Grazing behavior and forage preference of sheep with chronic locoweed toxicosis suggest no addiction

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Abstract

Addiction is commonly cited as a clinical sign of locoweed (*Astragalus* spp. and *Oxytropis* spp.) poisoning. In a previous study, ewes progressively poisoned on locoweed ("locoed") in cafeteria trials did not become addicted to locoweed. Following a year of recovery, these ewes were allowed to graze locoweed-infested rangeland to determine if there was any residual preference for, or addiction to, locoweed. Neither the locoed nor control ewes consumed appreciable amounts of locoweed on rangeland where associated forage was succulent and actively growing, and where grazing pressure was sufficiently low to allow selective grazing. There was no residual preference for locoweed in previously locoed ewes. However, locoed ewes often exhibited sudden involuntary seizures when attempting to take a bite of forage. The head would tremble and tuck up under the brisket in a bobbing motion, and eye lids fluttered for a few seconds before the animal was able to proceed in feeding. Biting rate of locoed ewes was about a third less than that of the control ewes ($P<.05$), and locoed ewes took fewer bites of grass than the control ewes ($P<.01$). Physical inhibition of feeding caused by the sudden seizures and reduced consumption of coarse forage, which may be more difficult to prehend, may contribute to the persistent emaciated condition and reduced productivity of some locoed animals.

Key Words: poisonous plant, *Oxytropis sericea*, grazing behavior, addiction

Addiction is commonly cited as a clinical sign of locoweed poisoning from *Astragalus* and *Oxytropis* species in North America (Marsh 1909, Kingsbury 1964, James et al. 1981) and *Swainsona* species in Australia (Everist 1981). However, the reported addiction was not observed in controlled cattle grazing trials. Cattle voluntarily selected only the immature seed pods of white locoweed (*Oxytropis sericea* Nutt.). When the pods were depleted, cattle resumed selecting grass even though locoweed leaves were abundant (Ralphs 1987, Ralphs et al. 1987). Senescent wahweap milkvetch (*A. lentiginosus* var. *wahweapensis*) was grazed in proportion to its availability on winter range, but cattle did not increase their proportionate consumption of it as they became intoxicated (Ralphs et al. 1988).

To further evaluate locoweed's addicting nature, we conducted cafeteria feeding trials to determine ewes' preference for locoweed (*Astragalus lentiginosus* Dougl. ex Hook) as they became progressively intoxicated (Ralphs et al. 1990). Ewes were fed a basal diet of 15 or 20% locoweed and offered a choice between locoweed, alfalfa pellets, or grain at 2-week intervals throughout the trial. Results from the initial experiment indicated the locoweed was not innately palatable to sheep. Ewes did not develop physiological or psychological addictions to locoweed. Neither did they lose their ability to discriminate between feeds when intoxication became severe. Most ewes rejected locoweed when a choice was offered, even when they were severely intoxicated. However, 3 of 37 ewes developed an acceptance of locoweed as they became intoxicated. Only 1 ewe exhibiting this acceptance recovered from the poisoning; the others died. Sixty days after being removed from the locoweed diet, the surviving ewe still maintained an acceptance of locoweed. However, after 120 days, she rejected it, as did all other ewes which had been poisoned.

The objective of this study was to expose the ewes that had been poisoned on locoweed in the previous pen-feeding trial to locoweed-infested rangeland, and determine if they would seek out and graze locoweed exclusively or express any residual preference for locoweed.

Methods

The grazing study was conducted on a high mountain grassland (2,900 m) on the Raft River Mountains in northwestern Utah. The range site was a high mountain loam and supported a homogenous grass/forb vegetation community. Dominant grasses included Idaho fescue (*Festuca idahoensis* Elmer) and mutton grass (*Poa fendlariana* (Stend.) Vasey). Dominant forbs included white locoweed (*Oxytropis sericea* Nutt.), tailcup lupine (*Lupinus caudatus* Kelogg) and yarrow (*Achillea lanulosa* Nutt.). Minor forbs included buckwheat (*Eriogonum heracleoides* Nutt.), rose pussytoes (*Antennaria rosea* Green), plantain (*Plantago lanceolata* L.) and dandelion (*Taraxacum officinale* Weber).

Six mature Columbia × Suffolk crossbred ewes poisoned on locoweed in the 1988 feeding trials (Ralphs et al. 1990), and 6 control ewes (naive to locoweed) of similar age, weight, and breeding were taken to the study site and allowed to graze during the flower and pod growth stage of white locoweed (July 13–28, 1989). Although a year had passed since they were poisoned, the locoed ewes still showed clinical signs of poisoning when stressed (nervousness, shaking of the head, and a stiff-legged gait), and 2 of the ewes were in poor condition.

Social facilitation (the influence of other animals eating a particular food) may influence an animal's diet selection (Lane et al. 1990, Ralphs and Olsen 1990). Therefore, the control and locoed groups were grazed in separate pastures. Four 0.25-ha pastures were constructed, and 3 locoed or control ewes were randomly allocated to each pasture. The ewes remained in the pastures for the duration of the study.

Diets were quantified by bite count (Lehner 1987). Each ewe was observed from a distance of 2 to 5 m for 2-minute periods, and the number of bites of grasses, forbs, loco leaves, and loco heads were recorded. Observers rotated through all pastures and obtained 2 to 3 sample periods for each ewe during each morning and evening grazing period. Diets were expressed as the mean number of bites taken of each forage category per 2-minute observation period. Biting rate (bites/min) was also calculated. All parameters were analyzed by repeated measures analysis of variance (ANOVA) in a split plot design. Treatment groups were the main plot and days were the split plot.

Standing crop was sampled at the beginning of the study. Twenty 0.25-by 1-m quadrats were systematically located along a transect running down the middle of the pastures before they were subdivided. Species were clipped and composited into grass, forb, locoweed leaf, and locoweed head. Samples were dried at 60° C for 48 hr, and weighed, and standing crop was calculated.

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Table 1. Mean number of bites of forage classes during 2 min. observation periods, percent of bites and biting rate of control and locoed ewes.

Forage class	Number of bites		Percentage of bites	
	Control	Locoed	Control	Locoed
			——%——	
Grass	39**	26**[1]	65*	59*
Forb	21	18	35**	42**
Locoweed	.05	.03	.09	.08
Total	60.05	44.03		
Biting rate (bites/min.)	30*	22*		

[1]Means between treatment groups are different *$P<.05$, **$P<.01$.

Results and Discussion

The ewes previously poisoned on locoweed did not revert to eating locoweed under grazing conditions encountered in this study. Both groups consumed negligible amounts of locoweed (Table 1). The ewe that showed a preference for locoweed in the pen cafeteria trial when she was severely intoxicated did not select locoweed to a greater extent than did other ewes in either the locoed or control group. Previous grazing studies on the same site showed that cattle selectively grazed the immature, succulent seed pods of white locoweed (Ralphs et al. 1987). The study encompassed the flower and immature pod growth stages when white locoweed should have been most acceptable to grazing livestock. Sheep in this study refused the pods, succulent flowers, and leaves of white locoweed. Grazing pressure did not limit forage availability during the study, and associated grasses and forbs were growing rapidly.

The ewes preferentially consumed more grass (59 to 65% of bites; Table 1) even though forbs dominated the site (50% of forage crop; Table 2). Idaho fescue and mutton grass were in the boot stage and

Table 2. Standing crop (SC) of forage classes at the beginning of the study.

	Grass	Forb	Locoweed leaf	Locoweed head	Total
	---------- kg/ha ----------				
Mean	658	834	138	37	1667
SE	50	68	28	8	
% of SC	40%	50%	8%	2%	

were consumed in equal proportions. Palatable forbs included buckwheat, dandelion, and rose pussytoes.

An interesting phenomenon occurred in the locoed ewes. As they lowered their heads to graze, they often seemed to experience sudden involuntary seizures or trembling of the head, apparently stimulated or initiated by lowering the head to graze. As the seizure progressed, the head would bow and tuck up under the chest in a bobbing motion, and eye lids would flutter. The seizures lasted a few seconds, and the ewes could not prehend food until it passed. When the seizures passed, they appeared to graze normally. However, when their raised their heads and moved, seizures recurred when they subsequently lowered their heads to graze. The biting rate of the locoed ewes was almost a third lower ($P<.05$) than that of the control group (Table 1), apparently due to interference by the sudden seizures. The 2 locoed ewes in poorest condition had the lowest biting rates (18 and 20 bites/min).

The locoed ewes consumed less grass than the control ewes (59 vs 65% of bites; Table 1). The locoed ewes appeared to pass over grasses and seek out and select fine textured forbs (buckwheat and rose pussytoes) more than did the control ewes. This might have been due to easier prehension of forbs compared to grasses, since the lignified structure of grasses may provide more resistance to prehension. There was a positive correlation (r = .65) between the amount of grass in the locoed group diets and their biting rate; ewes with higher biting rates (less impediment from the spasm) consumed more grass. The residual effects from locoweed poisoning may involve a physical impediment to prehending forage caused by seizures at the onset of prehension. Afflicted animals tended to select plants that are easier to prehend.

Management Implications

Under the conditions of this study, sheep poisoned on locoweed did not become addicted to it, and did not graze it exclusively or even preferentially when returned to locoweed-infested rangeland. The results raised another question: the ability of locoed animals to prehend and ingest adequate feed under rangeland conditions. The reduced ability to prehend feed may be a major contributor to the emaciated condition of animals previously poisoned by locoweed. We speculate the locoed animals may not be able to regain their productivity because of inability to prehend and ingest adequate amounts of feed uner rangeland conditions.

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