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MUNGBEANS

A Legme for Seed and Forage Production

OKLAHOMA AGRICULTURAL EXPERIMENT STATION
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MUNGBEANS

A Legume for Seed and Forage Production

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The mung bean *(Phaseolus aureus)* is a summer annual legume which grows one to three feet tall with clusters of yellowish flowers. It is native of southern Asia and is of ancient culture. The seeds are used for human food and the plant for forage. It is grown quite extensively in Oklahoma; but the last few years it has never competed commercially with the cowpea, which it somewhat resembles.

This legume is now attracting considerable attention in Oklahoma because of its food and forage value. The plant is used for soil building, hay, silage, and pasture. The seed may be used for livestock feed. Certain types of mungbean seed are at present in great demand for growing bean sprouts used in chop suey, chow mien, and other Chinese dishes.

There is a ready market at present for seed of any of the mungbean varieties, whether used for forage, soil improvement, or sprouting. Farmers who are accustomed to growing mungbeans often find them an excellent cash crop, and they may continue to be profitable for the next few years at least. Oklahoma is well located from the standpoint of climate, soil, and harvesting facilities. It is now the largest mungbean-producing state in the nation.

Although emphasis at the present time is on seed production for sprouting purposes, the other valuable uses of mungbeans should be kept in mind in case the demand for sprouting seed should lessen. No other crop can be grown with so little trouble, and few other crops can be planted following small grains and give as profitable a return.

The mung bean has the advantage over other legumes of not being susceptible to many of the diseases which attack cowpeas, soybeans, alfalfa, and others. It is also less subject to the attack of field insects than are cowpeas and other large-seeded legumes.

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ADAPTATION

The mungbean is adapted to the same general area now occupied by the cowpea. It does well in most sections of Oklahoma; however, the central section from north to south seems to be particularly adapted to its growth. It has been grown successfully in practically every section of Oklahoma except the extreme northwestern counties. It grows well on most any type of soil but is best suited to the warm, sandy loams.

VARIETIES

Mungbean varieties are of two major types, called "golden" and "green" because of the color of the seed. Both are summer annual legumes. The golden variety is used primarily for soil building, hay, silage, and pasture. The green variety is used for soil building, forage, and food purposes. The green varieties does not produce as much forage as the golden, but because of the abundance of seed it is more commonly planted for feed and for soil building.

Golden mung bean is an erect, bushy, summer annual legume which has greenish-yellow flowers. The plants will reach a height of three to four feet on average soil. It produces an abundance of short branches and leaves. The pods are about three inches long and turn black when ripe. There are eight to ten seeds per pod. The seed is golden in color, which accounts for the variety name. It is not a prolific seed producer, which somewhat limits the acreage planted. The seed is rather difficult to harvest because the seed pods mature irregularly during the season. The seed also shatters easily at maturity.

Green mung beans vary considerably in their growth habit. Some of the selections are viny and dwarfy, growing much like cowpeas. Others are semi-erect or bushy. The seed pods are very much like those of the golden variety, but the seed is green. Some selections produce seed which is dark green and slightly mottled. The seed of others is bright green and very hard in texture. It is a very prolific seed producer, and the seed pods ripen much more uniformly than in the golden variety.

At the present time, many selections of the green mung bean are being grown by farmers and seedsmen in Oklahoma. They are of two major types, commonly called "Natives" and "Orientals." The so-called natives are the large, dull-colored beans which have been grown in Oklahoma for several years. The orientals are the shiny, hard-textured beans which have been recently imported from foreign countries.

The most common strains of the shiny, hard-textured beans are Selection No. 12 from Indiana, now being multiplied and produced in Oklahoma; Illinois; Chinese; Morse; and several strains from the U. S. Department of Agriculture. Some of these strains are semi-prostrate in their habit of growth and are therefore difficult to combine.

Selection No. 12 was chosen for multiplication and distribution in Oklahoma because of its upright growth and good yield of seed. The plants are normally from 14 to 24 inches in height and produce most of the seed above or in the top, easily in reach of a combine. They can also be picked by hand more rapidly than the other lower-growing or more prostrate varieties.

USES

For Sprouting.

The present interest among many farmers and seedsmen in Oklahoma is to produce mung beans for commercial sprouting and canning. Heretofore the bean supply for sprouting came from China and other Asiatic countries. The present World War has stopped all importation of this food product, and there is a pressing demand for sprouting beans. The bean sprouts are used particularly by the Chinese restaurants for making chop suey, chow mein, and other articles of diet.

Not all green mungbeans are suitable for sprouting. Seemingly, varieties grown by the Chinese farmers have certain sprouting propensities not found in common green beans which have been grown in Oklahoma for several years. A bean which meets the requirements of the sprouters should have a shiny seed coat and a hard texture. Ordinarily the large, dull-colored, soft-textured beans will not sprout with entire satisfaction.

For Soil Improvement.

Green mung beans may be used as a combined cash and soil-improvement crop by harvesting the seed and plowing under the residues. The golden variety is more satisfactory for soil-building, however, because of the much larger amount of plant material produced (see yield data, Table I, page 9). Golden mung beans grown by the Experiment Station at Stillwater in 1929 analyzed 0.75 percent nitrogen in the roots, 1.48 percent in the stems, and 1.81 percent in the leaves.*

* Murphy, H. F. "More Mung Beans," *Better Crops With Plant Food*, November, 1930, pp. 28-29+.

For Hay, Silage and Pasture

The larger forage yield of the golden variety makes it more satisfactory than the green-seeded type for hay, silage, and pasture. It is more easily harvested than cowpeas because of its erect habit of growth. When used for pasture, the crop may be grazed when the plants have completed most of their vegetative growth.

Hay.—The Dairy Department at this station has made two feeding trials using golden mungbean hay, two using green mung bean hay, and three using golden mung bean silage.* Golden mung bean hay was worth 75 percent as much as No. 1 alfalfa hay for milk production, and hay made from green mung beans was worth about 87 percent as much. The difference was largely due to the more stemmy character of the golden mung bean hay. These tests, the Station dairymen concluded, "indicate that mung beans have considerable merit as an annual or emergency hay crop when other legumes are not available. They also emphasize the importance of proper harvesting and curing of the crop in order to reduce the amount of hay wasted at feeding time due to coarseness of stems and loss of leaves."

Silage.—By ensiling mungbeans, the entire plant was utilized without waste. The feeding tests showed no significant difference in milk production between cows fed 2 pounds of alfalfa hay daily for each 100 pounds of body weight and cows fed 1 pounds of alfalfa and 3 pounds of mungbean silage.

Mungbean silage packed much more firmly than either corn or sorghum silage, had no strong odors, and was very palatable. Good silage having excellent keeping quality was made without adding molasses or mineral acids. Such additions are usually necessary when other legumes such as alfalfa or soybeans are ensiled.

For Livestock Feed.

Green mungbean seed has been tested at this Station as a source of protein in rations of poultry, swine. and fattening lambs. Tests with dairy cows are now under way. Results indicate that mungbeans can replace vegetable sources of protein such as cottonseed or soybean meal, but are not a substitute for animal protein such as meat and bone scraps or tankage.* Even though sound beans may be too high priced for use as feed, beans which are cracked or otherwise unsuitable for sprouting or seed can be used.

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* Kuhlman, A. H. *Mungbean Hay and Mungbean Silage for Milk Production.* Okla. Agri. Exp. Sta. Circular C-101, June 1942.

* See *How to Feed Proteins in Wartime,* Okla. Agri. Exp. Sta. Circular C-113, and other publications cited in following paragraphs.

Analyses by Station chemists** show green mungbeans as having 23.31 percent protein, 9.31 percent water, 59.85 percent nitrogen free extract (carbohydrates); 1.02 percent fat; 3.64 percent fiber; and 2.87 percent ash. Carotene (vitamin A) is present in amounts greater than is found in many seeds, and a plentiful supply of the vitamin B complex is present when the bean composes 60 percent of the ration. Addition of salt and ground limestone appeared to provide a complete mineral ration for rats.

In general, the analyses indicate that the mung is a suprior type of bean nutritionally, but is not adequate as a sole source of protein.

In mixing rations, allowance would need to be made for the lower protein content of the beans (23 to 25 percent) as compared to the more common protein supplements such as cottonseed and soybean meals (40 to 43 percent protein).

Results of actual feeding tests at the Oklahoma Station include:

Poultry.—For *chickens,* ground green mungbeans satisfactorily replace soybean meal or cottonseed meal in both laying and growing mashes. The beans were used as high as 40 percent of the mash with no harmful results, when supplemented with some animal protein and 2 percent of bone meal.* One-half acre of mungbeans will produce enough to grow 100 pullets to laying age, using 25 percent of ground beans in the growing mash.

For *turkeys,* mungbeans satisfactorily replaced two-thirds of the cottonseed meal and soybean meal commonly used in starter rations. The beans were found to contain protein of high quality for turkey poults. Cooked beans gave only slightly better growth than uncooked beans, not enough to make cooking worthwhile.

Swine.—In two feeding trials,** ground mungbeans were a satisfactory substitute for 43 percent cottonseed meal in the standard mixture of two parts meat scraps, one part cottonseed meal, and one part dehydrated alfalfa leaf meal. They were not a satisfactory substitute for both the meat scraps and the cottonseed meal.

**Heller, V. G. "Nutritive Properties of the Mung Bean." *Journal of Biological Chemistry,* Vol. lxxv, pp. 435-442 (1927).

* "Mungbeans Satisfactory if Supplemented." *Science Serving Agriculture;* Report of Okla. Agri. Exp. Station 1942-44, p. 50.

** Thompson, C. P., and J. C. Hillier. "Mungbeans as a Protein Supplement for Growing and Fattening Swine." Okla. Agri. Exp. Sta. Mimeo. Circular 81 (April, 1942). See also *Science Serving Agriculture, op. cit.,* p. 33.

Lambs.—Cracked mungbeans supplied one-half to two-thirds of the protein requirement of fattening lambs when fed in an emergency ration with shelled corn and prairie hay.† The beans were not palatable beyond .35 lbs. per head daily, so some additional cottonseed meal was needed. Digestibility of the protein in the beans was equal to that of cottonseed meal.*

Dairy Cattle.—In the first of three trials** with dairy cows fed prairie hay as the only roughage, 300 pounds of ground mungbeans satisfactorily replaced 150 pounds of ground corn and 150 pounds of cottonseed meal. The mungbeans replaced 43 percent of the corn and 60 percent of the cottonseed meal of the control ration.

YIELDS

Yields in mungbean tests made by the Oklahoma Station are given in Table I. In general, the golden variety produced twice the weight of green forage or air-dry hay produced by the green variety, but the green variety produced about four to eight times more seed. Hay yield of the golden varieties was one to two tons per acre. Seed yield of the green varieties was 12 to 15 bushels per acre. (Standard weight per bushel is 60 lbs.)

CULTURE

Date of Planting.

Mungbeans may be planted from May to July. The May plantings have given the best yields of hay (Table II). This legume is sometimes planted in late June or early July following a small grain crop. When moisture conditions are favorable, good yields of forage or seed can be obtained at this late date. When the crop is to be used for seed, planting the last half of June is a good practice.

Best seed yields will be obtained by preparing a good seedbed and planting in May or early June. The young seedling will not do well in a cold wet soil, therefore one should not plant until the soil is warm. Mungbeans will germinate in a soil having a low moisture content. The plant is fairly drouth resistant.

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† Briggs, H. M. *Wheat, Mungbeans, and Prairie Hay in Lamb Fattening Rations,* Okla. Agri. Exp. Sta. Mimeo. Circular 90 (April, 1943); and, by the author, *Roughage, Grains and Protein Supplements for Fattening Lambs,* Okla. Agri. Exp. Sta. Mimeo. Circular 112 (April, 1944).

* "Mungbeans Supply Up to Two-thirds of Protein." *Science Serving Agriculture;* Report, Okla. Agri. Exp. Sta., 1942-44, p. 50.

** Unpublished data from Department of Dairying, Oklahoma Agricultural Experiment Station.

Rate and Method of Planting.

Mungbeans are usually planted in 3 to 3½ foot rows at present, but drilling is becoming more popular as the seed becomes more abundant and power machinery is used for harvesting. A two-row corn planter is best for row planting. If a grain drill is used, each alternate hole should be stopped, thus placing the beans in 14- or 16-inch rows. Drilled mungbeans

TABLE I.—Acre Yields of Forage and Seed of Golden and Green Mungbeans.

Year	GOLDEN			GREEN		
	Forage			Forage		
	Green weight (Pounds)	Hay (Tons, air dry)	Seed (Pounds)	Green weight (Pounds)	Hay (Tons, air dry)	Seed (Pounds)
Perkins and Stillwater, Payne County						
1926	11688	.91		7980	.77	
1927	27488	2.14	90	8900	.86	564
1928	22478	1.75	47	7660	.74	667
1929	17720	1.38	109	11900	1.15	327
1930	14260	1.11	279	7140	.69	284
1931	16320	1.27	23	9316	.90	310
1932	28000	2.18	30	15630	1.51	1512
1933	22860	1.78	144	12938	1.25	1410
1934	19220	1.49	*	6314	.61	**
1935	15540	1.21	*	7760	.75	**
1942	35200	2.74	*	6934	.67	612
1943	----	----	131	----	----	679
1944	14120	1.10	69	10558	1.02	416
Average	20408	1.59	114	9419	.91	678
Lone Grove, Carter County						
1930	9890	.77	174	3620	.35	249
1931	16956	1.32	235	4140	.40	490
1932	20420	1.59	48	14596	1.41	1068
1933	28900	2.25	----	4968	.48	516
1935	15540	1.21	47	7760	.75	122
1942	*	*	*	*	*	1462
Average	18341	1.43	126	7017	.68	651
Heavener, Le Flore County						
1930	7834	.61	90	3518	.34	60
1931	14772	1.15	24	9730	.94	127
1932	4752	.37	48	2692	.26	276
1933	34938	2.72	486	17494	1.69	1860
1942	22778	1.77	142	9629	.93	947
Average	17015	1.32	158	8613	.83	654
Granite, Greer County						
1931	7834	.61	16	3620	.35	484
1932	10020	.78	*	3100	.30	396
1933	9632	.75	144	6728	.65	984
Average	9162	.71	80	4483	.43	621

* No yields taken.
** No seed due to crop failure.

make a finer hay and there is less waste in feeding. This crop might also be planted in 18- to 21-inch rows by double-rowing with a two-row planter.

Only 5 to 8 pounds of seed are needed per acre for mungbeans planted in 3- or 3½-foot rows. When the grain drill is used, 15 to 20 pounds are required. Seed should be inoculated before planting. The inoculant for mungbeans is the same as that used for cowpeas.

When mungbeans are planted in rows to produce seed for commercial purposes, the seedbed should be well prepared and the beans planted on the level. The green variety should not be planted in a lister furrow when grown for seed. The lister furrow method is satisfactory for the golden variety when planted after small grain.

Row planted beans are easily cultivated with the same machinery used for other crops. Double-rowed plantings, however, make it necessary to change the setting of the cultivator every time this crop is worked, and are also nearly impossible to cultivate with a tractor cultivator.

If the drill method of planting is used, a well prepared and firm seedbed is essential so the mungbeans can get a quick start and thereby control the growth of weeds and grass. On the experiment station farms at both Stillwater and Perkins in both 1942 and 1944, growth of weeds was heavy enough to prevent combining. Adjacent row-planted plots were easily combined.

Yields of hay and seed from different methods of planting have not been tested experimentally, but there is some evidence that row planting is prefreable when the beans are planted in

TABLE II.—Date of Planting Mungbeans in Relation to Hay Yield; Perkins, Okla., 1942.

Date of Planting	Variety	ACRE YIELD (POUNDS)**	
		Green Forage	Hay (15% Moisture)
April 15	*	*	*
May 1	Golden	35170	5476
	Green	6889	1331
May 15	Golden	29127	4535
	Green	6729	1300
June 1	Golden	26159	4073
	Green	7748	1497

* Both varieties were planted April 15, but a very poor stand was obtained.

** No seed yields were taken on this test, but a nearby plot of green mungbeans planted May 15 gave a yield of 10.2 bushels (612 pounds) of clean combined seed.

May. Later plantings may be more successful when the drill is used, provided the seed bed has been thoroughly prepared and the weeds allowed to germinate and then destroyed. In 1942, typical 100 square foot areas in a drilled plot which could not be combined because of the weeds were picked by hand and gave a yield of about 16 bushels per acre. This was approximately the same as an adjacent rowed plot which was combined.

Harvesting.

For Hay.—If the crop is to be used for forage, it may be harvested either with a mower or with a binder. If a mower is used, the plants should be allowed to partially cure in the swath, then windrowed or cocked to complete the curing process. Like all large-leaved legumes, they should be put into the stack or barn just as soon as safety permits, to prevent loss of the leaves. The best time to harvest for forage is when the plants have reached their maximum growth, and only a few pods have turned brown in ripening.

In growing hay for the dairy feeding tests reported above,* the best quality of hay was obtained when the beans were cut in the morning of a clear day after the dew had disappeared. In the afternon or the following morning the wilted beans were piled in small cocks. During wet or cloudy weather the cocks were turned every second day. After curing in these piles for a week, the hay was baled in the field. This procedure greatly reduced the loss of leaves and pods by shattering which occurs if the hay is allowed to cure in the swath. It is desirable to bale the hay in the morning, because a considerable loss of leaves will occur if the hay is brittle.

For Seed.—Seed are often difficult to harvest because they shatter so readily. Some strains of the green mungbean varieties are more resistant to shattering than others. The pods may be picked or stripped by hand if machinery is not available. They can be harvested by hand much more rapidly than cowpeas, because the pods are produced in bunches.

For beans planted in rows, a bean harvester which cuts two rows at a time and throws the two rows together may be used. After the beans are dry, they can be threshed with a combine or thresher. The beans can also be harvested with a combine with good success.

For golden mungbeans, a beater-type thresher may be used. Such a thresher can be made from an old grain binder.

* Kuhlman, A. H. *Op. Cit.*

Green leaves and immature pods are often collected in the harvesting, causing excess moisture in the seed. In such cases, the beans should be screened immediately after harvest to separate out the good seed and remove all trash, and then spread out thinly to dry before being put into sacks or bins. The beans mold quickly if the green pods and leaves are not removed before storing. Beans which contain over 15 to 16 percent moisture may heat in storage, and stored beans should therefore be watched carefully to detect heating.

5-45—5½M