Techniques for Converting Bermudagrass Pastures to Native Grassland Habitat to Benefit Bobwhite Quail

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Multiple approach:

1. **Remove Bermudagrass (Summer Yrs 1)**
    a. **Imazapyr & glyphosate**
    b. **Glyphosate**
    c. **Mow & Glyphosate**
    d. **Hairy vetch cover crop**
    e. **Control**
2. **Prepare seedbed (Spring Yr 2)**
    a. **Disk**
    b. **Control**
3. **Seeding method (Spring Yr 2)**
    a. **Drill**
    b. **Broadcast**
4. **Seed mixture (Spring Yr 2)**
    a. **Simple**
    b. **Complex (more early succession)**
    c. **Local**
5. **Post-seed management (Summer Yrs 2 & 3)**
    a. **Mow**
    b. **Graze**
    c. **Control**

Timeline:

1. Project began November 2015 with Bermudagrass removal treatments
    - Plot locations: Beeville, College Station, McGregor, & **Stephenville**
        - **Windthorst find sandy loam**
2. Preparation treatments were completed in December 2016
3. Plots were seeded in March 2017
4. Post planting management was completed July 2017

1. **Bermudagrass Removal**

Bermudagrass treatments	Cost/ac
Repeat glyphosate*	$87.80
Imazapyr** and glyphosate	$116.87
Cut, bale, and repeat glyphosate	$107.17
Cool-season cover crop	$104.57

*3 applications; 96 oz/ac/application of glyphosate

**48 oz/ac of imazapyr

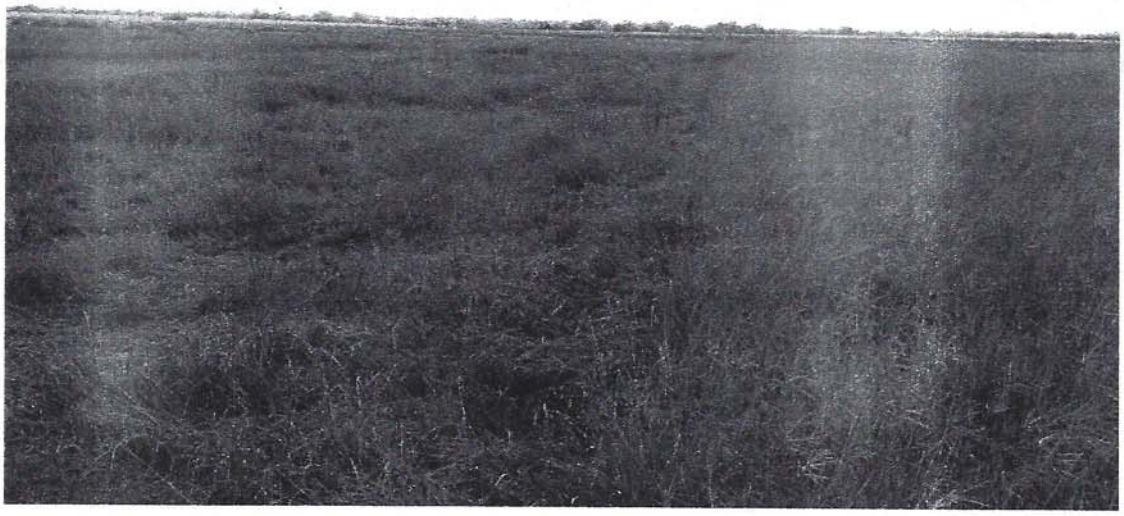

Figure 1. Repeat glyphosate treatment plot (left) and a control plot (right)

Figure 2. Imazapyr treatment (center) with repeat glyphosate (left) and cut, bale and repeat glyphosate (right)

2. Seedbed Preparation

Seedbed preparation treatments	Cost/ac
Disked and broadcast	$25.00
Disked and drilled	$45.50
No-till drilled	$20.00

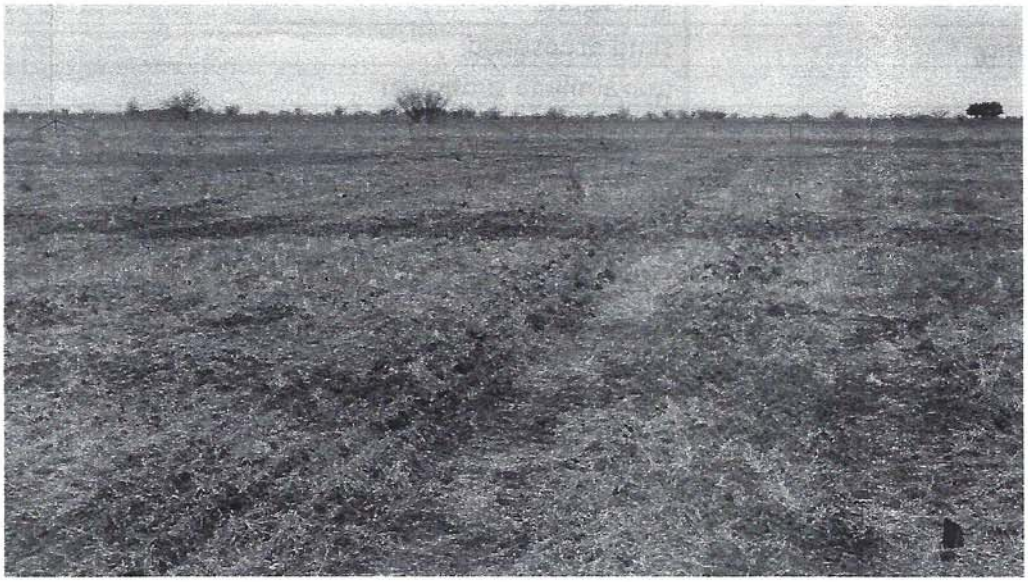

Figure 3. Seed bed preparation applied across all bermudagrass removal project treatments.

3. **Native Seeding**

Low diversity seed mix (NRCS)

Variety	Species	Seeding rate, PLS lb/ac
Earl	big bluestem	0.6
Cimmarron	little bluestem	0.9
Lometa	yellow indian grass	0.9
Bend	sand lovegrass	0.2
Haskell	sideoats grama	0.9
Alamo	switchgrass	0.175
Borden county	sand dropseeed	0.1
Aztec	maxamillion sunflower	0.06
Comanche	partridge pea	0.28
Sabine	Illinois bundlflower	0.3
$56.42/ac		

High diversity seed mix (early, mid late succession)

Variety	Species	Seeding rate, PLS lb/ac
Earl	big bluestem	0.3
OK Select	little bluestem	0.225
Carrizo blend	little bluestem	0.25
Lometa	yellow Indian grass	0.45
Van Horn	green sprangletop	0.1
Haskell	sideoats grama	0.225
Blackwell	switchgrass	0.175
Chaparral Germplasm	hairy grama	0.05
Duval Germplasm	red lovegrass	0.05
Guadalupe germplasm	white tridens	0.05
Borden county	sand dropseed	0.025
Nueces Germplasm	sand dropseed	0.025
La Salle Germplasm	Arizona cottontop	0.1
Welder germplasm	shortspike windmillgrass	0.025
Mariah Germplasm	hooded windmillgrass	0.05
Oso Germplasm	hall's panicum	0.05
Lavaca Germplasm	Canada wildrye	0.05
bend	sand lovegrass	0.05
Texoka	buffalograss	0.05
Cuero	purple Prairie Clover	0.25
Eldorado	Englemann Daisy	0.75
Aztec	Maximillian Sunflower	0.15
Comanche	partridge Pea	0.7
Sabine	Illinois Bundleflower	0.65
Plateau	awnless bush sunflower	0.125
Goliad Germplasm	orange zexmenia	0.03
Plains Germplasm	prairie acacia	0.25
$100.00/ac		

Wild harvest seed mix (Native American Seed)

Species	Species
American Basketflower	Plains Bristlegrass
Annual Winecup	Plains Coreopsis
Big Bluestem	Purple Prairie Clover
Black-eyed Susan	Purpletop
Broomsedge Bluestem	Prairie Verbena
Buffalograss	Prairie Wildrye
Butterflyweed	Rattlesnake Master
Cane Bluestem	Rose Milkweed
Clasping Coneflower	Sand Dropseed
Cutleaf Daisy	Sand Lovegrass
Eastern Gamagrass	Showy Milkweed
Florida Paspalum	Sideoats Grama
Foxglove	Standing Cypress
Green Sprangletop	Switchgrass
Hooded Windmill Grass	Texas Cupgrass
Illinois Bundleflower	Texas Yellow Star
Indian Blanket	Virginia Wildrye
Indiangrass	White Tridens
Inland Seaoats	Winecup
Lemon Mint	White Rosinweed
Little Bluestem	Mealy Blue Sage
Maximilian Sunflower	Prairie Agalinis
Partridge Pea	
$186.00/ac	

4. **Post-planting Management**

Post planting management implemented July 2017 & 2018;

- Mob grazing
- Mowing

Figure 4. Cattle grazing within a mob grazing treatment implemented after planting

Figure 5. Post planting mowed treatment (right) adjacent to a control (left)

5. **Results Stephenville**

Bermudagrass Cover

- All herbicide treatments reduced Bermudagrass cover
- Cut, bale and repeat glyphosate treatments significantly reduced Bermudagrass cover 100%
- Adding prepared seedbed decreased Bermudagrass cover
- Seeding commercially produced seed also decreased Bermudagrass cover

Species Richness

- Bermudagrass removal affects species richness
- Imazapyr still "nuked" 12 months later (no natives)
- Grazing & mowing reduced large weeds such as giant ragweed

Post treatment

- Bermudagrass reinvading where not 100% controlled
- Mowing & grazing reduced large weeds
- Mowing & grazing = more late succession grasses & forbs

Combination with the least Bermudagrass Stephenville:

- **Mow & glyphosate**

Combination with the greatest plant richness Stephenville:

- **Mow & glyphosate**
- **Seedbed prep/seeding method no effect**
- **Imazapyr, control & cover crop = no natives**

6. **Stephenville Insect Study**
    - August-September of 2017 and 2018
    - sweep-netting and pitfall traps
    - abundance and diversity
    - the following treatments
        - Glyphosate, Imazapyr, cover crop, and control
        - Control and low diversity mix
        - Disked and drilled seedbed preparation
        - Control and mob grazing post-planting management

Figure 6. Pitfall traps for insect collection

Findings

- Glyphosate treatments increased insect abundance in sweep net collection
- Glyphosate treatments increased diversity of insect orders in sweep net collection
- Mob-grazed treatments increased diversity of insect orders in pitfall collection
- Pitfall collection
  - Suppression treatments increased overall insect diversity and abundance
  - Post-planting treatments increased overall insect abundance
- Sweep net collection
  - Suppression treatments increased diversity of the following insect orders
    - Hemiptera (True bugs)
    - Lepidoptera (Butterflies and moths)
  - Post-planting treatments increased the following insect orders

Abundance	**Diversity**
Hemiptera (true bugs)	Lepidoptera (butterflies and moths)
Lepidoptera (butterflies and moths)	Diptera (flies)
Diptera (flies)	Orthoptera (beetles)
Orthoptera (grasshoppers)	

SITE MAP

N

E

W

S

		Mob graze					Mow					Control				
Disc + Broadcast	Standard mix															
	Local Harvest															
	Control															
	Diverse mix															
Disc + Drill	Local Harvest															
	Control															
	Standard mix															
	Diverse mix															
No-till	Standard mix															
	Diverse mix															
	Local Harvest															
	Control															
		1	2	3	5	4	2	4	3	5	1	5	1	4	2	3

Imazapyr & glyphosate	1
mow & glyphosate	2
glyphosate	3
mow & cover	4
control	5