

# Root Plowing Proved Best Method of Brush Control in South Texas

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Rootplowing proved to be the most effective method of killing brush in tests conducted by the Duval County Ranch Company near Freer, Texas. This method was compared with chaining, chopping, treedoing and spraying in a series of controlled tests.

Many methods of controlling brush have been developed in South Texas in recent years. More than a million acres have been treated in some way or another in the last ten years. Each method has its supporters claiming it to be the most effective or practical.

W. H. McDugald of the Duval County Ranch Company decided to try out various methods and see for himself. He obtained the help of the Agua Poquita Soil Conservation District and Don V. Allison of the Soil Conservation Service at Benavides in planning and establishing the plots and in making studies to evaluate the results. The Southwestern Research Foundation later joined in making the studies.

## Study Area

An area of 1,364 acres was selected on the ranch northwest of Freer. It is typical of a large part of the "Brush Country" of South Texas. Included are gently sloping ridges of shallow, gravelly soils, grading to almost level "flats" of deep soils. The soils are all highly calcareous and are very fertile. Moisture is the limiting factor in plant growth. Because of heavy texture, most of the soils of the study area are "droughty." They have been tentatively assigned to the Kenedy and Cardova series.

The area has been rather heavily grazed for more than 100 years,

and the vegetation has changed markedly from the original condition.

The original settlers and early writers describe the country when settled as being open prairie with only an occasional tree or bush, mostly along the streams. The dominant grasses in the prairie vegetation were trichloris (*Trich-*

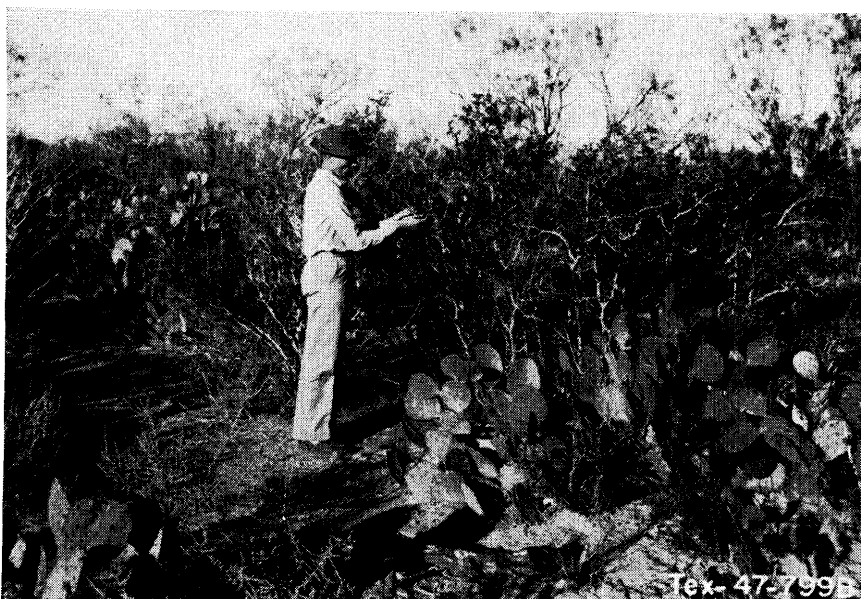


FIGURE 1. Condition of test area before control operations. Cacti are pricklypear and tasajillo. Woody plants are mesquite, condalias, blackbrush, guayacan and guajillo.

*loris crinita* and *T. pluriflora*), two forms of plains bristlegrass (*Setaria macrostachya*), cottontop (*Trichachne californica*), blue-stems. (*Andropogon barbinodis* and *A. perforatus*) lovegrass tridens (*Tridens eragrostoides*), and vine-mesquite (*Panicum obtusum*). In some areas these species have almost wholly disappeared. Plains bristlegrass has been able to stay better than any by utilizing the protection of the thorny shrubs.

Other grasses found in lesser amounts were curlymesquite (*Hilaria belangeri*), slim tridens (*Tridens mutica*), pappusgrass (*Pappophorum bicolor*) and filly panicum (*Panicum filipes*). Because these species are less palatable or grow short and close to the ground, thereby evading close grazing more effectively, they were able to replace taller species taken out by heavy grazing.

Under continued heavy use, even these species are greatly reduced. Red grama (*Bouteloua trifida*), whorled dropseed (*Sporobolus pyramidatus*), and Halls panicum (*Panicum halli*) remain on some of the more deteriorated ranges in a very sparse stand.

The dominant vegetation of the area now is woody shrubs and trees forming a thicket that in places is almost impenetrable. Only a sparse, stunted growth of grass occurs under the brush, and most soil surfaces are severely crusted, shedding much of the rainfall.

The principal woody species are mesquite (*Prosopis juliflora* var. *glandulosa*), blackbrush acacia (*Acacia amentacea*), several condalias (*Condalia* spp.), guajillo (*Acacia berlandieri*), amargosa

(*Castela texana*), allthorn (*Koeberlinia spinosa*), granjeno (*Celtis pallida*), guayacan (*Porlieria angustifolia*), whitebrush (*Aloysia ligustrina*), and desert yaupon (*Schaefferia cuneifolia*). Many other species occur in lesser amounts. Ceniza (*Leucophyllum frutescens*) is abundant on some shallow, gravelly ridges.

Many species of cactus are found. Pricklypear (*Opuntia lindheimeri*) is most common and is found almost everywhere, except where eradicated or controlled. It sometimes grows to heights of 7 to 9 feet in clumps 15 to 20 feet across, and occasionally forms dense thickets of its own. Tasa-jillo (*Opuntia leptocaulis*) is also widely spread, and many other species are abundant, at least in places. Several species of yuccas are common.

### Experimental Procedure

To test the various methods of control, the 1,364-acre area selected was divided into 9 plots, varying in size from 95 to 195 acres. Each plot contains some of the deep soils and the shallow and light soils, and is therefore representative of most of the area. Brush was treated by one of the control methods on eight of the plots, and no treatment was given on the ninth for a check plot (Fig. 1).

Soil Conservation Service technicians established permanent meter-square quadrats, 27 per plot, for counting grasses and 27 600-square-foot belt transects for counting the woody vegetation. These areas were observed before treatment and in 1954 and 1955 following the treatment.

Rainfall during 1954, the first year, was about normal with 19.4 inches. However, the early part of 1955 was below normal, when only 9.5 inches fell from November 1954 to September 1955. Heavy rains occurred in September and October 1955 to bring the 1955 total to 22.35 inches through October. Excellent grass growth followed the September and October



FIGURE 2. Roller cutting or chopping gave a 22 percent reduction of woody plants and a 95 percent increase in grasses. Grasses include trichloris, lovegrass tridens, plains bristlegass, cottontop, pink pappusgrass, panicums and three-awn.

rains, just prior to making the last readings.

The mechanical methods of control were carried out in November and December 1953. Spraying of the herbicide-spray plot was done in July 1954. The entire area was fenced in March 1954. No grazing has been permitted to date to permit the grasses to make the maximum growth. It is planned to graze the area later in order to better evaluate the effects of the treatments.

### Results

Table 1 gives the costs and results of the tests for the first two years.

### Chaining

The brush on three of the plots was chained, using an anchor chain with 90-pound links, pulled behind two crawler-type tractors. One of the plots was chained only in one direction. Larger, more rigid trees and bushes were snapped off, but occasionally one was pulled out with the roots. Smaller, pliable brush was only knocked down by the chain, some resuming a semi-upright position afterwards. The other two plots were chained a second time going in the opposite direction. The second chaining in the opposite direction broke off much of this brush, thereby making grazing less hazardous.

Table 1. Brush kill and grass increase on brush control plots.

Treatment	Cost	Brush kill	Grass increase
	per acre		
		%	%
Chained one way	\$ 2.00	21	61
Chained two ways	3.00	23	66
Chained two ways and raked	10.00	35	85
Sprayed with 2,4,5-T	3.50	21	12
Sprayed with 2,4-D/2,4,5-T	7.75	47	44
Rootplowed	10.00	62	268
Rootplowed and raked	17.00	63	35
Chopped (roller cutter)	4.00	22	95
Treedozed	5.00	28	104

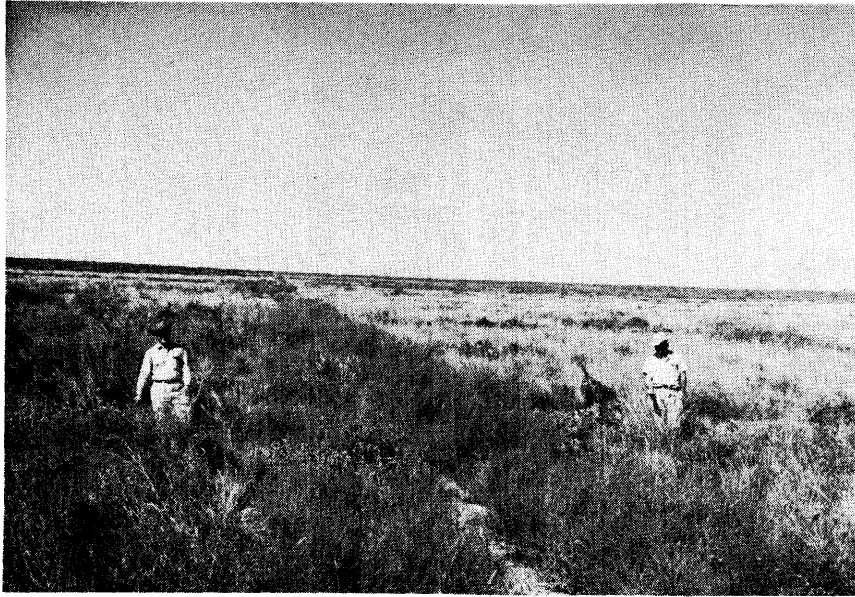


FIGURE 3. Area on left was chained two ways and raked and showed an 85 percent increase in grasses and a 35 percent decrease in shrubs over two years. The rootplowed and raked area on the right has had a 35 percent increase in grass and a 63 percent decrease in shrubs.

One of the plots, chained two ways, was raked with a 16-tooth brush rake, with 40-inch teeth at 16-inch spacings, attached behind the crawler tractor. Brush was raked into windrows about 300 feet apart, leaving relatively clean strips between.

Chaining did not kill much brush, only 21 percent one-way, 23 percent two-ways and 35 percent when raked afterwards. Most of the brush resumed vigorous growth, and much of it was three to four feet high at the end of the second year. Mesquite sprouted readily from the bud zone on the stem just below the ground surface. Repeat treatment will be necessary in a few years. However, it would be possible to use a small brush chopper the next time, thereby reducing cost, since the larger brush was knocked down by the chaining.

Chaining with a heavy chain in pulling up brush and trees disturbs the surface soil, breaking the crust, and thereby helps to absorb rains. Fair increases of grasses resulted from chaining one or two-ways (Fig. 2). Raking afterward did not leave the soil in condition for rapid recovery as the

strips between windrows were bare. Good grass growth did occur in the windrows which accounts for most of the increase shown in the table.

#### Rootplowing

Rootplowing, though the most expensive, was the most effective treatment both in reducing brush and improvement of grass. Two plots were rootplowed by means of a heavy V-shaped blade pulled at an average depth of 11 inches behind a crawler type tractor. Two "kicker bars" (iron rods) were welded on each side of the blade at such an angle as to partially invert the cut-off brush plants, exposing the roots to keep them from resuming growth. One of the plots was raked, following plowing, in a manner similar to the chained plot.

Rootplowing killed almost 100 percent of the brush. However, numerous seedlings appeared, and net reductions were only 62 and 63 percent for the two tests by the end of the second year. Rootplowing seems to spread pricklypear.

Grass recovery was better on the rootplowed plot than any other plot, more than twice that of the

second best plot. However, raking following plowing severely set back the grass so that the raked plot made very slow recovery. The raking pushed the grass and seed into the windrows leaving the bare surface exposed and an unfavorable site for grass seedlings, except in the windrows. An extremely dense stand of Russian thistle appeared, no doubt materially contributing to slow recovery of grasses.

Buffelgrass was broadcast in a small part of the plowed and raked plot in the spring of 1954. The disturbed surface was apparently a good seedbed for this grass as an excellent stand was obtained. Clippings that fall yielded 4,101 pounds of oven-dry grass, as compared to 447 pounds of grass from the non-seeded portion of the plot.

#### Brush Chopping

Brush on another plot was cut with a rolling brush chopper weighing 22,000 pounds with blades at 14-inch intervals. The blades entered the soil about 4 inches deep leaving a trench or furrow which served to catch both seed and rain. The brush was cut into short lengths, which formed a protective surface mulch, aiding in catching rain, protecting young seedling and reducing evaporation and erosion. Grass recovered most rapidly the first year on the chopped plot, though the rootplowed plot far exceeded the chopped plot by the end of the second year (Fig. 3). Chopping killed little brush, most of it resuming vigorous growth. Treatment will again be needed in a few years.

A small part of the chopped plot was seeded to buffelgrass and birdwoodgrass. Both made good stands (Fig. 4). A solid row of seedlings came up in many of the blade cuts as though they had been drilled. This seeded plot appeared equal to the seeded plot in the rootplowed-raked area.

#### Treedozing

Brush on another plot was cut with a treedozer, an inverted V-shaped bulldozer blade mounted in

front of a crawler tractor. Continuous forward movement is possible, as cut-off brush with some grass and soil is pushed to the sides where it forms a windrow. The blade moves along at the surface of the ground cutting off most brush plants and occasionally pulling one up.

A greater kill of brush was obtained by this method than by chopping or chaining. The dozed strips were scraped almost bare, an unfavorable site for grass seedlings. Major grass recovery was limited to the windrows the first year, but spread so that this was the second highest plot by the end of the second year.

#### Aerial Spraying

Brush on another plot was sprayed by airplane in July, 1954, with herbicidal sprays. One-half the plot was sprayed with  $1\frac{1}{2}$  pounds 2,4,5-T per acre in a 25 percent oil-water emulsion. The other half was sprayed with a mixture of one pound each, per acre, of 2,4,5-T and 2,4-D in the same carrier.

At the time of spraying moisture was deficient and most plants were in stress. Herbicides would probably have been effective had they been applied while the woody vegetation was in a flush state of growth. Mesquite was the only species materially affected by either treatment. The mixture containing both 2,4-D and 2,4,5-T killed more brush, but the 2,4,5-T spray killed the higher percent of the mesquite.

Since spraying does not affect the crusted soils, grass recovery in the sprayed plots was much less than on the other plots, except the plowed and raked plot. Perhaps a more rapid recovery would have occurred had a greater kill of the brush species been obtained.

#### Summary

Experience in these plots and on other ranches in South Texas



FIGURE 4. Buffelgrass and birdwoodgrass were broadcast on this plot following roller cutting or chopping. There was a 451 percent increase in grass compared with the check plot for the first year.

point to several conclusions. Perhaps the most important is that grass recovery, either of native or seeded grasses, is greatest where the soil surface is disturbed and a mulch left such as in rootplowing or chopping. Raking following other treatments generally destroy considerable grass, but seems to prepare a good seedbed for range seeding. It is doubtful if results justify the additional cost of raking.

Chaining, chopping and tree-doing kill relatively little brush. Follow-up treatment will be necessary. Information on how soon this should be done and what the kill will be in recurrent treatments may be found out as this study continues.

Rootplowing gave near 100 percent kill on all varieties of brush, but seedlings were numerous. Rootplowing appears best suited to deep soils with mixed brush but relatively free of pricklypear.

Chopping is more effective on smaller brush. Chaining, however,

appears better for larger brush. Treedoing appears quite effective on granjeno, whitebrush, and shrubs more common on deeper soils, and appears to give best control of pricklypear.

Since most of South Texas is infested with a mixture of woody species, many of which are not affected by sprays, herbicides appear to have only limited adaptability. Thickets of mesquite, particularly on sandy soils and away from cultivated fields, can be controlled with herbicides if sprayed when making rapid growth.

It is planned to continue the studies for several more years. It will be particularly important and interesting to note what effect a thick stand of grasses will have on growth of brush sprouts and seedlings. For this reason, the plots will be grazed in such a manner as to leave a thick cover of vigorous grass. It is known that if the grasses are grazed out the brush will soon reclaim the area, and the treatment will have been in vain.