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Acacia cochliacantha control in buffel grass pastures at Alamos, Sonora, Mexico

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Introduction

Chirahui (*Acacia cochliacantha*) is an aggressive tall-shrub which invades buffelgrass (*Cenchrus ciliaris* L.) in the short jungle area of Southern Sonora, Mexico. As brush invasion takes over the pastures buffelgrass forage production declines and spiny brush species interferes with cattle grazing (Martin *et al*., 1995). Manual brush control practices are common in the area but are normally ineffective because plants re-sprout back and reinvade pastures. *Tordon 101* herbicide (64.0 g a.i./l *Picloram* + 240.0 g a.i/l 2,4-D) has been widely used for brush control in northern Mexico but it is expensive and is planned to go out of the market soon. Prado herbicide (621.3 g a.i./kg. *Amynopyralid* + 94.5 g a.i./kg. *Metsulfuron metil*) is a new and economic product released from Dow Agrosciences in Mexico but no local data is available for its use. This study was conducted in summer of 2011 to evaluate the efficiency of Prado herbicide and manual control by machete to reduce chirahui populations.

Materials and Methods

The study was conducted at Rancho Tres Marias in Alamos, Sonora, Mexico (29° 05′11.0” N. Lat; 110° 35′13.1” W. Long). Treatments applied were: 1) Prado herbicide one doses on 100 liters of water, 2) Tordon 101 herbicide at 1% in water 3) manual control by machete and 4) the untreated check. Herbicides were foliar applied with an 18 liter backpack sprayer calibrated to release specific dosages for each treatment. All herbicide applications were conducted in early august when all plants were actively growing. Applications were conducted early in the morning from 8 to 9:30 AM when wind speed was either absent or negligible. Chirahui plants manually controlled by machete were cut 5 cm above the soil surface.

Evaluated variables were: brush mortality, grass density, plant height, basal cover and forage production. All variables were evaluated during the summers of 2011 to 2013. Brush density was estimated by counting *Acacia* plants on three permanent quadrats 30 m^2 each by plot. Brush mortality was estimated by difference at each sampling date. Buffelgrass density was estimated by counting plants on ten 1 m^2 quadrats, randomly selected per plot. Grass height was measured with a tape in all plants within these five quadrats. Plant basal cover was estimated in the same quadrats by individually measuring the basal area of each plant. Forage production was estimated by clipping forage on 20 subsamples of 1 m^2 quadrats per plot. Forage samples were weighted after they were dried at 60 °C in an air forced oven for 72 hours. Forage samples were separated into native grasses, buffelgrass and total biomass components. Plots remained excluded from cattle grazing during the study period.

Plots 10 by 30 m were used in a randomized complete block design with four treatments and four replications. Data were analyzed by ANOVA ($P \leq 0.05$). When differences were detected, the Duncan´s Multiple Range Test was used for mean separation.

Results and Discussion

Precipitation averaged 438 mm from 2011 to 2013 and was close to the long term mean (450 mm). Moisture conditions were adequate for plant growth and herbicide activity. Treated plants show intensive chlorosis and defoliation within 3 days of chemical application. Prado and Tordon 101 herbicides controlled 100% of chirahui plants and caused no phytotoxicity problems to either buffelgrass or native grass species present Bouteloua aristidoides, Cathestecum brevifolium, and Bouteloua rothrockii (*Table 1*). Manual control by machete initially removed the whole plants but they start sprouting intensively at the plant bases. Machete treatments controlled 15% of the chirahui species but treated plants sprouted back and reach pretreatment levels after three summer growing seasons. Chemical brush control significantly increased ($P \leq 0.05$) buffelgrass density, height, basal cover and forage production and changes were consistently greater ($P \leq 0.05$) on chemically treated plots as compared to plots where Acacia plants were controlled by machete. Buffelgrass density increased 82.7% and 48.2%; plant height increased 38.5% and 9.4%; basal cover increased 25.9% and 3.0% on herbicide and manually controlled plots, respectively.

Forage production of both native grasses and buffelgrass were significantly increased ($P \leq 0.05$) by brush control (*Table 1*). Production of native grasses varied from 0.22 to 0.40 tons/ha and although it is the grass component with the least productivity, these species took advantage of brush control. Forage production of native grasses, buffelgrass and total forage production was consistently greater ($P \leq 0.05$) on chemically treated plots as compared to machete treated areas and untreated checks. Total forage production varied from 8.9 to 9.2 tons D.M./ha on chemically treated plots, averaged 6.8 tons D.M./ha on machete treated areas and 4.9 tons D.M./ha on the untreated (checks). Buffelgrass plots where chirahui was controlled produced additionally from 1.9 to 4.3 tons of D.M/ha/year.

Table 1. *Acacia cochliacantha* mortality, buffelgrass density, height, basal cover and forage production following foliar application of Prado herbicide and manual control by machete on buffelgrass pastures at Alamos, Sonora, Mexico.

Variable	Prado	Tordon 101	Machete	Untreated Check
Brush mortality (%)	100.0 a	100.0 a	15.0 b	0.0 c
Plant density (pl/m^2)	5.5 a	5.1 a	4.3 b	2.9 b
Plant height (cm)	130.8 a	118.5 a	98.5 b	90.0 b
Basal cover (%)	12.6 a	12.1 a	10.1 b	9.8 b
Native grasses forage production (t/ha)	0.4 a	0.37 a	0.27 b	0.22 b
Buffelgrass forage production (t/ha)	8.8 a	8.5 a	6.5 b	4.7 c
Total Forage production (t/ha)	9.2 a	8.9 a	6.8 b	4.9 c

* For each variable means flowed by similar letter are not significantly different ($P \leq 0.05$; Duncan).

The results of this study suggest that *Acacia* plants compete with buffelgrass affecting normal grass development and reducing pasture productivity. Vegetation responses are the results of plant competition reduction, which aid in the establishment of forage species in areas previously occupied by invading species (Ibarra *et al*., 1986). These results agree with Morton *et al*. (1990), were the elimination of invasive shrubby species increased plant density, basal cover and forage production of grasses in rangelands. Similar results have been reported in Southern Sonora, Mexico by Ibarra *et al* (1986) after control of high densities of shrubby species with prescribed burning. Adequate brush management practices are needed to control invasive species on rangelands (Vallentine, 1989) and not all practices are equally effective for vegetation control. Control treatments that do not kill the plant roots may result in an ineffective vegetation practice (McGinty *et al*., 2009).

Conclusion

Foliar applications of Prado herbicide are appropriated to reduce chirahui populations and increase productivity in buffelgrass pastures in the humid areas of Southern Sonora, Mexico. Manual control by machete is not recommended because forage production increases are short-lived and may result economically not justified. Buffelgrass plots where chirahui was effectively controlled produced additionally from 1.6 to 3.6 tons of D.M./ha/year. Brush control is required to reduce *Acacia* populations and increase range productivity on infested buffelgrass pastures.

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