Agricultural Experiment Station U. S. Department of Agriculture

Department of Animal and Range Sciences

CLAYTON LIVESTOCK RESEARCH CENTER

PROGRESS REPORT

Route 1 Box 109 Clayton, New Mexico 88415 505-374-2566

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Early effects of locoweed toxicosis and influence of mineral supplements[1]

S. E. Bachman, M. L. Galyean, G. S. Smith and J. D. Graham

Locoweed toxicosis can result in reduced gains, abortions, birth defects and death; it can cause major economic losses for producers in the western United States. Visual symptoms appear only after chronic ingestion of locoweeds, and locoweed toxicity is often irreversible at this late stage of toxicity. The primary objective of our experiment was to monitor early stages of locoweed toxicity by evaluating changes in blood chemical constituents. In addition, certain minerals may ameliorate effects of locoweed toxins in the rumen and thereby prevent toxicity. Hence, our secondary objective was to test the efficacy of a commercial mineral mixture that has been reported to alleviate symptoms of locoweed toxicity (Silent Herder) and a naturally occurring zeolite, clinoptilolite, for prevention of locoweed toxicity.

Sixteen crossbred heifers [average initial body weight (BW) 650 lbs] were penned individually outdoors and limit fed 10 lbs of sorghum sudangrass hay for 7 days. During the following 28 days, heifers were fed 10 lbs/day of the following dietary treatments (four heifers/treatment): 1) sorghum sudangrass hay, 2) 80% sorghum sudangrass hay:20% locoweed, 3) 80% sorghum sudangrass:20% locoweed plus 3.5 oz of Silent Herder mineral mix and 4) 80% sorghum sudangrass:20% locoweed plus 3.5 oz of clinoptilolite. Before feeding roughage, all heifers received 300 g daily of a 95% hominy feed:5% molasses (as-fed basis) supplement; for heifers fed Silent Herder and clinoptilolite, minerals were mixed with this supplement. On day 29 of the experiment, all 16 heifers were moved to a single pen and given free access to sorghum sudangrass hay for a 2-week period.

White point locoweed was collected in Union County, New Mexico in June 1990, and included all aerial portions (pre-bloom/bloom) and some root portions. Locoweed and sorghum sudangrass hay (Table 1) were ground to pass a 2-inch mesh before mixing and feeding. Heifer BW were measured, and samples of jugular blood were collected before feeding on days 0, 7, 14, 21, 28, 35 and 42. Blood was centrifuged, and serum was analyzed for 30 chemical constituents by a medical diagnostic laboratory.

Table 1. Chemical composition of the sorghum sudangrass hay and 80% sorghum sudangrass hay:20% locoweed mixture fed to heifers for 28 days

Item	Hay only	Hay plus locoweed
	%	
Dry matter	92.7	91.8
Ash	12.9	12.0
Crude protein	12.6	12.4
Neutral detergent fiber	65.4	62.1
Cellulose	34.7	32.1
Hemicellulose	24.5	21.3
Lignin	6.2	8.7

As noted above, heifers started the experiment with an average BW of 650 lbs. After 28 days of feeding the four treatment diets, BW averaged 659 lbs, with no difference among treatments. Important differences in blood chemical components are shown in Table 2. Heifers consuming diets containing locoweed had increased ($P < .05$) blood concentrations of two enzymes, alkaline phosphatase and serum glutamic oxaloacetic transaminase (SGOT). Because there were no sampling day by treatment interactions during weeks 1 through 4, our data indicate that these enzyme concentrations were increased within 1 week of initiating locoweed feeding, and remained equally elevated during the following 3 weeks. Concentrations of these two enzymes were increased because locoweed toxins damaged liver and muscle cells, allowing these cellular enzymes to leak into the blood. Serum iron concentration also was decreased ($P < .05$) in heifers consuming locoweed-containing diets. Reasons for this decrease in serum iron are not known, but serum iron sometimes decreases with stress and infectious diseases.

One week after cessation of feeding locoweed (week 5), alkaline phosphatase was still elevated ($P < .05$), but had dropped to near-normal values; by 2 weeks (week 6), its concentration was below ($P < .05$) control values. Blood concentration of SGOT remained elevated ($P < .05$) for 2 weeks after cessation of feeding locoweed. Serum iron concentration did not differ among treatments during weeks 5 and 6, indicating that effects of locoweed on serum iron concentration were readily reversible. Although some changes were noted with other blood chemical constituents, these changes were not consistent among weeks or treatments.

[1]We appreciate the assistance of Farr Better Feeds, Guymon, OK, for supplying Silent Herder and Leonard Resources, Albuquerque, NM, for supplying clinoptilolite.

Although the length of the feeding period used in our study was insufficient to cause acute symptoms of locoweed toxicity, these data verify earlier reports of increased alkaline phosphatase and SGOT in response to consumption of locoweed. Further, it appears that alkaline phosphatase returns to normal levels within 2 weeks after cessation of feeding locoweed. Both alkaline phosphatase and SGOT should be useful indices of locoweed toxicity.

With regard to effects of supplemental mineral mixtures on locoweed toxicosis, neither Silent Herder nor clinoptilolite altered changes in blood chemistry associated with feeding locoweed. Whether these mineral supplements would alleviate acute symptoms of toxicity resulting from long-term consumption of locoweed remains to be determined.

Table 2. Serum alkaline phosphatase, glutamic oxaloacetic transaminase (SGOT) and iron concentrations in beef heifers fed roughage diets with or without 20% (DM basis) locoweed as affected by supplemental mineral compounds

	Treatment[a]			
Item	Hay only	Hay + locoweed	Silent Herder	Clinoptilolite
		Week 0		
Alkaline phosphatase	201	207	247	217
SGOT	104	107	110	100
Iron	136	147	139	160
		Weeks 1 to 4		
Alkaline phosphatase	273[b]	997[c]	1,243[c]	1,128[c]
SGOT	107[b]	233[c]	254[c]	224[c]
Iron	147[b]	102[c]	104[c]	113[c]
		Week 5		
Alkaline phosphatase	228[b]	374[c]	372[c]	472[c]
SGOT	123[b]	290[c]	296[c]	293[c]
Iron	148	119	133	103
		Week 6		
Alkaline phosphatase	246[b]	177[c]	199[c]	177[c]
SGOT	82[b]	246[c]	247[c]	249[c]
Iron	119	119	95	112

[a]Hay only = sorghum sudangrass hay; Hay + locoweed = 80:20 mixture of sudangrass hay and locoweed; Silent Herder = 80:20 sudangrass:locoweed plus 3.5 oz daily of Silent Herder mineral mix; Clinoptilolite = 80:20 sudangrass:locoweed plus 3.5 oz daily of clinoptilolite, a natural zeolite.

[bc]Row means with different superscripts differ ($P < .05$).

Department of Animal and Range Sciences
New Mexico State University
Box 30003/Department 3I
Las Cruces, New Mexico 88003-0003