

Feeding Tests

with

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In Dairy Rations**

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Mungbean Forage and Seed in Dairy Rations

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The mungbean has several properties which suggest its usefulness as a feed crop in Oklahoma. Extensive feeding tests conducted by the Oklahoma Agricultural Experiment Station indicate that mungbean forage is a good feed for dairy cows. In addition, it was found that ground mungbeans could be used satisfactorily in concentrate mixtures.

The mungbean is a summer annual legume which is relatively resistant to drought, hot weather, disease, and insect damage. The two major types are "golden" and "green." Golden is more suitable for forage production because of its greater yield. The green variety is primarily noted for bean production. One to two tons of hay per acre have been reported for the golden variety. Seed production of the green variety ranges from 12 to 15 bushels per acre.

PROCEDURE

Twelve 90-day double reversal feeding trials were conducted to determine the value of mungbean forage and seed in dairy rations.

In the forage comparisons, one test was made with golden and two with green varieties of mungbean hay. Additional data were obtained on golden mungbean hay from one 60-day feeding trial.

Four other tests were made to determine the value of golden mungbean silage.

In all trials, mungbean forages were compared directly with good quality alfalfa hay, and were fed with a low-protein grain mixture.

Five feeding trials were conducted to test the value of two different concentrate mixtures containing ground green mungbean seed.

* Deceased.

In three experiments, ground mungbeans were substituted for one-half of the corn and one-half of the cottonseed meal of the control concentrate mixture to make up the experimental mixtures.

In the other two trials, all of the cottonseed meal and 71 percent of the corn were replaced with ground mungbeans.

Good quality prairie hay was fed as the only roughage in these five trials.

Throughout all the trials the rate of roughage feeding was variable. Concentrate feeding, however, was relatively constant and was fed according to requirements for milk production and maintenance of bodyweight.

Results were measured in terms of the experimental feed's milk production capacity as compared to the control or check ration. All milk production figures were standardized to 4 percent fat-corrected milk.

The experimental forages and ground mungbeans were chemically analyzed during each period of the feeding trials. The average composition of the mungbean feeds studied is presented in the Appendix table (page 8.)

RESULTS AND DISCUSSIONS

Mungbean Hay

Results of two trials with hay made from each of the two varieties of mungbeans are summarized in Table 1. Golden mungbean hay was used in Trials I and II, and green mungbean hay in Trials III and IV.

Hay was offered at the rate of 0.8 and 1.6 pounds per 100 pounds body-weight in Trials I and II, respectively. In these trials, beet pulp was added to the ration to provide a nearly normal fiber content. In Trials III and IV, hay was offered at the rate of 2.0 pounds per 100 pounds bodyweight.

The mungbean hay consumed was efficiently utilized by the animals; however, an appreciable portion of the coarser stems was refused.

On the basis of total hay offered, the average value of golden mungbean hay was 100 percent and 96 percent that of good quality alfalfa hay in Trials I and II, respectively. Refusals in these trials averaged 15.5 percent, Trial I; and 7.9 percent, Trial II. Trial I was a 60-day trial in which hay was fed in limited amounts. The major source of nutrients was the concentrate and beet pulp mixture. Under these conditions, no marked difference in milk production would be anticipated unless one hay was decidedly inferior to the other.

Table 1.—Feeding Value of Mungbean Hay as Compared to Good Quality Alfalfa Hay.

(Eight Cows in Trials I, III, and IV; Nine in Trial II)

	Average daily hay consumed (lbs.)	Hay refused (Pct.)	Concentrates consumed (lbs.)	Beet pulp consumed (lbs.)	Average daily 4 percent F.C.M. (lbs.)	4 percent F.C.M. per pound hay offered
Trial I*						
Alfalfa	8.6	0	9.5	6.1	24.6	2.86
Golden mungbean	7.1	15.5	9.4	6.2	23.9	2.85
Trial II						
Alfalfa	16.4	0	13.9	4.0	35.2	2.15
Golden mungbean	15.1	7.9	14.4	3.9	33.7	2.05
Trial III						
Alfalfa	20.9	0.5	10.7		30.0	1.43
Green mungbean	18.0	10.0	10.6		28.4	1.42
Trial IV						
Alfalfa	23.4	0.9	12.6		31.9	1.36
Green mungbean	22.7	15.6	12.5		30.3	1.13

* Sixty-day feeding trial.

Hay refusals by individual cows in Trial II varied from zero to 39 percent during one 20-day period. During the period of poorest consumption, it was estimated conservatively that the golden mungbean hay was worth 66 percent as much as alfalfa hay.

The difference in average rate of refusal between Trials I and II is partially explained by the difference in harvesting methods. In Trial I, the mungbeans were cut and tied in bundles with a corn binder, cured in shocks and then stacked. In Trial II, the mungbeans were mowed and wilted, then piled into small cocks. After curing in these small piles for one week, the hay was baled in the field. This method greatly reduced the loss of leaves and pods by shattering, and was used to harvest mungbean hay for the remaining trials with the green variety.

There was considerable difference between the results of Trials III and IV involving hay made from the green mungbean variety. In Trial III, there was an average 10.0 percent refusal, but the feeding value of green mungbean hay was 99 percent of alfalfa on the basis of hay offered. In Trial IV, there was an average refusal of 15.6 percent, and the mungbean hay offered was worth 83 percent as much as the alfalfa hay.

The highest refusal by one cow during a 20-day period was 28 percent in Trial III and 24 percent in Trial IV. On the basis of the pro-

duction equivalent of the control alfalfa hays, it was estimated that the mungbean hays were worth 80 percent and 75 percent, respectively, as much as alfalfa hay under these conditions of unfavorable consumption.

The difference in results of Trials III and IV probably was due to differences in hay quality during the two years involved. Any variation in the quality of the alfalfa hay between the two years could affect the results of the trials as much as quality variation in the mungbean hay. In order to have a direct comparison between the two trials it would be necessary to have the two lots of control alfalfa compared directly with one another.

Mungbean Silage

Three 90-day double reversal feeding trials were conducted to determine the feeding value of golden mungbean silage for milk production. Another trial, (No. III) was designed on the same plan, but it became necessary to terminate it 15 days early because of insufficient silage.

In these trials, alfalfa hay was fed at the rate of 2 pounds per 100 pounds bodyweight as the control roughage with a low-protein concentrate mixture. For the experimental rations, one-half of the alfalfa hay was replaced with mungbean silage at the rate of 3 pounds of silage per pound of hay. Concentrates were fed according to requirements for milk production and maintenance of bodyweight. Average daily consumption of grain was practically equal in both groups in all trials.

The results of these feeding trials are summarized in Table 2. The average daily 4 percent fat-corrected milk produced by both forage feeding systems was nearly the same in all trials. In Trials II and IV, the milk production was slightly in favor of the silage ration. In Trials I and III, however, the reverse was true, indicating that these differences were due to variations other than the type of roughage.

On the average for all trials, 2.85 pounds of mungbean silage was equivalent to one pound of alfalfa hay. The alfalfa hay-mungbean silage ratio was 1:2.89, 1:2.78, 1:3.17, and 1:2.58, respectively, in the four trials. Thus mungbean silage compared favorably to the more common types of silage, since it is usually considered that three pounds of silage are equivalent to one pound of hay. The small variations in the results between trials probably were due in part to slight variations in the quality of roughages. Variations in moisture content of the silage may also have been responsible for some variations in the final results.

No difficulty was experienced in making good quality silage from mungbean forage. The crop was cut with a mower when the pods were

Table 2.— Feeding Value of Golden Mungbean Silage as Compared to Good Quality Alfalfa Hay.

(Ten Cows in Trials II, III, and IV; Eight in Trial I)

	Average daily feed consumed (pounds)			Average daily 4 percent F.C.M. (lbs.)	Hay-silage ratio 1:
	Alfalfa hay	Mungbean silage	Grain		
Trial I					
Hay and silage	10.3	28.0	11.8	32.2	2.89
Hay only	20.3		12.3	32.7	
Trial II					
Hay and silage	10.3	28.7	10.7	29.1	2.78
Hay only	20.2		10.7	28.5	
Trial III*					
Hay and silage	9.4	25.7	11.4	27.8	3.17
Hay only	17.6		11.4	28.0	
Trial IV					
Hay and silage	10.4	29.9	11.8	32.5	2.58
Hay only	20.4		11.4	30.2	

* Terminated 15 days early due to silage shortage.

well developed, run through a silage cutter, and ensiled in an upright tile silo. No preservative was needed to produce high-quality silage. The cows readily consumed mungbean silage when it was prepared this way.

Ground Mungbeans

The feeding value of three concentrate mixtures, two of which contained ground mungbeans, was compared in a series of five 90-day double reversal feeding trials. The concentrate mixtures used are shown in Table 3. Mixture No. 1 served as the control for all trials.

In Trials I, II, and III, ground mungbeans were substituted in the control mixture for one-half of the corn and one-half of the cottonseed meal to make up the experimental mixture. Three hundred pounds of ground mungbeans replaced 150 pounds each of corn and cottonseed meal in this mixture.

In Trials IV and V, Mixture No. 3 was formed by increasing the amount of ground mungbeans to replace 71 percent of the corn and all of the cottonseed meal. Five hundred pounds of ground mungbeans were substituted for 250 pounds of each of cottonseed meal and of corn.

Prairie hay, the roughage in the rations, was fed at the rate of 1.6 pounds per 100 pounds bodyweight in Trials I, II, and III, and 2.0 pounds

per 100 pounds bodyweight in Trials IV and V. The concentrate mixtures were fed according to requirements for milk production and maintenance of bodyweight.

Results of the feeding trials are presented in Table 4. No differences were observed in the average daily feed consumption, nor the average

Table 3.—Concentrate Mixtures Used to Test the Value of Ground Mungbean Seed for Milk Production.

Ingredient	Mixture No. 1 (lbs.)	Mixture No. 2 (lbs.)	Mixture No. 3 (lbs.)
Corn, No. 2 yellow	350	200	100
Oats, ground	200	200	200
Wheat bran	200	200	200
Cottonseed meal, 41 percent	250	100	---
Ground mungbeans	---	300	500
Minerals	30	30	30
TOTAL	1,030	1,030	1,030
Digestible protein, percent*	14.6	14.5	14.4
Total digestible nutrients, percent	70.6	72.0	72.9

* From Morrison's average analyses.

Table 4.—Ground Mungbeans in the Concentrate Mixture of Dairy Cow Rations.

(Cows in Trials: I and III—12; II—13; IV and V—14)

	Average daily feed consumption (pounds)		Average daily 4 percent F.C.M. (lbs.)	4 percent F.C.M. per pound concentrate
	Prairie hay	Concentrate		
Trial I				
Control	15.9	13.3	25.6	1.92
Low mungbean	15.7	13.5	25.9	1.92
Trial II				
Control	17.5	14.7	27.6	1.88
Low mungbean	17.7	15.0	27.9	1.86
Trial III				
Control	17.2	14.9	27.7	1.86
Low mungbean	17.2	14.8	28.0	1.89
Trial IV				
Control	20.0	12.8	27.7	2.16
High mungbean	19.8	13.0	26.8	2.06
Trial V				
Control	20.1	11.4	23.0	1.14
High mungbean	20.2	11.7	23.5	1.16

daily production of 4 percent fat-corrected milk between any of the rations in any of the trials. While the grain-milk ratio was variable in these trials, the amount of 4 percent fat-corrected milk produced per pound of concentrate was nearly equal between rations in each trial.

Chemical analyses showed that green mungbean seed contains about 24.0 percent protein (Appendix table below). On this basis, ground mungbeans furnished 38.5 percent and 68.2 percent of the protein in Mixtures No. 2 and No. 3, respectively.

SUMMARY

A series of feeding trials conducted by the Station indicated that mungbean forage and seed have good feed value for dairy cows.

The tests showed that golden mungbean hay averaged 96 to 100 percent as high in feeding value as good quality alfalfa hay. The feeding value of the green variety was 83 to 88 percent as much as that of alfalfa hay.

The palatability of mungbean forage is improved by ensiling. Good quality silage can be made without the use of preservatives and with no special handling. On the average, 2.85 pounds of golden mungbean silage were equivalent to 1.0 pound of good quality alfalfa hay for milk production.

Ground green mungbean seed was a satisfactory ingredient for dairy cow concentrate mixtures. Liberal use of ground mungbeans in concentrate mixtures was considered economical if a source of cracked beans, or beans otherwise unsuitable for sprouting purposes, were available.

APPENDIX

The Nutrient Content of Mungbean Forage and Seed.
(Percent, dry weight basis)

Kind	Dry matter	Protein	Ether extract	Fiber	Nitrogen free extract	Ash	Number of analyses
Mungbean hay							
Golden	90.7	9.1	2.3	25.8	47.1	6.4	2
Green	89.6	11.0	2.1	20.5	45.5	10.5	1
Mungbean silage							
Golden	27.3	3.8	1.2	5.2	9.9	7.2	3
Mungbean seed							
Green	90.3	24.0	1.3	3.0	57.8	4.1	5