditions can influence seeding dates. Fall planting is considered to result in the most successful germination of forbs because seed stratifies over winter, though fall planting can result in high germination rates of cool-season grasses such as Canada wild rye. Fall planted prairies are less likely to be dominated by warm-season grasses such as big bluestem and Indian grass than spring planted ones. Warm-season prairie grasses will not germinate when mean soil temperatures are below 65 degrees Fahrenheit, so they normally will not germinate in late fall and early spring.

Broadcast seeding is sometimes conducted on soybean fields in the fall without additional site preparation, though harrowing is often needed to loosen the soil surface. When broadcast-seeding, carriers such as cracked corn, vermiculite, or sand can be added to seed mixes to make seed dispersal easier and make it easier to see where seed has been spread. Carriers and seed can be combined in barrels that are then sealed and rolled over the ground surface for mixing. Seed can also be mixed with grain shovels on a smooth, clean floor.

When broadcast seeding, make two or three passes at right angles with a broadcast seeder to ensure that the entire site has been seeded. Sites should be cultipacked or rolled after broadcast seeding to ensure seed-to-soil contact. An exception is when late fall or winter seeding and snow will promote seed to soil contact. In some cases, large seed such as fluffy grasses are broadcast first followed by harrowing and then small forb seed is broadcast followed by cultipacking. As a general rule, seed shouldn't be buried deeper than one-half inch and small seed should be at the surface. Rolling firms the soil around the seed and reduces moisture loss during germination.

In some cases upland mixes are seeded into temporary cover crops. In these situations the temporary cover may need to be mowed down and a no-till drill, Brillion, or Trillion seeder used to install the seed. If broadcast seeding will be conducted, such as for wetlands, the permanent wetland mix can be broadcast into the cover crop stubble. In some cases a disk is used to loosen the soil and incorporate the cover crop stems but additional time is often needed to allow the soil to settle and the tilling may promote weeds if done in the spring. Additional weed growth is not a concern in late fall.

Fertilizers are typically not necessary when seeding upland areas unless the soils are found to be low in available nutrients. Low-nutrient soils should be tested for available NPK (Nitrogen, Phosphorus, Potassium). If phosphorus and potassium levels are low, use a 0-10-20 NPK analysis slow-release fertilizer applied at 60 pounds per acre. Nitrogen is not recommended when establishing warm-season grasses because it can lead to increased weed competition and can promote reed canary grass growth if washed into wetlands. Lime is not necessary if soil pH is 5.5 or higher.

**Broadcast Seeding (into perennial weeds)** - Broadcast seeding can be conducted in fields with perennial weeds such as smooth brome grass if sufficient management can be conducted afterward. This strategy has been used by the Detroit Lakes Fish and Wildlife Service Office in situations where extensive site preparation is not possible (Hanson & Kahan 2008). The following steps outline the process for early spring broadcast seeding.

- Conduct an early spring prescribed burn where you wish to change the vegetative community.
- Seed directly into the ash the next day.
- When the existing non-native vegetation reaches four to eight inches, spray with a high rate (2 Qts.) of glyphosate & surfactant.
- Conduct another early spring burn again in four years.
- Follow the burn with a glyphosate herbicide application (1 to 1.5 Qts.) when the non-native vegetation that remains reaches a height of one to two inches. If any native species are up, they will not be affected by the glyphosate at this very early stage of growth.

**Broadcast Seeding (in late winter)** – Broadcast seeding of prairies can be conducted into the fall and during the winter months when site conditions allow it. Conditions are most suitable for this type of seeding late into the fall or late into the winter when snow depths are limited or packed down. The natural freezing and thawing action helps set the seed firmly in the soil (eliminating the need for further packing), preparing it for growth in the spring. This technique, often referred to as frost seeding, should be conducted on a previously prepared seedbed. Frost seeding has also been successful on sites where soybeans were recently harvested without additional site preparation. This technique is not recommended for areas that will likely be flooded or have flowing water the following spring.



The following are guidelines for winter seeding from the Detroit Lakes Wetland Management District (*Prairie Restoration Techniques/Tips*, Hanson, L. Kahan, S.)

- Conduct a fall glyphosate herbicide application (1 Qt.) or do this application in early spring prior to native emergence (timing is important)
- Be ready to seed when conditions are right (have seed and equipment ready)
- Seed late in the winter when sun has a higher angle (late Feb./March/early April)
- Pick partly to mostly sunny days with temperatures between 20° to 40° F
- Seed when there is less than one foot of snow
- Start work early so that seeding is done by 1:00 pm allowing time for sun to warm seed into the soil.
- Since this technique maximizes emergence of native forbs, post seeding mowing may not be needed.
- On soybean stubble most natives will attempt to produce seed the first summer
- If mowing is required, clip very high (18 to 30 inches).

## Drill Seeding

Seed drills require a seed bed that is relatively firm. Sites that were recently tilled should be cultipacked or rolled to ensure a firm seed bed for planting. As they can cut through stubble effectively, no-till drills work well on sites that have been in agricultural production. Drill seed directly into existing crop residue or vegetation or after the site has been cultivated and packed. The following are recommended guidelines for drill seeding:



- Ensure the seedbed is properly packed.
- Use a seed drill designed for native seed.
- Keep the tractor speed at 2-3 miles per hour.
- Attempt to seed shortly before a rain
- Keep the seedbox at least 1/3 full.
- Plant no deeper than ¼ inch.
- Seed widely over the entire site and then make passes over smaller areas to place specialized species (Galatowitsch and van der Valk 1994).
- Mowing of weeds with a rotary mower is very important the first year and may be needed in the second year to decrease weed competition and seeding.

If weeds are germinating around the time that seeding is conducted, the weeds can be sprayed a week before seeding or within five to seven days after seeding.

## OTHER CONSIDERATIONS

Weed control should be conducted before seeding until problematic weeds are controlled. Stabilizing the upland areas either before or after the seeding is recommended to protect seedlings from wind and drying. Mowing and spot herbicide treatment of weeds is important to ensure that upland seeding is successful.

## COSTS

The costs for upland planting vary depending on the size of the area to be planted, site conditions and the equipment to be used. Seeding generally costs between \$20-100 per acre. Upland seed mixes range in cost from \$75 per acre to \$800 per acre depending on diversity levels and seeding rates.

## ADDITIONAL REFERENCES

The Tallgrass Restoration Handbook for Prairies, Savannas, and Woodlands, Packard, S., Mutel, C.F.

Going Native, A Prairie Restoration Handbook for Minnesota Landowners, Fuge E.

Restoring Canada's Native Prairies: A Practical Manual, Morgan, J.P., Collicutt, D.R. and Thompson.

Prairie Restoration Techniques/Tips, Detroit Lakes Wetland Management District, Hanson, L, Kahan, S.

*A Landowner's Guide to Prairie Management in Minnesota*, Svedarsky, W.D., M.A. Kuchenreuther, G.J. Cuomo, P. Buessler, H. Moechnig, and A. Singh.

*The Tallgrass Restoration Handbook for Prairies, Savannas, and Woodlands*, Packard, S., Mutel, C.F.

*Going Native, A Prairie Restoration Handbook for Minnesota Landowners*, Fuge

*Restoring Canada's Native Prairies: A Practical Manual*, Morgan, J.P., Collicutt, D.R. and Thompson.

*Restoring the Tallgrass Prairie: An Illustrated Manual for Iowa and the Upper Midwest*, Shirley S.

*Establishment of Native Grasses & Forbs (645) NRCS Biology Job Sheet #9*