Offprint from

Proceedings of the XI International Grassland Congress

1970

UNIVERSITY OF QUEENSLAND PRESS

quality. Fertilizer studies have shown that the dry matter production in all the three communities was considerably increased through application of both N and P, indicating that the grassland soils are deficient in these two elements. Considering the trend of response, there appears to be a greater need for nitrogen fertilizer. Combinations of N and P did not give any added response, and therefore either of the two could be used for fertilizing the native grasslands. The results have also shown that potassium has no effect in the grasslands. These results are of direct value in improving the productivity from the reserved grasslands traditionally maintained for haymaking. The crude protein content in fertilized *Heteropogon* pasture was 5.8% only, while in the unfertilized one it was 5%, indicating no marked difference between the two.

Studies on the introduction of legumes *A. scarabaeoides* and *P. atropurpureus* in *Heteropogon* communities have shown that the crude protein content of mixed forage was increased at the ripe stage. The introduction of legume is thus an important way of improving the quality of the pasture. The habitats of *Heteropogon* and *Sehima* are related and therefore *Atylosia* and *Phaseolus* are expected to succeed in *Sehima* community also. In the wet habitat of the *Iseilema* community, the use of moisture-loving legumes such as *Sesbania microcarpa, Aeschynomene indica, A. americana, Geissapsis cristata,* and *Alysicarpus* spp. needs to be investigated.

Studies have also shown that *Heteropogon* communities could be successfully reseeded with superior strains of *C. ciliaris, C. setigerus,* and *C. fulvus*. The crude protein content of *Cenchrus* spp. is 10–11% in the ripe stage. This constitutes another approach in improving the native grass communities.

References

DABADGHAO, P. M. (1960). *Proc. VIII Int. Grassld Congr.* 227.

Control of mesquite, creosote bush, and tarbush on arid rangelands of the southwestern United States

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Summary

Sparse stands, up to 200 plants per ha, of mesquite, creosote bush, and tarbush may be economically controlled with an individual plant treatment of fenuron pellets or other dry herbicides. Aerial spraying with 2, 4, 5-T is also an economical method of reclaiming mesquite-infested areas. The treatment also affords an excellent method of increasing production of perennial grasses.

Introduction

Honey mesquite [*Prosopis juliflora* (Swartz) DC. var. *glandulosa* (Torr.) Cockerell], creosotebush [*Larrea tridentata* (DC.) Coville], and tarbush [*Flourensia cernua* DC.] have invaded large areas of semi-desert rangeland in the southwestern United States and northern Mexico (Buffington and Herbel, 1965). This has resulted in a substantial reduction in livestock-carrying capacity. Control measures are required to maintain or increase productivity of these rangelands.

Field studies were conducted using dry herbicides for individual plant treatments, and liquid herbicides for aerial applications and simulated aerial applications. In this paper, defoliation means percentage reduction in living top growth on treated plants compared with untreated; and plants killed means the entire plant was killed. Defoliation and observations of plants killed were obtained in the third growing season following herbicide application. Most of this research was conducted on the Jornada Experimental Range near Las Cruces, New Mexico. The average annual precipitation is 229 mm.

Individual plant treatment with dry herbicides

Individual plants of the three shrubs were given a single treatment with various rates of the following herbicides in each of several years: fenuron pellets [1, 1-dimethyl-3-phenylurea], monuron powder [3-(*p*-chlorophenyl)-1, 1-dimethylurea], fenuronTCA granules [1, 1-dimethyl-3-phenylurea monotrichloroacetate], monuronTCA granules [3-(*p*-chlorophenyl)-1, 1-dimethylurea mono(trichloroacetate), dicamba granules [3, 6-dichloro-*o*-anisic acid], picloram granules [4-amino-3, 5, 6-trichloropicolinic acid], bromacil powder [5-bromo-3-*sec*-butyl-6-methyluracil], isocil powder [5-bromo-3-isopropyl-6-methyluracil], and 2, 3, 6-TBA granules [2, 3, 6-trichlorobenzoic acid]. Plants killed were recorded by plant size. On mesquite, 3 g active ingredient of fenuron, monuron, picloram, or monuronTCA per metre canopy diameter satisfactorily killed in excess of 80% of the plants up to 2 m in canopy diameter growing on sandy soils. On creosote bush, 2 g active ingredient per metre canopy diameter of bromacil, fenuron, picloram, fenuronTCA, isocil, and dicamba killed in excess of 80% of the plants on sandy loam soils. On tarbush, 1 g active ingredient per metre canopy diameter of isocil, bromacil, fenuronTCA, monuronTCA, monuron, fenuron, and dicamba killed in excess of 85% of the plants on clay loam soils. For each species, herbicides not listed were less effective at comparable rates. Best results were obtained when these materials were applied just prior to, or in the early part of, an unexpected rainy season. This prevents deterioration of the herbicide from prolonged exposure to sunlight.

Field-scale applications of fenuron pellets on sparse stands (up to 200 plants per ha) of mesquite were made from 1958 to 1965. The rate per plant was 3 g active ingredient per metre canopy diameter. Table 1 shows representative results and costs for the 1961–64 period. The percentage of plants killed was negatively related to growing season (July–September) precipitation in the year of application. The growing season precipitation for 1962 was 271 mm and for 1964, 102 mm. The long-time average July–September precipitation is 127 mm. The costs shown in Table 1 were obtained from horseback applications of herbicide. The average cost of fenuron pellets was $8.27 per kg active ingredient.

Table 1. Results and costs of applying fenuron pellets on mesquite

Year	Plants per ha	Plants killed	Cost per ha
	No.	%	$
1961	19	67	1.78
1962	32	20	1.93
1963	81	70	2.77
1964	173	79	6.08

Broadcast spraying

Various herbicides and additives were tested in low volume, high concentration spray applications for toxicity to mesquite, creosote bush, or tarbush. Earlier work by Valentine and Norris (1960) indicated that the optimum time of the year for spraying mesquite was from the time the plants reached the full leaf stage until the fruit was fully elongated but not filled. They also found that fewer plants died when winter-spring precipitation was below average prior to spraying.

Our standard treatment for aerial spraying of mesquite-infested land is 0.56 kg 2, 4, 5-T [(2, 4, 5-trichlorophenoxy) acetic acid] per ha, in a 1 : 7 diesel oil to water emulsion at a total volume of 47 litres per ha. Plants killed with a single spray treatment ranged from 8% to 57%. The results are highly dependent on precipitation in the winter-spring period prior to spraying; the poorest results were obtained when spraying followed a droughty winter-spring. Applications of 0.28 kg dicamba plus 0.28 kg 2, 4, 5-T per ha, 0.28 kg picloram plus

0.28 kg 2, 4, 5-T, and 0.56 kg picloram plus 0.56 kg 2, 4, 5-T per ha killed more plants than the standard treatment. However, present herbicide costs dictate the use of the standard spray material of 0.56 kg 2, 4, 5-T per ha. This treatment costs about $5.00 per ha. Two spray applications, from 1 to 3 years apart, killed 23–64% of the mesquite.

Mesa dropseed [*Sporobolus flexuosus* (Thurb.) Rydb.] has responded favourably on the sprayed areas where 40% or more of the mesquite plants were killed. Table 2 shows the average perennial grass production on unsprayed areas and on areas sprayed twice for mesquite control during 1958–61.

Table 2. Perennial grass yields on areas sprayed twice for mesquite control and on adjacent unsprayed areas (0.56 kg 2, 4, 5-T per ha)

Year	Sprayed area	Unsprayed area
	kg/ha	kg/ha
1963	92	35
1964	383	52
1965	48	13
1966	277	19
1967	335	11
1968	269	104
Av.	234	39

Simulated aerial applications of herbicides were made on 250 m^2 plots of creosote bush- and tarbush-infested land at 2-week intervals from July to October or November of 1961 to 1965. We first used 2, 4-D [(2, 4-dichlorophenoxy) acetic acid], 2, 4, 5-T, dichlorprop [2-(2, 4-dichlorophenoxy) proprionic acid], silvex [2-(2, 4, 5-trichlorophenoxy) propionic acid], 2, 3, 6-TBA, and amitrole [3-amino-*s*-triazole]. In 1962, we added dicamba to the list, and in 1963, picloram. The herbicide rate at each application date was 0.56 kg/ha in 1961 and 1962, 1.1 kg/ha in 1963, and 1.7 kg/ha in 1964 and 1965. On one spray date each year, we applied herbicides at two or three times the above rates to help elucidate the optimum herbicide rate.

On tarbush, the degree of defoliation was quite variable among dates of application; the September treatments were generally the most toxic. At rates up to 2.2 kg/ha the phenoxy herbicides and amitrole usually defoliated less than 30% of the top growth. Dicamba was the most toxic herbicide, defoliating 70% of the top growth on one or more spray dates each

Table 3. Percentage creosote bush plants killed by aerial treatments[a]

Chemical	Rate kg/ha	Year of application: 1964	1965	1966	1967	1965 + 1966	1966 + 1967
		%	%	%	%	%	%
Dicamba	0.6	0	12	4	1	15	14
	1.1	1	25	25	13	54	41
	2.2	5	34	51	54	62	86
Picloram	0.6	1	16	—	—	—	—
	1.1	5	25	15	—	17	—
	1.7	6	34	39	—	29	—
2, 3, 6-TBA	1.1	3	3	3	4	21	6
	2.2	16	4	10	6	51	34
2, 4, 5-T	1.1	2	6	4	—	0	—
	2.2	3	5	1	—	0	—
2, 4-D	2.2	2	5	2	—	6	—
Dichlorprop	2.2	3	—	—	—	—	—
Silvex	2.2	2	—	—	—	—	—
2, 4-D + 2, 4, 5-T	1.1 + 1.1	1	4	1	—	3	—
	2.2 + 2.2	—	—	3	7	—	14
2, 4, 5-T + picloram	0.6 + 0.6	—	7	6	—	37	—
2, 4, 5-T + dicamba	0.6 + 0.6	—	7	7	14	33	28
	1.1 + 1.1	—	—	19	41	52	36

[a] Evaluations made 2 years after final treatment. Results from 1967 treatments are preliminary.

year. Increasing the rate of dicamba, from 0.56 to 2.2 kg/ha, increased the degree of defoliation only when treatment was not on the optimum date. At comparable rates, picloram and 2, 3, 6-TBA were also much less effective than dicamba.

On creosote bush, the dates of maximum herbicide toxicity varied yearly from late July to early November. Treatments during September defoliated more plants in 3 of the 5 years. Not all applications made before July were effective. Creosote bush is most susceptible to herbicides when treated after the start of the summer rainy season. The phenoxy herbicides and amitrole were ineffective on creosote bush. Defoliation was 70% on several spray dates with 1.7 kg/ha of 2, 3, 6-TBA, dicamba, and picloram.

Aerial applications of herbicide materials were made each year on 5 ha plots of creosote bush-infested land during the period of 1964–67. Plants killed 2 years after treatments were applied are shown in Table 3. Part of the area sprayed initially in 1965 was sprayed again in 1966, and part of the area sprayed in 1966 was sprayed again in 1967. None of the phenoxy herbicides was effective either as single or repeated treatments. Approximately additive effects, or better, resulted from the repeated applications of dicamba or 2, 3, 6-TBA. Two applications of picloram were no better than one. Combination treatments of 2, 4, 5-T with dicamba or picloram did not kill more plants than when 2, 4, 5-T was omitted, except for the lowest rates of 2, 4, 5-T plus dicamba in the repeat spray treatments.

Current herbicide prices, and lack of registration for use on grazing lands in the USA, preclude the use of effective herbicides now available for aerial spraying of rangelands infested with creosote bush or tarbush.

References

BUFFINGTON, L. C., and HERBEL, C. H. (1965). *Ecol. Monogr.* **35:** 139.

VALENTINE, K. A., and NORRIS, J. J. (1960). *Bull. New Mex. agric. Exp. Stn* 451.

The utilization of certain native pastures composed of grasses of varying palatability

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Summary

Grazing experiments in the Dohne Sourveld of South Africa indicate that a system of rotational grazing by oxen alone, or in a narrow ratio with wethers, can be effective as an interim measure to achieve control of the undesirable grass *Elyonurus argenteus,* which is unpalatable, except when young.

Control is achieved by frequent, close defoliation of the sward, since *E. argenteus* is more susceptible to such treatment than its desirable components.

Some undesirable deterioration in species composition of the pasture results, but this is minimal in comparison with sheep grazing alone.

Introduction

The Dohne Sourveld, as described by Acocks (1953), is characterized by a fairly high rainfall (*ca.* 750 mm per annum), moderate temperatures during the 8 summer months, and a cold and relatively dry winter. Under these conditions the various dominant grass species mature rapidly during the early summer season and progressively but differentially decline in palatability and nutritive value with advancing maturity. Several grasses, particularly *Elyonurus argenteus,* are considerably less palatable to stock than others. *E. argenteus* is particularly