Lupine Poisoning as a Possible Factor in Congenital Deformities in Cattle

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Cattle losses from poisoning by grassland lupine *(Lupinus laxiflorus)* have long been reported from California mountain ranges. Both death and the production of deformed calves have been attributed to this plant. Deformities of the fetus may make delivery difficult or even cause death of the dam at parturition. Published reports on the toxicity of this lupine to livestock are brief, but the evidence is definite that it is poisonous to cattle (Clawson, 1931).

Congenital deformities attributed to lupine consist of cleft palate, wry neck, and crooked forelegs (figure 1). Manifestations of these deformities are considerably varied, and may not all occur in the same animal. Some stockmen believe the cleft palate and wry neck are due to separate causes. Some believe that plants other than lupine such as wild parsnip *(Ligusticum gravi),* are responsible. Others think the deformities are inherited.

Deformed calves are most likely to be produced by cows bred in July then poisoned in late August. The incidence of congenital deformities has been highest with heifers at first calving, but has occurred with females of all ages. It has been reported that setting the breeding season ahead two months from July to May and moving cattle out of lupine areas are effective prevention procedures.

Cattle apparently show no interest in this lupine until the seed pods are well formed usually during later August. The seed pods and plant tops are extensively fed upon. Rancher reports indicate that young cattle, especially steers, are more prone to feed on this plant than cattle that have previously been poisoned. Other species of lupine growing on the same areas are reportedly not eaten.

Reported symptoms of poisoning are staggering gait, quivering flank, convulsions, and some bloating. Combinations of these symptoms have been termed "jimmies", or "jitters". The animals may fall when moving about or when driven. Anicals that fall with their heads downhill are unable to rise and may die of bloat.

Procedure

Tests were conducted at the U. S. Forest Service's San Joaquin Experimental Range, O'Neals, California, with grassland lupine collected on a mountain range on the Plumas Na-

FIGURE 1. Calves with deformities attributed to their dam's eating (and being poisoned by) lupine.

tional Forest. The user of this range reported a history of lupine poisoning extending back over 80 years.

On September 1, 1954, 50 pounds of whole lupine plant tops containing very little seed were collected. Again on August 24, 1955, 27 pounds of whole plant tops containing maturing seed pods, and 118 pounds of floral spikes containing maturing seed pods, were collected. Range cattle were reported feeding on the lupine at this time. The collected plant material was placed in cloth bags to prevent seed loss, and dried at about 165°F. After drying it was finely ground in a hammer mill.

Except for one 1,150-pound 4-year-old grade Hereford cow used in the 1954 test, the animals were all two-year-old grade Hereford heifers. In 1954 and 1955 the animals were about 2 months pregnant at the start of the test. In 1956 they were less than one month pregnant. The tests were conducted with one cow in 1954, 3 heifers in 1955 and 2 heifers in 1956. There was a control animal for each test except in 1956.

The lupine was fed mixed in finely chopped oat hay or a mixture of barley and straw and good-quality alfalfa hay. The dried, ground lupine proved unpalatable, and the animals were deliberately underfed to keep them hungry during the tests. Each animal had an individual stall. A small adjacent lot with water and additional hay was also available. The animals were fed daily, usually about 8:00 A.M. If the feed was eaten by mid-day a second feeding followed. The intent was not to kill the animals but to produce toxicity and maintain it for several days.

Results

Half a pound of grassland lupine daily (1.2 pounds green basis) gradually increased to 2.75 pounds (6.6 pounds green basis) over a 15-day period produced no ill-effects in the one cow tested in 1954. After the last feeding, this cow was driven about three-fourths of a mile over rolling terrain. Even though driven hard, she showed no abnormalities. She later dropped a normal calf, as did the control.

In the 1955 and 1956 feeding tests, all five heifers developed symptoms of poisoning. These continued for 6 to 11 days. All animals later dropped normal calves except the 1956 control.

In 1955 the first symptoms of poisoning were a dullness of the eyes and a stiff gait—especially in the hindquarters. At times the animals would stumble when a leg "ankled under". As the toxic condition became more pronounced, the hair became rough, the eyes notably sunken and movement was difficult.

Table 1. Lupine fed six animals in three tests

Feeding test	1954[1]	1955[2]		1956[2]		
Animal number	971	325	351	359	402	495
Weight	1156	695	785	773	762	700
Days pregnant at start	55	63	68	59	14	24
Days	Pounds dry lupine fed					
1	0.50	0.66	0.66[3]	0.66	0.0	0.17
2	0.75	[4]	[4]	[4]	0.0	[4]
3	0.50	[4]	[4]	[4]	0.22[3]	0.17
4	[4]	[4]	[4]	[4]	0.27[3]	0.22
5	0.50	0.33	0.33[3]	0.22	0.33	0.11
6	0.50	0.44	0.17[3]	0.33	0.33	0.33
7	0.75	0.55	0.44[3]	0.44	0.44	0.44
8	2.00	0.66	0.55[3]	0.44	0.77	0.77*
9	1.75	1.21*	1.10[3]	1.10	0.66	0.55*
10	1.75	[4] *	1.10	0.99	0.22*	0.22*
11	1.75	0.44*	0.88*	0.66	1.10*	0.94*
12	1.75	0.66*	0.66*	1.32*	1.21*	1.05*
13	2.62	1.10*	1.21*	0.77*	1.32*	1.54*
14	2.75	0.0 *	0.77*	0.77	1.32*	1.32*
15	2.75	0.0 *	0.88*	0.88*	1.32*	0.99*
16	0.0	0.0	0.99*	1.43*	0.33	0.33*
17	0.0	0.0	0.88*	1.43*	0.0	0.0 *
18	0.0	0.0	0.66*	0.66*	0.0	0.0 *
19	0.0	0.0	0.0 *	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0

[1]Whole plant just past seed maturing stage. One lb. dry material equals 2.4 lb. green plant. Collected 9/1/54.

[2]Floral spikes with seed pods with seed in dough stage. One lb. dry material equals 2.8 lb. green plant material. Collected 8/24-25/55.

[3]Whole plant top with seed pods with seed in dough stage. One lb. dry material equals 3.2 lb. green plant material. Collected 8/24-25/55.

[4]Uneaten material from previous day's feeding fed back.

*Animal showing toxic effects.

There was no bloating. In the more advanced stages the animals were markedly depressed and spent considerable time lying down. When these sick and hungry animals were offered roughage free of lupine, they ate hungrily. This usually initiated a period of coughing and retching with some vomiting. In one case (No. 325) there was some foaming about the mouth and in the vomited material.

In 1956 the two test animals became definitely sick on the 10th day. When driven about the corral both were very stiff-gaited and stumbled considerably. The daily feeding rate was increased, and when driven about on the 12th day the animals showed even less coordination.

By the 13th day falling and convulsions were evident.

On the 15th day, both test animals were unintentionally left in their stalls overnight. One was found flat on her side next morning and had to be helped to her feet. The eyes were very dull and sunken; the muzzle quivered. After an hour the muscle trembling was slacking off. About two hours after the heifer had been helped to her feet she laid down and at times turned her head back toward her flank. She was very sick.

Although it was not the intent of this study to establish the degree of toxicity of this lupine, some information developed. In 1954 the lupine fed was whole plant tops collected about two weeks after most of the seed had been cast. Even when the daily feeding was increased to 2.75 pounds there was no evidence of toxicity. Feeding whole plant tops containing green seed pods (table 1) was not given a complete test; however, feeding 1.10 pounds daily gave no evidence of toxicity. If it is assumed that toxic reactions were first manifested the day following ingestion of a toxic dose, feeding 0.44 to 0.66 pounds (about 0.20 pounds per cwt. green basis) of seed pods gave toxic reactions. This test also indicates (see No. 359 in table 1) that some animals resist poisoning more than other animals.

Discussion

The dried seed pods of grassland lupine gave heifers the same symptoms of poisoning, except bloat, reported by cattlemen. The dry state of the lupine may have prevented bloat.

At the first symptoms of poisoning the heifers varied in stages of pregnancy from 23 to 79 days. The periods of continuous illness varied from 6 to 11 days. All the heifers dropped normal calves.

The evidence clearly establishes the toxic effect of this species of lupine. It does not support the view that lupine consumed during early pregnancy may lead to congential deformities. Neither does it definitely rule out lupine as a cause of congenital deformities. The amounts of lupine fed and the length of feeding may not represent the feeding habits of cattle on the mountain range. Furthermore, lupine, as normally consumed on the range, is green, whereas in these trials it was fed dry.

LITERATURE CITED

CLAWSON, A. B., 1931. Two lupines shown to be poisonous to livestock. U.S.D.A. The Official Record. 10(9):71.