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THE CONTROL OF CASHA (*Acacia* spp.) ON NATIVE PASTURE

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ABSTRACT

Native pastures, dominated by guineagrass (*Panicum maximum*) and leucaena (*Leucaena leucocephala*), provide the basic feed resource for the ruminant livestock industry in the Virgin Islands. However, many of these pastures are in advanced stages of deterioration because of overgrazing. There are currently no standard recommendations to prevent the continued ingress of malevolent plants such as casha (*Acacia* spp.). A split plot field trial was set up to test the efficacy of mechanical and/or chemical treatments for the control of casha. Main plots, replicated three times, consisted of mechanical shredding vs. non-shredded mature plants. These treatments were applied in May, 1990. Subplots were 6 chemical foliar sprays: 2.0 and 3.0 kg/ha of dicamba alone; 1.28 and 2.56 kg/ha of Trimec[R] Super Brush Killer (1:4:4 dicamba, 2,4-D and 2,4-DP); 285 L/ha of diesel oil; and a herbicide check. Subplot treatments were applied 12 wk after mechanical treatments to allow for sufficient regrowth on shredded plots. Chemical application was repeated 24 wk after the first application. Plant density of casha and frequency of canopy occurrence of all dominant plant species were taken initially in May, 1990, and again after 36 wk (just before second herbicide application) and 84 wk. Shredding alone prevented the 14% increase ($P<0.05$) in the initial casha plant density (1.3 plants/m^2) that was observed on the non-shredded herbicide check, but did not kill any existing casha plant over the 84-wk period. However, shredding plus regrowth combined with dicamba or Trimec[R] application synergistically induced greater ($P<0.01$) casha mortality (68%) than similar herbicide-treated mature non-shredded plots (48% mortality). A significant leaf drop and canopy reduction (62%) followed the first application of diesel oil on

shredded plus regrowth treatment but there was no long term topkill (4%) of existing casha plants. The higher rates of both herbicides provided the best control of casha. Approximately 80% casha mortality was obtained by the initial application of 3.0 kg/ha of dicamba or by double application of 2.56 kg/ha of Trimec^R to the shredded plus regrowth treatment without any deleterious effect on the associated leucaena or guineagrass. These data signify that mechanical shredding could be integrated with available herbicides for satisfactory control of casha on native pasture.

INTRODUCTION

The livestock industry of the Virgin Islands is supported primarily by 6,000 hectares of rangeland. The native pastures are dominated by guineagrass and leucaena in productive areas. However, dry season overgrazing has resulted in widespread range deterioration and the development of less productive casha and/or hurricane grass (*Bothriochloa pertusa*) associations. In a survey (Michaud and Michaud, 1987), casha had invaded 90% of St. Croix's fields and decreased utilizable pasture by up to 26%.

Both *Acacia tortusa* and *A. macracantha* are particularly successful pasture pests because of tolerance to drought, fire and calcareous clay soils and their high reproductive capacity, longevity of seed and lack of browsing by livestock (Oakes, 1970; Little et al., 1974). Additionally, their shrubby stems and horizontal branches, covered with lignified spines, combine to form impenetrable thickets that reduce forage productivity and hinder movement of livestock and light machinery.

Individual, mature casha plants may be destroyed by hand rogueing but this method is cumbersome, expensive and effective only for small areas. Mechanical rogueing using tractors and bulldozers remove the top soil and vegetation and adversely affect the physical condition of rangeland. Moreover, mechanical rogueing methods, fire and selective livestock grazing enhance casha seed dispersal while reducing the vigor of desirable forage. Oakes (1970) investigated mechanical and chemical means for the control of casha and recommended a basal spray of a mixture of 2,4-D and 2,4,5-T in diesel oil on older mature plants. He also recommended foliar application of the same herbicide mixture without diesel oil for the control of young actively growing casha plants. However, the herbicide 2,4,5-T has since been banned by the E.P.A. from general use. Most farmers on the Islands continue to use plain diesel oil as basal spray with marginal success. Holder (1987) obtained over 95% casha control with basal application of hexazion and tebuthiuron. Diesel oil, hexazion and tebuthiuron are all non-selective herbicides and must be carefully applied to the base of individual mature plants in order to preserve the associated forage species. Moreover, basal application of herbicides to individual plants is impractical on dense spiny casha thickets. Banvel (dicamba) at 2.2 to 3.4 kg/ha active ingredient in double (April and September) foliar applications provided 91 to 96% control of a similar woody brush, sand blackberry ***(Rubus cuneifolius)***, in Florida (Mislevy et al., 1986).

The objective of this study was to investigate mechanical and foliar chemical methods for the control of casha on native Virgin Island pastures.

MATERIALS AND METHODS

A field trial was established in 1990 at the sheep research facility of the Agricultural Experiment Station, University of the Virgin Islands to test the efficacy of mechanical shredding and herbicide treatments for the control of casha. The trial was located in natural stands of dense (1.3 plants/m^2) and well-distributed casha plants. The experimental design was a split plot randomized complete block with three replicates. The main plots consisted of mechanical shredding to approximately 10-cm stubble vs. non-shredding. Subplots consisted of 6 chemical treatments including a check. Each subplot occupied an area of 2.0 x 6.1 m. Shredding was done in May 1990, 12 wk prior to the first application of herbicides, to obtain sufficient casha regrowth. The 6 chemical treatments applied to each main plot were: 2.0 and 3.0 kg/ha of dicamba alone; 1.28 and 2.56 Trimec^R Super Brush Killer (1:4:4 dicamba, 2,4-D, 2,4-DP); 285 L/ha of diesel oil and a herbicide check.

A backpack boom sprayer with a pressure gauge (30 psi) was used to broadcast herbicide on foliage in August when regrowth from the shredded area was approximately 40 cm in height. Herbicide treatments were repeated 24 wk after the initial application.

Plant density and frequency of canopy accurrence of *Acacia* spp. were determined on each plot in May, 1990, prior to mechanical shredding and repeated at 36 wk (just before the second herbicide application) and 84 wk. Frequency of canopy occurrence was measured with a modified line transect and point method (Hyder et al. 1965). The modification consisted of a 0.09-m^2 quadrat as the point which was moved at 0.6-m intervals along the transect. Plant species with canopy intercepted within the quadrat were recorded as being present. Canopy frequency of occurrence was also monitored for all important pasture species such as guineagrass, hurricane grass, leucaena and *Teramnus labialis* at the beginning of the experiment, and at 36 and 84 wk following mechanical treatment. Plant density of casha and data on frequency of occurrence were expressed as a percentage of their initial pre-shredding estimates to determine the extent of control. Botanical data were subjected to analysis of variance according to the GLM SAS procedure and means were separated by the Duncan's multiple range test.

RESULTS AND DISCUSSION

Effect of Mechanical Treatment

Plant counts, made 36 wk after the initiation of the experiment, indicated that 58% of the initial casha plant population remained alive (i.e. 42% mortality) on shredded plus regrowth treatment compared with 75% (25% mortality) on non-shredded treatment (Table 1). Estimates made at 84 wk following double herbicide application averaged 47% of initial live casha population (53% mortality) and 64% (36% mortality) for shredded with regrowth and nonshredded treatments, respectively. Corresponding casha canopy frequency values for shredded vs. non-shreded were 45 vs. 78% of the initial at 36 wk and 48 vs. 62% at 84 wk. Thus, 84 wk after mechanical and chemical treatments, shredding plus regrowth induced 17% and 14% more reduction of the initial casha plant density and canopy spread, respectively, than nonshredding, when averaged across herbicide treatments (Tables 1 and 2). Although this beneficial effect of shredding plus regrowth over non-shredding was numerically consistent across herbicide treatments (i.e. no mechanical x chemical treatments interaction, $P > 0.22$), two distinct patterns emerged. For subplots that received the herbicide check and diesel oil treatments, shredding simply prevented further casha multiplication from the initial density (Table 1) and further canopy spread (Table 2) when compared with non-shredded treatment. However, when combined with the application of dicamba or Trimec, shredding plus regrowth synergistically reduced the initial casha plant density and canopy spread (Tables 1 and 2). These observations suggest that while periodic shredding or diesel oil application could help contain the increase of casha on native range, those treatments by themselves are incapable of killing existing plants unless integrated with herbicide application.

Effect of Chemical Treatment

Significant ($P < 0.0001$) differences were observed in the response of relative casha plant density and canopy frequency of occurrence to herbicide treatments. The first application of 2.0 and 3.0 kg/ha of dicamba alone reduced the original casha plant density to 49 and 22% of the initial density on previously shredded plots and to 66 and 47% on non-shredded plots, respectively (Table 1). This agrees with Oakes (1970) observation that foliar application of phenoxy herbicides provided a more effective control when applied to young, tender, fast-growing casha plants. Double application of 2.0 kg/ha dicamba resulted in further reduction of casha density ($P < 0.01$), irrespective of mechanical treatment. However, double application of 3.0 kg/ha dicamba produced an additional significant decrease in casha density only on the mature non-shredded stand (Table 1). The first application of Trimec[R] Super Brush Killer reduced the casha density to 35-48% of the initial density on previously shredded plots and to 58-74% on non-shredded areas, depending on the rate of application (Table 1). There was a further decline ($P < 0.02$) in casha population at 84 wk as a result of double Trimec[R] application except for the lower rate on non-shredded plots (Table 1). Double application of both herbicides also produced significant decreases in casha canopy spread with the exception of the lower Trimec[R] rate on non-shredded plants (Table

2). The data reemphasize the difficulty in chemical destruction of mature casha plants through foliar spray and the necessity for multiple treatments (Oakes, 1970; Mislevy et al, 1986), especially on mature plants.

Overall, diesel oil had little effect on the initial casha plant density (Table 1), but caused a significant reduction on the canopy spread compared with the herbicide check (Table 2). The data show that diesel oil, when applied to the regrowth of previously shredded casha, could give a false impression of casha control because of significant leaf drop and a 62% canopy reduction (Table 2) without actual plant kill (Table 1). This could explain the continued use, with limited success, of diesel for casha control by farmers.

Optimum (84 wk) casha control was obtained with the application of the higher rates of either dicamba or Trimec. Approximately 80% of casha control was obtained with a single application of 3.0 kg/ha dicamba or two applications of 2.56 kg/ha Trimec^R Super Brush Killer on pasture 12 wk after shredding the field.

Other Dominant Plant Species

The remaining dominant pasture plants exhibited a widely variable response to the application of treatments. ***Teramnus labialis*** was extremely sensitve to the broadleaf herbicides and was virtually eradicated from the experimental site (including the herbicide check) because of its creeping habit. The apparent increase in the initial leucaena canopy spread from plant coppices following shredding was only short-lived (Table 3). There were no measurable final (84 wk) changes in the initial canopy coverage of the two most valuable pasture species, guineagrass and leucaena, in response to mechanical and chemical treatments (Table 3). Hurricane grass, the other pasture pest, increased in canopy frequency with time, especially following shredding and herbicidal control of casha. At the final botanical assessment, hurricane grass had increased in canopy frequency approximately five times the initial value on shredded and herbicide (dicamba or Trimec^R)-treated areas and twice on similarly treated non-shredded plots (Table 3). Shredding alone did not induce any large increase in hurricanegrass because of complete casha recovery.

As native pasture becomes more open due to casha control, proper fertilizer and grazing management schedules would be required to contain the spread of hurricane grass.

CONCLUSIONS

The results suggest that mechanical shredding plus regrowth, when integrated with application of herbicides can provide satisfactory control of casha on native pasture. The most vulnerable casha plant regrowth stages to herbicide application and their implication on fertility and grazing management programs necessary for the maintenance of a desirable botanical balance between guineagrass and hurricane grass are subjects currently under research.

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Table 1. The effects of mechanical pretreatment and chemical foliar spray[1] on the percentage of casha (*Acacia* spp.) plant population density relative to the initial density at two post treatment intervals.

Chemical treatment	Rate	36 wk Shred	36 wk Non-shred	36 wk Mean	84 wk Shred	84 wk Non-shred	84 wk Mean
		--------	--------	-------- %	--------	--------	--------
Dicamba (kg/ha)	2.0	49	66	58bc*	35	40	37bc
Dicamba (kh/ha)	3.0	22	47	35c	20	25	22c
Trimec[R2] (kg/ha)	1.28	48	74	61b	34	72	53b
Trimec[R] (kg/ha)	2.56	35	58	47bc	13	37	25c
Diesel oil (l./ha)	285	98	94	96a	96	111	103a
Chech	--	93	108	100a	86	100	93a
Pretrt.mean		58BC	75A		47C	64AB	
time int. mean		67 A			56 B		

* Chemical treatment means in a column followed by the same lowercase letter or pretreatment and time interval means in a row followed by the same uppercase letter are not significantly different ($P > 0.05$).

[1] First and second chemical sprays were applied 12 wk and 36 wk after mechanical pretreatment.

[2] Trimec[R] contains 1:4:4 dicamba, 2,4-D, 2,4-DP.

Table 2. The effects of mechanical pretreatment and chemical foliar spray[1] on the percentage of casha (*Acacia* spp.) canopy frequency of occurrence relative to the initial frequency at two post treatment intervals.

Chemical treatment	Rate	36 wk			84 wk		
		Shred	Non-shred	Mean	Shred	Non-shred	Mean
		%					
Dicamba (kg/ha)	2.0	58	75	67b*	29	33	31d
Dicamba (kh/ha)	3.0	31	86	58bc	21	38	30d
Trimec[R2] (kg/ha)	1.28	35	68	51bc	34	69	51c
Trimec[R] (kg/ha)	2.56	27	50	39c	13	27	20d
Diesel oil (L/ha)	285	38	72	55bc	77	84	81b
Chech	--	82	115	98a	116	122	119a
Pretrt. mean time int. mean		45B	78A		48A	62A	

* Chemical treatment means in a column followed by the same lowercase letter or pretreatment means for each period followed by the same uppercase letter are not significantly different ($P > 0.05$).

[1] First and second chemical sprays were applied 12 wk and 36 wk after mechanical pretreatment.

[2] Trimec[R] contains 1:4:4 dicamba, 2,4-D, 2,4-DP.

Table 3. The effects of mechanical pretreatment and chemical foliar spray[1] on chanyes in the percentage of canopy frequency of occurrence of three dominant pasture species relative to their initial frequency.

Pasture species	Chemical treatment	Rate	36 wk		84 wk	
			Shred	Nons	Shred	Nons
			-------------- % --------------			
Leucaena	Dicamba (kg/ha)	2.0	108	95	109	97
	Dicamba (kg/ha)	3.0	111	96	95	114
	Trimec[R2](kg/ha)	1.28	137	108	110	103
	Trimec[R] (kg/ha)	2.56	102	107	102	108
	Diesel oil (L/ha)	285	118	99	96	96
	Check	---	116	112	103	97
	Pretreatment mean		115A*	103B	103A	103A*
Guineagrass	Dicamba (kg/ha)	2.0	98	98	98	98
	Dicamba (kg/ha)	3.0	99	98	99	96
	Trimec[R] (kg/ha)	1.28	94	105	97	92
	Trimec[R] (kg/ha)	2.56	96	116	93	156
	Diesel oil (L/ha3	285	102	98	99	111
	Check	---	98	98	99	96
	Pretreatment mean		98A	102A	98A	108A
Hurricane grass	Dicamba (kg/ha)	2.0	474a	189a	605a	188a
	Dicamba (kg/ha)	3.0	179c	194a	600a	201a
	Trimec[R] (kg/ha)	1.28	309b	193a	457b	206a
	Trimec[R] (kg/ha)	2.56	332b	152ab	606a	167a
	Diesel oil (L/ha)	2.85	281bc	130ab	363b	151a
	Check	---	115c	90b	153c	131a
	Pretreatment mean		282A	158A	464A	174B

* Mechanical pretreatment means for each species within each period followed by the same uppercase letter or chemical treatment values in a column for hurricane grass followed by the same lowercase letter are not significantly different ($P>0.05$).

[1]First and second chemical spray were applied 12 wk and 36 wk after mechanical pretreatment.

[2]Trimec[R] contains 1:4:4 dicamba, 2,4-D, 2,4-DP.