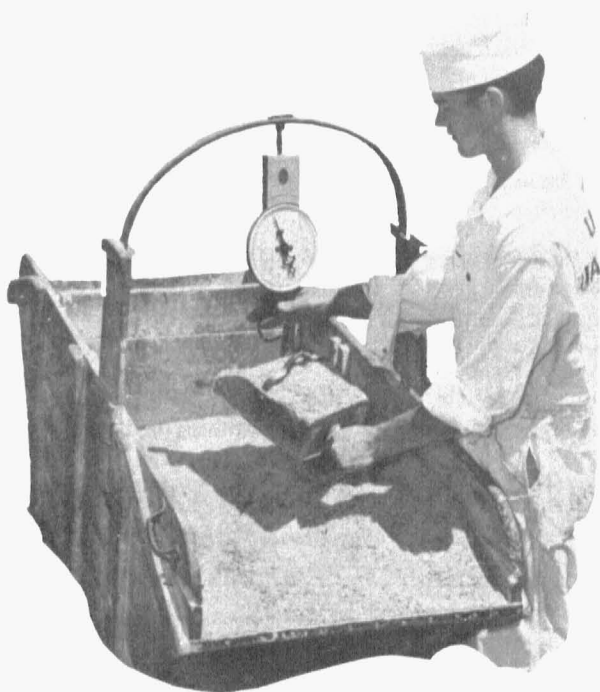


UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE  
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# Korean Lespedeza Seed as a Protein Supplement for Milk Production

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## SUMMARY

1. Feeding trials with dairy cows indicate that ground Korean lespedeza seed may be satisfactorily substituted for cottonseed meal and soybean oil meal as a high protein supplement for milk production.
2. Ten cows fed ground Korean lespedeza seed as a source of high protein concentrate during two 40-day periods averaged 29.39 pounds of fat-corrected milk daily. Control groups of cows, fed cottonseed meal and soybean oil meal in sufficient amounts to supply the same level of protein as the Korean lespedeza seed supplement averaged 29.48 lbs. of fat-corrected milk daily.
3. The ground lespedeza seed was palatable, and readily eaten by all cows. There was no evidence of deleterious effects, and the normal physiology was apparently undisturbed. Body weight was maintained equally as well as that of cows fed soybean oil meal and cottonseed meal.
4. To be successfully used in feeding dairy cows, lespedeza seed must be thoroughly ground so as to break all seed. In these trials it was found desirable to twice grind the seed in a hammer mill, using a  $\frac{3}{8}$  inch screen.
5. Ground Korean lespedeza seed was found to compare favorably in chemical composition to high protein feeds such as cottonseed meal, soybean oil meal and linseed oil meal.
6. Digestion trials with two growing heifers indicate that the nutrients provided by Korean lespedeza seed has a digestion coefficient similar to those of the common high protein feeding stuffs.

# Korean Lespedeza Seed as a Protein Supplement for Milk Production

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Feed costs generally make up one-half or more of the total cost of milk production. Dairy farmers are among the heaviest purchasers of high protein supplements, which as a rule are the most expensive ingredients used in the grain ration. More economical proteins, of suitable quality and palatability, are therefore of great importance in reducing the cost of producing milk.

Chemical analyses of Korean lespedeza seed made at the Missouri Agricultural Experiment Station show a striking similarity in protein content to that of high protein feeds, such as cottonseed meal, corn gluten meal, soybean oil meal, and linseed oil meal, commonly used throughout the middle west in balancing dairy rations. This favorable comparison is illustrated by the values reported in Table 1.

TABLE 1. COMPARATIVE ANALYSES OF SOME HIGH PROTEIN FEEDS AND KOREAN LESPEDEZA SEED

Feed Stuff	Total Dry Matter	Dig. Protein	T. D. N.	Nutritive Ratio	Average total composition				
					Protein	Fat	Fiber	N. Free Ext.	Mineral Matter
	%	%	%		%	%	%	%	%
Corn Gluten Meal (43%)	91.5	35.5	82.0	1:1.3	41.8	2.5	2.6	42.7	1.9
Cottonseed Meal (41%)	92.8	33.9	73.6	1:1.2	41.9	7.0	10.8	27.2	5.9
Linseed Meal (33-37%)	91.3	30.7	78.4	1:1.6	35.3	6.4	8.0	36.2	5.4
Soybean Oil Meal (43%)	90.5	34.8	80.5	1:1.3	40.9	5.4	6.4	31.6	6.2
Lespedeza Seed*	92.0	26.5	69.9	1:1.6	33.5	9.1	9.5	34.6	5.3

\*Missouri analyses of lespedeza seed used in these trials. (We have other analyses showing some samples of lespedeza seed to contain more than 40 per cent crude protein.) Analyses of all other feeds from Morrison "Feeds and Feeding" 20th edition.

It is estimated that 7,000,000 to 8,000,000 acres of Korean lespedeza is grown annually in Missouri, although only about 200,000 acres are now harvested for seed each year. This legume reseeds itself and is grown throughout this state on soils of widely varying fertility. The annual seed production averages from 300 to 500 lbs. per acre but may range anywhere from 200 to 1000 lbs. per acre. With this

vast supply of protein available from a relatively cheap source, and in view of preliminary experiments at the Missouri Station indicating that the ground Korean lespedeza seed might serve in the rations for lambs and poultry, an experiment of the alternate feeding trial plan was conducted using two groups of 10 dairy cows each, to determine the value of the ground seed as a substitute for cottonseed and soybean oil meal in the ration of milking cows. The cows in the two groups were comparable as to body weight, stage of lactation, and daily milk yield.

Each feeding trial consisted of a 40-day period with a 10 to 15 day preliminary period. The cows were fed roughage consisting of alfalfa hay and sorgo silage. The grain was fed in accord with daily milk production. The average daily milk yield at the start of the experiment was 35 lbs. per cow on twice a day milking. Holstein cows were fed 1 lb. of grain for each 4 to 4½ lbs. of milk produced daily. Jerseys and Guernseys were fed 1 lb. grain for each 3 to 3½ lbs. milk produced daily.

The lespedeza seed used was finely ground and mixed into a ration so as to give the same protein content as a grain ration containing 7½ per cent choice cottonseed meal and 7½ per cent soybean oil meal as the main source of protein. Grinding was accomplished by running the seed twice through a hammer mill, using a ⅜ inch screen. It was found necessary to use care in grinding so as to make certain that all seed were broken.

The analyses of the seed used is shown in Table 1. The grain mixture fed to each group was calculated to average 13.8 per cent crude protein. It was found that 188 pounds of the ground Korean lespedeza seed (analyzing 33.5 per cent crude protein) was necessary to replace the protein supplement afforded by 75 pounds of cottonseed meal (41 per cent crude protein) and 75 pounds of soybean oil meal (41 per cent crude protein) used in the grain mixture fed the control group of cows.

Ration I, as fed the control group is a typical, home-mixed grain ration which has been used for the last 5 years in the feeding of the Station milking herd. Ration II is the same as Ration I, except the cottonseed meal, and the soybean oil meal have been replaced by sufficient ground Korean lespedeza seed to furnish a similar amount of protein. The make-up of the rations, the digestible crude protein, and total digestible nutrients furnished by each are given in Table 2.

The results of the feeding trials are summarized in Table 3. All milk weights are expressed as 4 per cent equivalent milk, known as fat-corrected-milk (F. C. M.).

TABLE 2. INGREDIENTS USED, AND COMPOSITION OF GRAIN RATIONS USED IN FEEDING TRIALS

Feeding Stuff	Ration I			Ration II		
	Lbs.	Dig. Crude Protein	Total Dig. Nutrients	Lbs.	Dig. Crude Protein	Total Dig. Nutrients
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Ground Corn	800	56.80	644.80	800	56.80	644.80
Ground Oats	600	56.40	429.00	600	56.40	429.00
Wheat Bran	400	52.40	280.00	400	52.40	280.80
Cottonseed Meal (41%)	75	26.10	60.40	---	-----	-----
Soybean Oil Meal (41%)	75	25.40	55.20	---	-----	-----
Ground Korean Lespedeza Seed	---	----	-----	188	49.82*	131.60*
Steamed Bone Meal	20	----	-----	20	----	-----
Salt	30	----	-----	30	----	-----
Total	2000	217.10	1470.20	2038	215.42	1486.20
Average %		10.85	73.51		10.57	72.91

\*Digestion coefficients for Korean lespedeza seed were determined on two Holstein heifers after feeding trial was in progress, and the averages for digestible crude protein and total digestible nutrients quoted above are as a result.

TABLE 3. SUMMARY OF FEEDING TRIALS USING GROUND KOREAN LESPEDEZA SEED AS PROTEIN SUPPLEMENT

Period	Group of Cows	Grain Ration Fed	Days in Period	Daily Milk Yield	Milk per pound of grain per cow daily	Daily hay Consumption per cow	Daily silage Consumption per cow	Ave. Daily liveweight of cows
				(4% milk)	(4% milk)			
				lbs.	lbs.	lbs.	lbs.	lbs.
I Preliminary Feeding	I	II (Les. Seed)	15	34.32	3.64	13.7	32.6	1180
	II	I (Normal)	15	36.04	3.64	13.8	32.6	1186
II Feeding Trial	I	II (Les. Seed)	40	31.44	3.61	13.0	47.6	1206
	II	I (Normal)	40	32.52	3.58	13.2	48.0	1220
III Preliminary Groups I and II Switched	I	I (Normal)	10	28.49	3.60	9.2	51.0	1209
		II (Les. Seed)	10	29.02	3.63	9.5	53.0	1223
IV Feeding Trial	I	I (Normal)	40	26.50	3.47	9.4	47.6	1200
	II	II (Les. Seed)	40	27.35	3.72	9.5	49.9	1219

In the first 40-day feeding trial following a 15-day preliminary trial, the 10 cows fed ground Korean lespedeza seed as a high protein supplement averaged 31.44 lbs. of fat-corrected milk daily as compared with 32.52 lbs. for the group receiving a ration with the protein supplement

made up of equal parts of soybean oil meal and cottonseed oil meal. At the end of the first 40-day trial, the groups were reversed as to the grain ration fed. The second trial following a 10-day preliminary period between trials, resulted in the 10 cows receiving the lespedeza seed supplement averaging 27.35 lbs. of fat-corrected milk daily. The control group averaged 26.50 lbs. daily. A summary of milk production for all cows fed Ration I (normal grain mix), shows an average of 29.48 pounds of fat-corrected milk daily throughout the feeding trials, while those cows fed Ration II (ground lespedeza seed supplement) averaged 29.39 pounds daily.

The amount of grain, silage, and hay fed the two groups was approximately equal and was carefully controlled. The cows maintained their body weight and were in good physical condition on both rations. The ground Korean lespedeza seed mixture was eaten readily and seemed in no way to affect the palatability of the grain ration. The deleterious effects on milk production where the matured Korean lespedeza plant, in the seed stage, is pastured apparently cannot be attributed to any toxic properties of the seed, at least to the extent of amounts fed in these experiments. While it is a common observation that cows thus pastured tend to fall off in milk production, the cause seems to be due to factors associated with the lowered feed value of the plant with increasing maturity, a decrease in palatability, and development of varying amounts of tannic acid, all of which may contribute to making Korean lespedeza pasture unsatisfactory for milking cows after the plant approaches maturity and the seeds have formed. This particular problem is being investigated further.

The fact that the ground Korean lespedeza seed seemed to provide protein equal in milk producing value to that provided by cottonseed

TABLE 4. DIGESTION COEFFICIENTS (PER CENT)

	Protein	Fat	Fiber	N.F.E.	No. of Trials
Corn Gluten Meal (43% protein)	85	93	58	93	16
Cottonseed Meal (38.5-41%)	81	94	45	71	9
Linseed Oil Meal 31%	84	89	74	80	12
Soybean Oil Meal (all analyses)	85	86	68	98	29
Korean Lespedeza Seed 33.5%*	79	62	40	78	2

\*Missouri Experiment Station preliminary report--Data on two growing Holstein heifers. All other data from Morrison "Feeds and Feeding" 20th edition.

meal and soybean oil meal is further substantiated by digestion trials conducted on two Holstein heifers. While the work here reported is of a preliminary nature, it indicates that the nutrients provided by Korean lespedeza seed are comparable with those provided by the common high protein supplement feeds ordinarily used in dairy cattle feeding.

Note.—The average percentage of each nutrient digested in a feeding stuff is termed the *digestion coefficient* (or it may be termed the *coefficient of digestibility*) for that nutrient in the feed.

Acknowledgment.—The authors are indebted to Eric W. Swanson of the departmental staff who assisted in the conduct of the digestion trials here reported.

These feeding trials indicate that the proteins of ground Korean lespedeza seed are equal, pound for pound, to the proteins of a mixture of equal parts of cottonseed oil meal and soybean oil meal in the ration of lactating cows.

The average dairy cow in well fed herds consumes from 1 to 2 tons of grain feed annually. The average concentrate mixture as used on most Missouri dairy farms will contain from 15 to 20 per cent high protein concentrates.

Thus a cow consuming  $1\frac{1}{2}$  tons of grain feed per year receives approximately 500 lbs. of high protein feeds. The protein supplements required by the 1,011,000 cows maintained in Missouri for milk purposes according to the 1941 census would be approximately 505,500,000 lbs. The present acreage of Korean lespedeza in Missouri, if only half of it were harvested for seed for feed purposes, would yield over one billion pounds, or more than twice that required by the milking cows of the state.

The use of Korean lespedeza seed as a protein supplement in the usual dairy ration, fed over a long time period, is now under investigation at the Missouri Station.