

SUMMARY

Invasion of woody plant species on the Rio Grande Plain of Texas has so decreased forage production that many ranchmen have bought additional rangeland or have invested in range improvement to maintain or increase family income.

Rootplowing and seeding in the same operation with the introduced species blue panic and buffel grasses have, in many instances, produced phenomenal results in brush kill, especially mesquite, and in successful grass stands.

On the basis of personal interviews with 29 ranchmen in McMullen, LaSalle, Frio and Medina counties, and additional information from the Soil Conservation Service, Agricultural Stabilization and Conservation offices and other sources, a determination of treatment cost was made.

Ranches in the study ranged from 163 to more than 18,000 acres, and averaged 2,010 acres. Total area rootplowed and seeded per ranch ranged from 10 to almost 1,200 acres, with an average of 241 acres. Up to 40 percent of the total acreage was treated on the smaller ranches; 3 to 5 percent of the total acreage was treated on the larger ranches.

A common sequence of operation was first to chain the brush, then rootplow and seed, and defer grazing on the treatment area. In most instances, these operations were contracted by local equipment operators. Chaining for the most part had been done in previous years. The most frequent contract prices quoted were \$3 per acre for chaining, and \$10 per acre for rootplowing and seeding. One dollar per acre was the assigned cost for non-use of the land for 1 year. In cases of failures to obtain adequate grass stands, retreatment by use of a rootrake and attached grass seeder is becoming widespread. A common contract price for this operation was \$6 per acre plus an assigned cost of \$1 per acre for an additional year's deferment.

Of 490 contract operations observed during 1953-58 by range technicians of the Soil Conservation Service on the six major range sites in the area, 166 grass stands resulted. This made an average success of 33.9 percent, or a failure of 66.1 percent. Using the 66.1 percent failure as a risk factor, the determination was made that treatment, including chaining, rootplowing and seeding, and range defer-

ment, resulted in a cost of \$18.63 per acre. This figure does not include additional costs of fencing, water facilities, grubbing and weed control, which may or may not be necessary. Cost-sharing assistance through the agricultural conservation program of up to 50 percent of the cost of treatment was obtained by many of the ranchmen interviewed.

Benefits received from this method of range improvement vary and many cannot be measured at this time. Increases in livestock carrying capacity and in calf weights, fewer insects and reduced handling costs were reported.

Numerous management problems confront the ranchman because of the nature of the introduced grass species and the often limited acreages on which they occur. Indications are that the areas rootplowed and seeded successfully can be handled best as temporary pastures in a manner similar to Sudangrass.

CONTENTS

Summary	2
Introduction	3
Purpose	3
Method of Study	3
Rootplowing and Seeding	3
Chaining	4
Rootraking and Seeding	5
Additional Costs	5
Weed Control	5
Deferment	5
Fencing and Water Development	6
Other Costs	6
Risk Factor	6
Cost of Treatment	7
Cost-Sharing Assistance	8
Returns from Treatment	8
Management Problems	8
Acknowledgments	8
References	8

Costs of Rootplowing and Seeding Rangeland, Rio Grande Plain

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WITHIN THE RIO GRANDE PLAIN OF TEXAS more than 15,000,000 acres of rangeland have been invaded by brush species to the extent that once abundant grass stands have been diminished significantly. Common high-forage-producing grass species which have decreased in this change of plant composition are bluestems, plains bristlegrass, sidecoats grama and two and four-flowered trichloris.

With this change in plant composition, livestock carrying capacities have been reduced greatly and ranchmen have been forced to buy additional land or to improve the land they now have to maintain or improve family income. Most of their efforts have been devoted to various means of brush control. Both chemical and mechanical means have been used on prevalent brush species such as mesquite, whitebrush, acacia, cacti, spiny hackberry and others.

Within the past few years, a method of rootplowing and seeding in the same operation has come into rather wide use. Phenomenal results in terms of brush kill and increases in forage production have been obtained in many instances with the use of introduced grasses such as blue panic, buffel and other grasses.

PURPOSE

Since rootplowing and seeding as a means of improving range conditions has drawn the attention of ranchmen in other areas of the State infested with brush, the purpose of the study reported here was to determine the costs of these operations, including the costs of additional treatments needed to insure the desired results.

METHOD OF STUDY

McMullen, LaSalle and Frio counties, on the Rio Grande Plain, plus the portion of Medina county on the Rio Grande Plain, were selected for study. This is an area in which rootplowing and seeding have been carried on for some time.

Twenty-nine ranchmen who had rootplowed and seeded a portion of their rangeland since the early

1950's were selected for interview from a list of 84 provided by research personnel of the Department of Wildlife Management. This constituted a 34 percent sub-sample from their study. Their list had been developed from Soil Conservation Service records for a study of the effects of brush control on vegetative composition and on wildlife populations. The sample of 84 was selected to represent proportionately the various sizes of ownerships and their incidence in the major types of vegetation.

By selecting for interview only those ranchmen who had rootplowed and seeded prior to 1959 and especially in the early 1950's, data were obtained concerning projects where sufficient time had elapsed to enable an evaluation of results with greater accuracy.

The 29 ranchmen in the area supplied information by personal interview on methods of treatment, costs, apparent results of treatment and special management problems encountered.

Additional information about methods, extent and apparent success of treatment was obtained from work unit conservationists and range specialists with the Soil Conservation Service, the local Agricultural Stabilization and Conservation office managers, county agricultural agents, contractors and machinery company representatives.

The size of ranches in the sample on which rootplowing and seeding were done ranged from 163 to more than 18,000 acres, and averaged 2,010 acres. Total acres treated per ranch ranged from 10 to almost 1,200, with an average of 241 acres. On the average, 12 percent of the acreage was treated. Some of the smaller ranches had almost 40 percent of the total acreage treated, while on some of the larger ranches, only 3 to 5 percent of the total acreage was treated.

Nearly all of the ranches were owner-operated with a cow-calf system of livestock management.

ROOTPLOWING AND SEEDING

A rootplow is a horizontal V-type blade with attached fins mounted on or pulled by a large crawler-type tractor, Figure 1. The blade cuts a 12-foot swath 10 to 20 inches below the surface of the soil. The addition of fins to the blade assists in severing or heaving roots and root crowns of brush species to the surface. When brush roots are cut this way, many of the plants die. Chances for a large percentage kill

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TABLE 1. TIMES OVER, RATES OF APPLICATION AND CONTRACT PRICES OF ROOTPLOWING AND SEEDING AND ASSOCIATED TREATMENTS

Treatment	Times over	Acres per 10-hour day	Cost per acre, \$
Chaining (one direction)	1	200	2- 3
Chaining (two directions)	2	150	3- 4
Rootplowing and seeding	1	15 - 20	8-12
Roottraking and seeding	1	40 - 50	5- 7
Chemical weed control	1	-	2- 4

are increased if the soil is dry at the time of treatment and remains dry for some time afterwards. Brush kills up to 90 percent were reported by the ranchmen interviewed. While rootplowing without seeding was done in many instances a few years ago, most of the work done since 1953 by those interviewed has included reseeding at the time of rootplowing.

Seeder boxes are mounted on the rootplow, and the seed are broadcast by the tractor exhaust far enough back to prevent them from falling into deep cracks opened by the blade as it is pulled through the soil. Blue panicgrass and buffelgrass, both introduced, tall-growing, bunch-type summer grasses, have been used separately and in mixtures in most of the operations to date. Usually a seeding rate of approximately 2 pounds per acre of each grass, either separately or in a mixture, was used. Cost of seed varied from \$.60 to \$1.25 per pound for blue panic seed and from \$.75 to \$2.00 for buffelgrass seed. Two of the ranchmen in the sample used home-grown seed. Native

grasses were used in a few instances, and sorghum alumum was used by three ranchmen on abandoned cropland.

Most of the rootplowing and seeding on ranches in the sample was done under contract by local equipment operators. Cost per acre ranged from \$8 to \$12 including the cost of seed, Table 1. The most common contract price reported by the 29 ranchmen interviewed was \$10 an acre. The time required and resulting costs varied according to the range site treated, density and types of brush present, acreage in the treatment area and the distance the machinery had to be moved for use. Fifteen to 20 acres per 10-hour day were common treatment rates. While dates of treatment ranged from early spring to late summer, March to May is the period generally recommended to obtain the best results from reseeding.

CHAINING

While rootplowing and seeding frequently are the only treatment performed, the contractors interviewed indicated chaining is required sometimes for efficient operation of the tractor and rootplow. This is especially true on bottomland and on some hardland sites where tree-type brush, principally mesquite, is common. Among the ranchmen interviewed, more than half reported that the land which was rootplowed and seeded had been chained several years previously.

Chaining involves the use of a large anchor chain dragged over the area by two large crawler-type

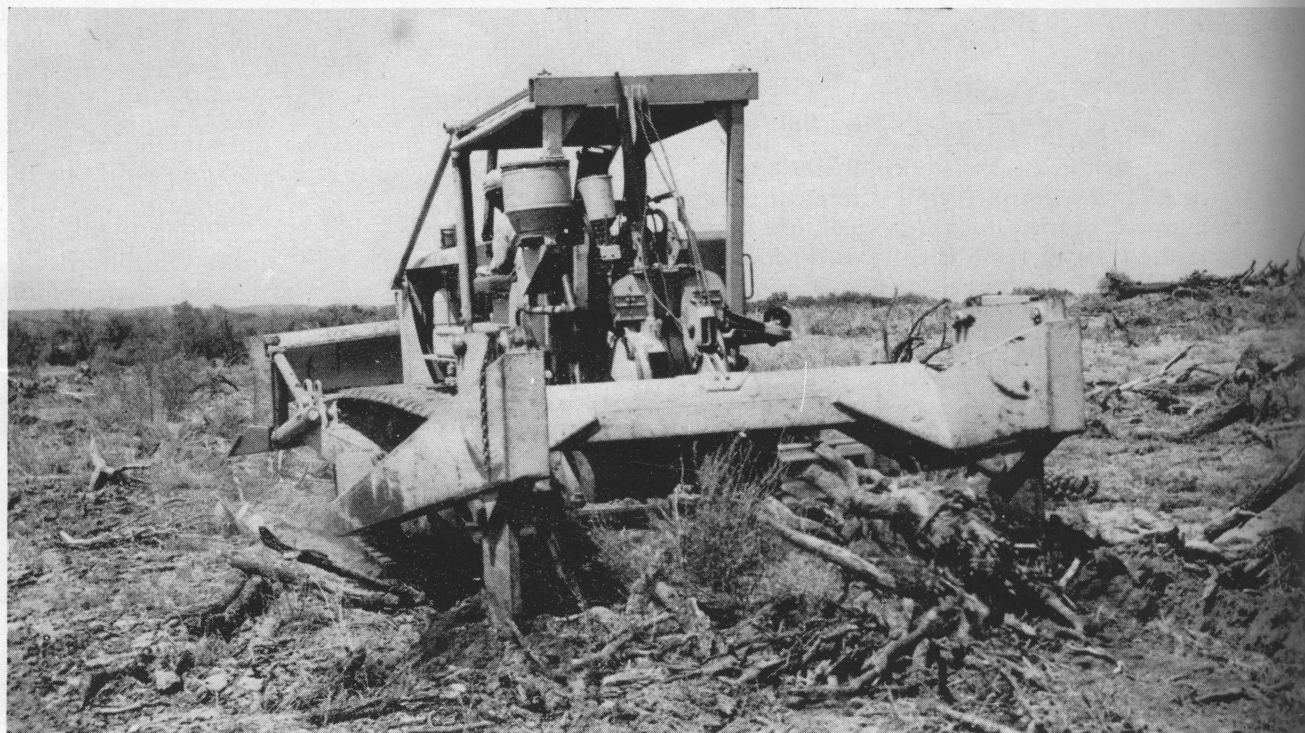


Figure 1. Crawler-type tractor equipped with rootplow and dozer blade rootplowing thick mesquite and brushland. Photo courtesy of the Soil Conservation Service.

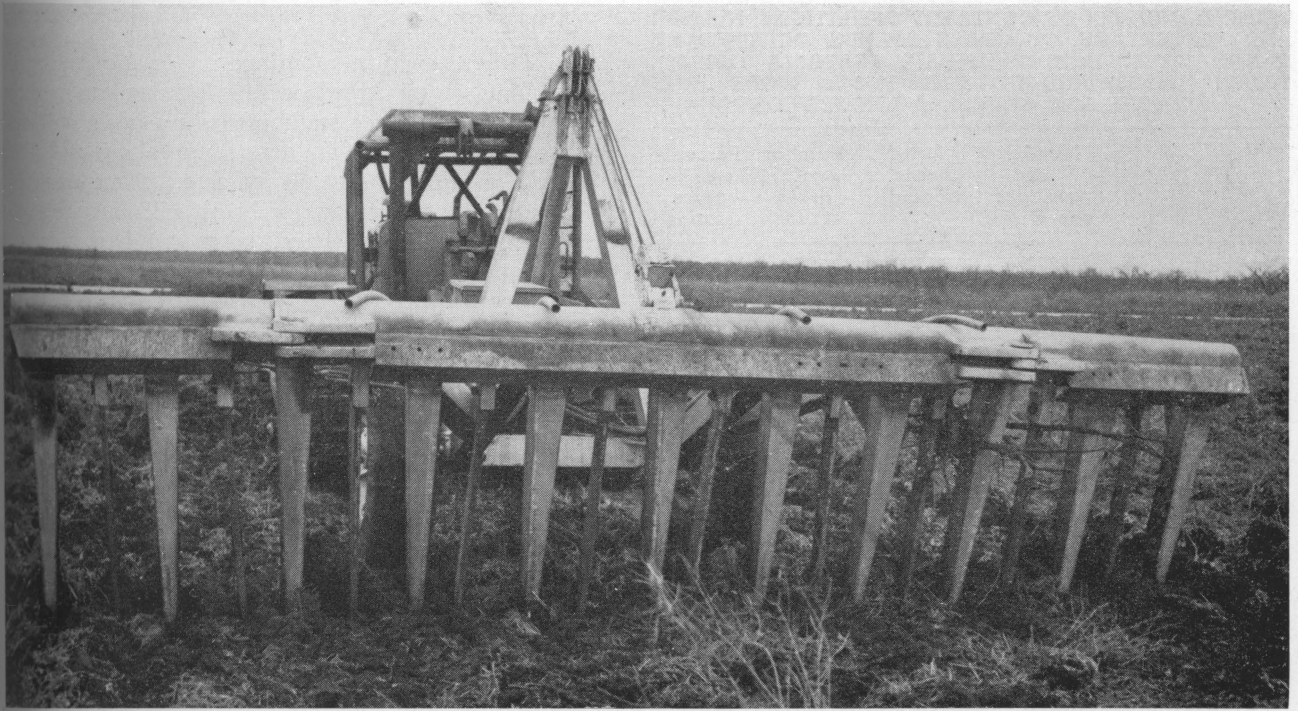


Figure 2. Rootrake with attached seeder, pulled by a crawler type tractor. Photo courtesy of the Soil Conservation Service.

tractors traveling parallel. Each end of the chain is attached to a tractor. The chain as it is dragged over the area uproots or breaks the large brush. Frequently brush-infested areas are chained in two directions to pull out trees which are only partially uprooted from the ground.

Rates of chaining in a 10-hour day varied from 150 acres for chaining in two directions, to 200 acres for chaining in one direction, Table 1. Reported contract prices were \$2 to \$3 an acre.

ROOTRAKING AND SEEDING

Not all rootplowing and seeding treatments have resulted in grass stands, according to Soil Conservation Service technicians. When failures occur, the question of retreatment arises if grass stands are to be established. A method of rootraking following rootplowing or bulldozing on brush is commonly used when putting raw land into cultivation. By attaching a grass seeder to the rootrake, a method of retreatment of many of these failures has been devised. Several ranchmen in the sample tried and generally recommended that this method be used to salvage earlier failures. The rootrake pulls out much of the remaining stumps and branches, stacks them and smooths over the roughed-up surface left by the rootplow. A finer seedbed results, chances of seed germination are increased and the greater expense of retreatment with the heavier rootplow is partially eliminated.

The rootrake is approximately 20 feet wide, has variably spaced teeth and is pulled by a large crawler-type tractor. It was reported by those interviewed

that 40 to 50 acres could be rootraked and seeded in a 10-hour day, Table 1. Reported contract prices were \$5 to \$7 an acre including the cost of seed.

ADDITIONAL COSTS

Weed Control

Depending on climatic conditions, some degree of weed control is often needed to keep down competition with grass seedings. This may be done more readily by spraying with air or ground equipment rather than by mowing. It is difficult to mow weeds since the ground is roughed up by the rootplow.

Ranchmen in the sample reported that several successful grass stands apparently were lost because of heavy competition from weeds. Many earlier treatments during the drouth period on which sufficient moisture fell to bring up the seed, but not enough moisture to bring on much weed competition, were successful.

Only three of the ranchmen interviewed said that they had actually practiced weed control. Others stated that additional control must be carried out in the future if successful grass stands are to be obtained. Cost estimates for weed spraying were \$2 to \$4 an acre.

Deferment

Deferment of grazing on the treated area for at least 1 year and sometimes 2 has long been advocated by range technicians and others to increase the chances of obtaining adequate stands of grass. More than

TABLE 2. NUMBER OF CONTRACT OPERATIONS, NUMBER AND PERCENTAGE OF GRASS STANDS OBTAINED BY RANGE SITES, HONDO (1955-58), PEARSALL (1955-58), TILDEN (1957-58) AND COTULLA (1953-58) WORK UNITS OF THE SOIL CONSERVATION SERVICE

Range site	Number of contract operations	Acres treated	Number of grass stands ¹	Percentage of grass stands
Hardland	230	37,152	75	32.6
Sandy loam	190	30,298	53	27.9
Gravelly ridge	12	1,457	6	50.0
Bottomland	38	3,258	25	65.8
Shallow upland	19	1,453	7	36.8
Deep Sand	1	320	0	0.0
Total	490	76,818	166	
Average percent success				33.9
Average percent failure (risk factor)				66.1
Total				100.0

¹A grass stand is an area on which sufficient seeded species have been established and constitute a major percentage of the plant composition.

half of the ranchmen contacted reported that they had deferred grazing for periods ranging from a few months to 1 year. Only two reported deferment for a period longer than 1 year. This period of non-use represents an immediate cost to the ranchman since he foregoes the opportunity to add to his income by grazing the range during this time. Therefore, a cost which may be approximately the lease value of the land for the period is included. If the ranchman pays \$1.00 an acre lease, or if he owns the land and could lease it out for \$1.00 an acre, this charge enters into the cost of treatment. If deferment is carried out for 2 years, then the cost is \$2.00.

Fencing and Water Development

Another item which may vary considerably is the cost of additional fencing and water development. Deferment is cited by range technicians as being a prerequisite for successful establishment of a grass stand, and livestock must be fenced away from the treated area for the desired results. With the addition of a fence, livestock may be cut off from previously developed water facilities. This creates the need for a new water well, stock pond or pipeline and trough.

Several of the ranchmen interviewed treated whole pastures at one time, or at least treated a sufficient area in a pasture that they felt the need to preclude the use of the entire pasture for some time. Ten of the ranchmen said they had constructed additional fence. Three reported that they used a temporary electric fence. Most of those who fenced had to build or renovate a stock pond or develop other means of supplying water to livestock. Cost of fencing varied considerably; \$50 to \$90 a mile for electric fences, and \$225 to \$500 a mile for barbed wire fences, depending on the cost of labor.

Other Costs

Other practices of minor importance among the ranchmen interviewed were: burning-brush, costing around \$2 an acre; grubbing white-brush and brush sprouts, around \$5 an acre; and raking and piling brush, approximately \$6 an acre. These treatments increase the percentage of brush kill, but are expensive because of the hand labor required. Many of the ranchmen felt that with progress in the use of chemicals, spraying over rootplowed and seeded areas after resprouting will become a cheaper method. This is the case especially with mesquite sprouts and white brush.

RISK FACTOR

The possibility of failure becomes an important factor when a sizable investment is made in range improvement by rootplowing and seeding. In this particular practice, there have been spectacular successes and sometimes failures. During the drought, when rootplowing and seeding were first used on a large scale, the ranchmen reported high percentage brush kills and excellent stands of blue panicgrass, buffelgrass, or mixtures of the two grasses. Later, when moisture became more plentiful, fewer successful stands of grass resulted, although brush kills continued to be adequate. Several good stands of grass, especially buffelgrass, were winter-killed, and in some areas rats were so prevalent that grass stands were virtually wiped out.

In many instances, native grass species were coming back into treated areas and, in the opinions of many ranchmen and range technicians, range conditions would continue to improve with conservative stocking and provision for some deferment.

Among the ranchmen interviewed, there was a commonly held opinion, on past experience, that the seeded grasses had a 50-50 chance of germinating and surviving. In an attempt to determine more accurately what these chances might be, a record of treatments, acreages, successes and failures was obtained from the Soil Conservation Service work unit offices, and from the range specialist in the study area, Table 2.

While the observations were not complete, sufficient evidence was available to assign a risk factor to guide ranchmen in their figuring of possible costs and assist them in their decision of whether to invest in rootplowing and seeding.

The number of treatments, acres treated and number of resulting stands of grass were recorded by the principal range sites in the area during 1953-58 for the Cotulla work unit, 1957-58 for the Tilden work unit and 1955-58 for the Hondo and Pearsall work units. These work units service the Medina Valley, Frio and Dos Rios Soil Conservation Districts

The criterion for evaluating the results of rootplowing and seeding, as used by the range technicians, was that any area needing another seeding to obtain an adequate stand of blue panic or buffelgrass was declared a failure. An adequate stand for these evaluations constituted areas with sufficient seeded species established so that they made up a major percentage of the plant composition. Reasons given for lack of adequate stands were: long wet winters in 1957-58, heavy weed infestations, failure to defer treated areas and rat damage.

The largest percentage of grass stands was obtained on the bottomland sites, with 65.8 percent. Fifty percent success was recorded on the gravelly ridge sites, 32.6 percent success on the hardland sites and 36.8 percent on the shallow upland sites. The sandy loam sites were next with 27.9 percent success, and the one trial on the deep sand site was unsuccessful. Overall success, or the attainment of adequate grass stand treatments under observation, was 33.9 percent, or 66.1 percent failure. This failure figure of .661 represents the risk factor used in the determination of costs.

COST OF TREATMENT

A common sequence of operations, Table 3, used in rootplowing and seeding was to chain, rootplow and seed, and defer use. Chaining in most instances was done several years prior to rootplowing and seeding. The total per-acre cost of treatment usually was \$3 for chaining, \$10 for rootplowing and seeding and \$1.00 for a 1-year deferment.

If, after a lapse of time varying from a few months to a year or more, it was determined that the seeding was a failure, then rootraking and seeding may be used and followed by another period of deferment. This secondary treatment was reported commonly to cost \$6 per acre and \$1.00 for another year of deferment.

Since the future results to be expected are unknown, one can estimate results only from past experiences. It is practically assured that the brush kill will

be favorable. If the seeding fails, which may happen, Table 2, then it often is necessary to rootrake and seed. It may be necessary to do this 66.1 percent of the time.

Thus in assigning a cost for rootraking and seeding, it is necessary to enter only \$6.00 x .661, which equals \$3.97 an acre. The same holds true for the deferment cost. In this instance it would be \$1.00 x .661, which equals \$.66 an acre. Added to the \$1.00 cost already incurred, the total cost for deferment would be \$1.66. The assumption is made here that the rootraking and seeding will result in an adequate stand of grass. While chances for obtaining an adequate stand of grass are increased considerably, failures may be expected. There were insufficient trials to assign a risk factor to this treatment.

Cost of the first treatment including chaining is \$14. Cost of the second or follow-up treatment, which includes only rootraking and seeding and deferment, equals \$7. The latter treatment is needed .661 of the time, thus making an expected cost of \$4.63. The total cost with .661 failure is estimated to be \$18.63 an acre. With a follow-up treatment needed 100 percent of the time, the total cost is estimated to be \$21. These costs assume that the treatments would be a series made on approximately the same range sites and over a period of time with soil and moisture conditions similar to those during the period under study.

Another method to state these costs is to say that the ranchman knows he will have a cost of \$14 as a minimum. Given this cost, he stands to pay an additional \$7 with a probability of .661, or he has a probability of no additional cost of .339. Thus, he has the probability of paying \$14 approximately .339 of the time, and a probability of paying \$21 approximately .661 of the time. When chaining is not required, the cost could be reduced by \$3 per acre. When extra fencing and water facilities are needed, these costs should be added. Similarly, such further expenses as grubbing, spraying weeds and other associated costs should be added.

TABLE 3. COMMON SEQUENCE OF TREATMENTS, COST OF FIRST AND FOLLOW-UP TREATMENTS USING THE RISK FACTORS, AND TOTAL COST PER ACRE

Treatment	Cost of treatment per acre, \$				
	First treatment	Follow-up with 100 percent failure	Follow-up with .661 failure	Total cost with .661 failure	Total cost with 100 percent failure
Chain	3.00	0.00	0.00	3.00	3.00
Rootplow and seed	10.00	0.00	0.00	10.00	10.00
Rootrake and seed	0.00	6.00	3.97 ¹	3.97 ¹	6.00
Deferment	1.00	1.00	.66	1.66 ²	2.00
Total	14.00	7.00	4.63	18.63	21.00

$$0.00 + 6.00 (.661) = 3.97$$

$$1.00 + 1.00 (.661) = 1.66$$

With no treatment and a lease rate of \$1.00 per acre and a stocking rate of 20 acres per cow, cost per cow is \$20 per year. Assuming that rootplowing and seeding would last 10 years and using the cost of \$18.63 an acre, the annual cost of treatment would be near \$1.86. Using the same lease rate of \$1.00 per acre and adding the \$1.86 per year treatment cost, results in a cost of \$2.86 per acre. If the carrying capacity could be doubled, as some reported, to a rate of 10 acres per cow, the cost would be \$28.60 per cow per year.

COST-SHARING ASSISTANCE

Financial assistance has been available to ranchmen for rootplowing and seeding and other associated practices through the agricultural conservation program administered by the County Agricultural Stabilization and Conservation offices. A common cost-sharing rate for rootplowing is 50 percent of the cost not to exceed \$5 an acre. Cost-sharing for blue panic-grass seed has amounted to around \$.75 per pound, and \$1.25 per pound for buffelgrass. In some cases, cost-sharing on grass seed has been reduced with a decrease in price of seed to ranchmen.

Cost-sharing for chaining in two directions amounts to 50 percent of the cost not to exceed \$1.25 per acre. Cost-sharing for root-raking has been carried out on the basis of 50 percent of the cost not to exceed \$2.50 per acre.

A ranchman is limited in the total amount he can earn through cost-sharing. Several years may be required to treat a significant portion of the average-size ranch if the ranchman is to receive help for all work done. However, a number of ranchmen treated more land than the acres for which they received cost-sharing payments.

RETURNS FROM TREATMENT

Little information concerning returns from rootplowing and seeding were obtained from the ranchmen interviewed. Most ranchmen answered that an increase in carrying capacity was obtained on acreages treated successfully. Three reported that carrying capacity had been increased from a rate of 20 acres per cow yearlong to 10 acres per cow yearlong. Benefits from rootplowing and seeding were received, according to the ranchmen who had acreages on which grass stands were established, not only from an increased carrying capacity, but also from an increase in calf weights, a lesser incidence of insects, a reduc-

tion of handling costs and the establishment of conditions whereby livestock could be supervised better.

Both ranchmen and range technicians reported that on many acreages where the reseeded species of blue panic and buffelgrass failed to make an adequate stand, native grasses had increased in composition.

Further observations would be necessary before satisfactory returns information could be determined to compare with the cost data presented here.

MANAGEMENT PROBLEMS

As mentioned earlier, several years are required for a significant acreage of the total rangeland in a ranch to be rootplowed and seeded. This means that small areas of successfully treated land pose a grazing management problem seldom faced by the ranchmen previously. Seasons and intensities for grazing blue panic and buffelgrass are different from the native grasses. What appears to be proper use may actually be overuse to these introduced species. Periods of deferment also are required and it often may be that these grasses can be managed better as temporary pastures similar to Sudangrass. It may well be that these treated areas should be grazed heavily for short periods during the summer and rested in other seasons.

Biologic effects of rootplowing are largely unknown, although the harvest game species of wildlife, particularly white-tailed deer, represents reliable income to ranchmen in many parts of the Rio Grande Plain, according to hunting preserve records kept in compliance with state game regulations.

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REFERENCES

- Allison, D. V. and Rechenthin, C. A. "Rootplowing Proved Best Method of Brush Control in South Texas," *Journal of Range Management*, Vol 9, No. 3, May 1956.
- Carter, M. G. "Reclaiming Texas Brushland Range," *Journal of Range Management*, Vol. 11, No. 1, January 1958.
- Rogers, R. H. and Campbell, J. R. "An Economic Analysis of Land Clearing and Subsequent Crop Production in the Corpus Christi Area," PR 1628, Texas Agricultural Experiment Station, November 1953.