General Guidelines for Native Seeding in South Texas

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Table of Contents

Summary……2

A word about cost……2

Site preparation……2

Seed mixtures and seeding rate……5

Planting equipment……8

Management considerations……11

Evaluation performance……14

Bird nest in reseeded native grassland.

General Guidelines for Native Seeding in South Texas

Summary

Planting native seeds is a viable tool for south Texas land managers to combat exotic grass invasion and increase wildlife habitat availability and quality. This document serves as a non-technical, easy-to-use guide for landowners, managers, and amateur restorationist to successfully implement the practice of planting native seed in south Texas. For more detailed information on this topic, please consult the *Restoration Manual for Native Habitats of South Texas*, or the website of the South Texas Natives Project (http://ckwri.tamuk.edu/research-programs/south-texas-natives/).

A word about cost

Seeding natives is a high cost land management practice. Native seed mixes can cost 50-hundreds of dollars/acre. Excellent site preparation is rarely done for less than $25/acre. Maintenance costs for suppressing exotic grass reinvasion will approach $10/acre annually. These costs necessitate prudent action on the part of those planting native seed to insure things are done right. Excellent seedbed preparation, proper seeding techniques, and post-planting management of reinvading exotic grasses are critical actions to ensure success-at less than half the cost of the initial seed investment. To control seed costs, careful calibration of seeding equipment is also prudent. Planting more seed than recommended, or planting more than once should not be necessary if you do it right the first time.

Site Preparation

Photos of adjacent areas and restoration sites in Maverick County, June 2010. Left is representative condition before restoration efforts, dominated by exotic grasses; center had poor seedbed prepared prior to seeding; and right shows 65% cover of seeded native grasses obtained when planted the same date as center, but with an good seedbed prepared.

Preparing an excellent seedbed is essential to establishing native plants by seeding! Common seedbed preparation techniques and when to use each:

- ***Cover crops***-planting traditional crops such as oats, sorghum, or peas at the same time, or before sowing native seeds is a beneficial practice on many restoration sites. These plants help

build soil microbial populations and prevent erosion between planting and emergence of native seed. Since these crops are short-duration annuals, they typically emerge and complete their life cycles before most native plants emerge.

- ***Mowing***-when renovating or converting vegetation from one type to another, it is best to first mow the existing vegetation as short as possible to allow efficient use of soil preparation equipment and herbicides.
- ***Prescribed fire***-can be substituted for mowing to save cost, but will result in ash and soot on equipment and operators (use with cab tractor for later preparation).
- ***Herbicides***-are useful for added control of some exotic invasive grasses, but herbicide application almost always must be followed by mowing or burning before use of soil cultivation equipment. Applications of glyphosate (trade names Roundup, Cornerstone, etc.) may be useful to "brown-out" dense stands of unwanted grasses to facilitate a prescribed fire or easier shredding. Herbicides may also be useful after cultivation if weeds emerge between final site preparation and seeding.
- ***Discing***-the principle site preparation treatment on restoration sites, it is used to break-up the top layer of the soil surface and remove unwanted plants. Two passes with a heavy, off-set disc are best, but should be followed by a field cultivator or finishing disc to create uniformity of the soil surface.
- ***Moldboard plowing*** –deeper plow that "flips" the top layer of soil. Should be used in areas with surface soil textures >24". Moldboard plowing is extremely effective at removing sod-forming exotic grasses such as bermudagrass and Old World bluestems if conducted during hot, dry weather. Moldboard plowing also helps bury the existing exotic grass seed bank.
- ***Finishing disc or field cultivator***-light weight or minimal depth implement that levels the planting site, reduces clod size, and provides a uniform surface for planting.
- ***Cultipacker or roller-*** the final implement used just prior to and after planting to firm and level the seedbed, resulting in consistent planting and good soil to seed contact. For best results one pass should be done just prior to planting, and one just after planting, especially when broadcast seeding. When seed is planted with a drill, cultipacking or rolling afterward may not be needed.
- ***Drag***-lightweight implement (can be a gate, rail-road tie, post, or cattle panel) to be pulled across the seedbed after broadcast planting to lightly cover seed. Should be followed by cultipacking or rolling to insure good seed-soil contact.

An excellent seedbed is:

- **Firm** (You should be able to walk across the seedbed in flip-flops or sandals).
- **Even** (Are there noticeable low spots or humps? If wearing flip flops would you trip or get soil in-between your toes?).
- **Weed-free** (Is there anything green present? If so, make sure it is a plant that is desirable on the site, because it will out-compete native seedlings if you don't remove it!).
- **Free of clods and old grass clumps** (Is there anything in the seedbed, besides rocks, that you can throw more than 10 feet?).

What time of the year to plant?

- We have successfully planted diverse native seed mixes in every month of the year.
- Planting season generally has implications for short-term success; in our research there is no correlation between long-term success and planting date.
- For short-term results, our research indicates that seeding between *August 20 and September 30* is ideal in most of south Texas.
- In areas formerly dominated by exotic grasses, late summer or early autumn plantings have resulted in greater success than spring or early summer seedings.

Excellent seedbeds

Good-fair seedbeds

Poor seedbeds

Seed Mixtures and Seeding Rate

<u>The importance of selecting the right seed for your planting site</u>

- Selecting the right species and the origin of the seed you plant are two of the most important consideration of a restoration project. Non-adapted plants will not persist.
- Soil textures have a tremendous influence on plant community composition.
- Different plants will perform best on coarse vs. fine textured soils on the same ranch.
- Our seed release brochures list general adaptations according to soil texture
- Early successional native plants that will establish quickly and provide quick cover should comprise 25-50% of most native seed mixtures. Examples of early successional plants are:
    - Zapata Germplasm Rio Grande clammyweed
    - Divot Tallow Weed Blend
    - Dilley Germplasm slender grama
    - Texas panicum
    - Van Horn green sprangletop
    - Welder Germplasm shortspike windmillgrass
    - Mariah Germplasm hooded windmillgrass

Early successional native grasses (slender grama (l) and shortspike windmillgrass (r)) are essential components of restoration seed mixes in South Texas. These fast establishing grasses help prevent erosion and limit exotic grass invasion onto restoration sites. Rio Grande clammyweed, an early successional native forb can also be seen in the bottom right of this picture.

How to determine the seeding rate of a multiple species mix:

- **Always plant native seed at the recommended seeding rate. A given piece of ground can only support a given number of plants. A century of scientific research with forage and range plants, and our own research with native plants tells us this is the equivalent of 20 pure live seeds planted per square foot. Published seeding rates for our releases are based on this rate at the average percent pure live seed of the plant releases. More seed is not better, it is simply a waste of money.**
- Find the pure stand seeding rate of each species in the mix.
- Determine the percentage of each species you desire on your site, convert to decimal expression (10%=0.10).
- Multiply the pure stand rate by the decimal expression of the species desired
- Example
    - Mix of Arizona cottontop 25%, slender grama 50%, and plains bristlegrass 25%
    - Pure stand rates are: Arizona cottontop 2 lbs PLS/acre, slender grama 8 lbs PLS/acre, and plains bristlegrass 2 lbs PLS/acre
    - Calculations
        - Arizona cottontop 2 lbs PLS/acre x 0.25 of mix =0.50 lbs PLS in mix per acre
        - Slender grama 8 lbs PLS/acre x 0.50 of mix = 4.00 lbs PLS in mix per acre
        - Plains bristlegrass 2 lbs PLS/acre x 0.25 of mix =0.50 lbs PLS in mix per acre

Multiple species native seed mixes require careful calculations to ensure proper planting rates. Most commercial seed producers will premix seed according to the desired species composition for consumers on request.

Converting pure live seed to bulk seed for calibration and planting purposes:

- Pure live seed (PLS) is an expression of the percent of actual weight of the bag of seed that is viable seed.
- PLS is used to determine *seeding* rates, percent PLS will be listed on the analysis tag of the bag of seed.
- Bulk seed weight must be used to determine actual seeding rates and to calibrate planting equipment.
- When calibrating planting equipment, the exact seeding rate frequently cannot be metered by the drill or broadcaster. Deviations from the recommend rate of +/- 10% are acceptable. In some cases, to put out the amount of seed needed on the site, 2 passes with planting equipment are required.
- To convert desired PLS planting rate to bulk seed, multiply lbs PLS x 100, then divide by % PLS of the seedlot
- Given the previous mixture above for one acre, assume that PLS is 50% for Arizona cottontop and slender grama, and 75% for plains bristlegrass
    - Calculations
        - Arizona cottontop 0.50 lbs PLS per acre @ 50% PLS= 1.00 lbs bulk seed
        - Slender grama 4 lbs PLS per acre @ 50% PLS =8.00 lbs bulk seed
        - Plains bristlegrass 0.50 lbs PLS @ 75% PLS =0.66 lbs bulk seed
        - Equipment should be calibrated to plant 9.66 lbs (+/- 10%) of your seed mix per acre

Careful calculations to determine accurate seeding rates and precisely calibrate planting equipment are essential parts of any restoration seeding effort.

Planting equipment

Native Seed Drill-using a specialized native seed drill to plant native mixes is the superior seeding method in almost all instances. Limitations to these drills are: 1) few exist in south Texas (check with your local NRCS office or SCD for more information), 2) they are difficult to calibrate, 3) they work best in good-excellent seedbeds, and 4) they plant large acreages slowly. Advantages of these drills are 1) even planting and distribution of seed, 2) ability to plant seed shallow, but cover it, 3) able to plant a large variety of seeds simultaneously (we've planted mixes of 20+ species of native seed in one pass with a Truax drill). If you are considering doing large amounts of native seeding in the future, a specialized native seed drill might be a good investment.

Native seed drills such as this Truax Flex II, are the best tool to use to plant native seed mixes.

Traditional grain drill-can be used with coated seed or native plants with large seed. The major limitation to use of these drills for native seed mixes is the inability to plant small-enough quantities of bulk seed. Also, most grain drills plant native seeds deeper than the optimal planting depth for emergence. Many native seeds will bridge-up in these planters and require time consuming monitoring and unclogging if used with uncoated seed.

Broadcaster-is used to plant extremely fluffy seed such as bluestems and some grama species if the seed cannot be coated. Broadcasting is a good tool for very rough or rocky terrain, or for uneven seedbeds. Accurate calibration and metering is more difficult with broadcasters than drills. In most all cases, broadcast planting must be followed by dragging and/or cultipacking to insure good soil to seed contact and lightly cover the seed to reduce depredation by insects, rodents, and birds. Dragging should be done at a 90° angle to the path of seeding to help spread seed over gaps in seed distribution. Broadcast seeding can be challenging during windy times.

Broadcaster seeders are useful to plant fluffy native seeds, but applications must be followed by dragging, rolling, and packing to ensure soil to seed contact and seed coverage.

Aerial seeding from fixed winged aircraft-is an excellent technique for large acreages, rocky sites, or rough terrain as a resulting from brush management efforts. Cost for aerial seeding can be half that of ground-based methods. Insure that aerial seeding contractors have the equipment and ability to accurately meter seed, and experience planting multiple species seed mixtures. Efforts to insure good soil: seed contact may be needed on some soils. Carriers such as cracked milo or other inert bulking agents may be needed to insure good seed distribution of small native seeds.

<u>Planting depth, and packing the seedbed after planting:</u>

- As a general rule, native seeds should be planted no deeper than ¼"; many should be planted shallower or essentially left on the soil surface.
- Packing or pressing seed into the seedbed will improve establishment by ensuring moisture retention near the seed.
- If some seed is not visible on the soil surface after a pass with your drill, you can be certain most of it is getting planted too deep!

Some seed visible on the soil surface after planting is desirable, especially with small seeded native grasses.

Managing a Native Plant Restoration Site after Seeding

- ***Patience*** is a necessity of planting native seed. Native seeds are not selected or adapted to germinate under a broad range of conditions, or to germinate immediately after planting the way traditional crop seeds are. Native seeds can and frequently do germinate and establish 3 or more years after being planted. While some early successional plants establish quickly, many of the most desirable native species rarely, if ever, visibly establish until a year or more after being planted. **We have monitored plantings that were very successful long-term, but *did not have a single native seedling present for 6 months to 1.5 years after planting!*** Even under ideal moisture and planting conditions, maximum expression of a reseeded native community will still take a minimum of 6 months. If you desire quick results, a high percentage of your seed mix should be early successional plants like slender grama, windmillgrasses, and annual forbs and wildflowers.

This successful planting had no rain whatsoever for 6 months after planting!

Management considerations

Dense cover of volunteer native forbs may slow the early establishment of native grass seeds, but generally does not impact long-term performance.

- ***Broadleaf weed control, yes or no?-***many native weeds are a positive at low to moderate densities; they are nurse plants for other natives. These weeds provide cooler, moister micro sites beneath their canopies that favor the establishment of native grasses. Volunteer sunflowers, cowpen daisies, or croton plants DO NO HARM AT MODERATE DENSITIES to a native planting, and they are excellent food sources for wildlife. Even pigweed, at moderate densities, is a beneficial plant on most restoration sites. If solid (complete shade beneath), tall (>4') canopies of weeds appear to be developing, shredding may be advisable. Care should be taken to shred before the weeds get too tall, otherwise the shredded vegetation may act as mulch and prevent future seedling emergence. An excellent guide for determining if weed control is necessary is to view seedlings weedy and weed-free areas; if seeded plants in weedy areas are performing similar to those in weed-free areas, control is not warranted.

Planting site (l) where weed control might have been beneficial. Please note however, we did not control these sunflowers, and still had successful planting results. Planting site (r) where no weed control is necessary and weeds present likely increased native grass establishment.

- ***Irrigation, yes or no****?*-unless a commitment to irrigate religiously for 2-6 months can be made, most native plantings are best left up to the mercy of rain. Irrigation can promote germination in unnatural conditions (i.e. extremely hot weather, or the wrong season of the year), and if too much irrigation is applied, shallow root development can be expected. Also consider that irrigation water can be a major source of exotic grass and weed seed in south Texas (unless the water source is a well).
- ***Address exotic grasses***- Exotic grasses almost always begin to invade restoration sites within 3 months of planting, even with very little rain. *The amount of exotic grasses that emerge on the restoration site is directly correlated to the quality of site preparation done before seeding*. Thorough site preparation efforts usually result in only sporadic early occurrences of exotic grasses after planting. As soon as exotic grass seedlings can be definitely identified, immediately spot treat or "IPT" these patches before they produce seed, using glyphosate herbicide. This action will make a big difference in reducing the amount of these unwanted plants that will later impede native plant establishment. Many exotics are easy to kill with glyphosate when small, but almost impossible to control with herbicides once they reach full maturity. Once good establishment of native plants occurs, the spread and reinvasion of exotics will be slowed significantly, but not stopped. Bi-annual IPT of exotic grass patches is the greatest insurance of long term success and productivity of a native restoration site. Typically, applications in early spring and early fall are appropriate timing for these treatments. IPT of exotic grasses is the most beneficial post-planting management action on native plant restoration sites in south Texas.

In early growth stages, volunteer plants of exotic grasses (such buffelgrass in foreground) can be controlled by IPT applications of glyphosate herbicide.

- ***Soil crusting***- is a problem on some sites, however, adequate rains for native seed germination will typically correct this problem.
- ***Herbicides***-are generally too nonselective to be of use in diverse native plantings, and other than for spot spraying unwanted exotic grasses, they have limited use in most restoration seedings. Some special situations do benefit from herbicide use:

- *For plantings of grasses only*: 2, 4-d herbicides can be very effective at reducing broadleaf weed competition. Some native grass seedlings are harmed by 2, 4-d at the seedling stage, so defer applications of this herbicide until grasses are 6" or taller, or consult with herbicide specialists for more guidance.
- *In forb only plantings*: grass specific herbicides such as Fusillade can be used to control unwanted grass competition. Applications of grass specific herbicides are expensive, so make sure grasses to be sprayed are actively growing before applying.
- *If sod-forming grasses such as bermudagrass or Old World bluestems re-emerge from old rhizomes before native seeds germinate* : a quick application of glyphosate to the entire site will be beneficial. Timing of this type of treatment is crucial, it must be done before native seeds germinate and the leaves emerge from the soil.

- ***Insect control***-is generally not needed, and insect infestations will not harm a species-diverse planting of native seed**.**
- ***Prescribed fire*-**should be completely deferred for 2-3 years, afterward extreme discretion should be heeded; fire often encourages the incursion of exotic grasses into native communities. Furthermore, many native grasses require 2-3 years to develop adequate root systems to withstand high intensity fires.
- ***Livestock grazing***-implementation is dependent on plant development and establishment. Once plants reach full maturity (check release brochure for these specifications and sizes) and produce seed, grazing can be implemented. Grazing pressure should be kept at low-moderate levels for 2-5 years after seeding native vegetation.

Livestock grazing should be closely monitored on restored native pastures for up to 5 years after seeding.

Evaluating performance

- ***By the numbers****:*
  - Seeding success can easily be measured with a simple ft^2 frame randomly placed at 100 locations throughout the restoration site.
  - If an average of 0.5-1 seeded plant is present per ft^2 across the restoration site between 1 and 2 years after seeding, most agencies define this as a successful planting.
  - Other agencies require 70% perennial vegetative cover by 6 months; rarely is this metric achievable in south Texas unless the seed mix is dominated by annuals and early successional grasses.
  - Plant density of 1 or more seeded plant per square foot will result in a community principally dominated by native plants on most planting sites.
  - In exotic grass dominated areas, plant densities of 5-10 native plants per square foot may be needed to suppress exotic grass reinvasion
  - Goal oriented success:
    - Example 1: Increase species diversity by 500%=establish 5 native species in a buffelgrass dominated area
    - Example 2: Increase structural components needed by wildlife, i.e.:
      - Perches for grassland birds (establish big bluestem, and other tall grasses)
      - Pollinator and insect plants (plant native annual forbs)
      - Foraging areas for deer and quail (plant perennial and annual forb species)
      - Nest sites for grassland birds (establish native bunchgrasses)
      - Shortgrass areas for prairie wildlife species (plant gramas and windmillgrasses)

Photo showing seedling (l) and plant density (r) of slender grama exceeding 5 plants per square foot. Most conservation programs rate plantings with 0.5-1 seedlings per square foot, 1-2 years after planting, as satisfactory or successful. In areas where exotic grasses are problematic, higher plant densities may be needed to insure long-term native plant dominance.

- ***Set realistic goals***
    - A goal of percent plant cover equal to the degree of native plant cover in adjacent relict stands is a wise one. Cover approaching 100% may be possible in high rainfall areas in the Gulf Coast prairies, but in western south Texas, vegetation cover of 20-40% may be the maximum possible, and achieving this is just as successful as 100% cover along the coast.
    - Increasing plant diversity-adding plant diversity of just a few species can have a profound effect on insects, wildlife, and ecosystem function. The addition of 1 or 2 wildlife food plants to exotic dominated systems may have immediate benefits for recreational use of these areas.
    - Modifying vegetation structure -adding native bunchgrasses to retired croplands may provide a critical habitat component for quail. Adding structural diversity to exotic grass monocultures may increase wildlife use. Structural diversity may be a major limiting factor in exotic grass dominated landscapes.

Restoration of dominant perennial forbs such as prairie acacia (l) and orange zexmenia (r-yellow flowers) may greatly improve exotic grass monocultures for wildlife. These native forbs provide structural diversity, and food for wildlife and insects.

    - Most sites took years to degrade to the point of necessitating restoration by seeding; therefore don't expect to repair these damages overnight. Goals in restoration should have 5-10 year, or even longer horizons for achievement and evaluation.

Four year photo-point sequence of an exotic grass dominated landscape restored using native seed in the Lower Rio Grande Valley of South Texas.

Ten-month photo-point sequence showing progression of reseeded rangeland in Western South Texas. Clockwise from top left: prepared seedbed after planting in August; dominated by annual forbs (mostly clammyweed) and early successional grass in November; high plant density of cool-season annuals (primarily redseed plantain) in March; and >60% canopy cover of perennial native grasses (slender grama, Arizona cottontop and plains bristlegrass) in June.

South Texas Natives

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