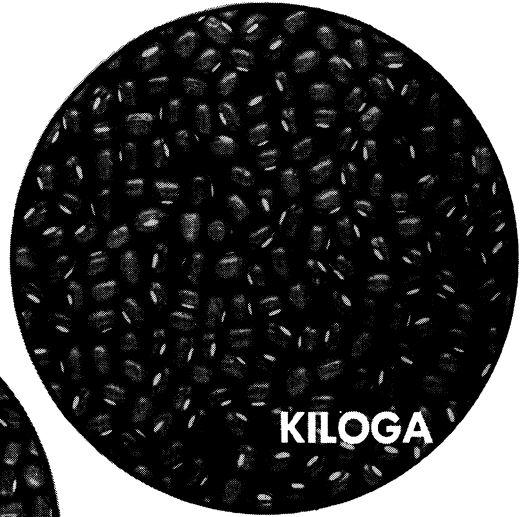


MUNGBEAN VARIETIES

for Oklahoma



June 1963

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Mungbean Varieties for Oklahoma

Berken — Kiloga — Oklahoma 12

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Large-seeded green mungbeans, referred to in the trade as jumbo mungbeans, have been grown in Oklahoma for several years, but have been generally unsatisfactory because of late maturity and severe lodging.

Berken is the first large-seeded mungbean variety developed and released by the Oklahoma Agricultural Experiment Station. In comparison with many large-seeded types, it is resistant to lodging and seed shattering and matures earlier and more uniformly. Berken is adapted to the same mungbean areas in Oklahoma as the smaller-seeded varieties, Oklahoma 12 and Kiloga.

Breeder's seed of Berken was released to Oklahoma Foundation Seed Stocks, Inc., in the fall of 1962. Seed should be available for some commercial production after harvest in 1963.

This bulletin reports test results of Berken in comparison with Oklahoma 12, Kiloga, and certain strains of the jumbo type.

Description of Mungbean Varieties

BERKEN

Berken is a new variety developed by selection from a single plant in a field of jumbo type mungbeans. Depending on locations and seasons, the erect bushy plants range from 19 to 31 inches in height when planted in rows 40 inches apart. The medium-size leaflets are pinnate trifoliate with the length of the odd leaflet averaging 1.25 times its width. The lemon-colored flowers are borne in racemes on peduncles 8 to 28 cm. long. Under favorable conditions, three to four pods develop per raceme. The pods range from 7 to 12 cm. in length and contain 10 to 13 seed per pod. The pods are dark brown to black when mature and seed do not shatter easily. The seed are glossy with semi-rounded ends and contain 6,800 to 7,700 per pound.

Research reported herein was conducted under Oklahoma Station Project Number 1044.

Origin and History

W. E. Berkenbile, before his death in 1960, was a pioneer mungbean grower near Dover, Oklahoma. In 1938 he selected four plants with large seed from a 50 acre field planted to small green seed from China. He increased the seed which eventually became the primary jumbo type mungbean grown in Oklahoma.

In 1955 and 1956, respectively, Wilmer R. Oltmanns and the senior author made 100 and 238 single plant selections in a field of jumbo type mungbeans near Dover, Oklahoma. Three composites* were made by combining seed from certain progeny rows on the basis of plant and seed characteristics. Further testing indicated that none of the composites were more resistant to lodging or were earlier than the jumbo check.

The single plant selection, M-71** (OK 55-69), observed in a progeny row in 1955, was included in the observation nursery in 1956 and advanced to a classification nursery in 1957. In 1957, a single plant was selected from M-71 (OK 55-69) and designated as M-339 (M-71-57-1). The single plant was early, produced large seed, and did not lodge. Seed of this single plant was increased and planted in the preliminary nursery near Perkins in 1960. In 1961, the strain was advanced to the replicated variety test at Perkins. Also in 1961, from a field planting at the Stillwater Agronomy Research Station, 50 plants were selected to eliminate an occasional dull-seeded plant.† Approximately 100 seed from each of 32 single plants of this group were planted in progeny rows in 1962. Plant and seed characteristics were similar among the progeny rows.

The remainder of the seed from the 50 plants was bulked, with a portion used in the 1962 variety tests near Perkins, Paradise, Stratford and Heavener. Remaining seed was used for an isolated planting, from which 70 pounds of breeder's seed were obtained.

The variety was named Berken in recognition of the contribution made by W. E. Berkenbile.

* Composites are experimental strains designated OAEJM56-Composite, OAEJM56-Composite 2, and OAEJM56-Composite 3. (Tables I to IV).

**The Oklahoma M number represents the number assigned each mungbean selection, variety or plant introduction in the experiment record book.

† Preliminary research indicates that dull seed are caused by papillate outgrowths on the epidermal layer. The glossy or shiny seed are preferred and this characteristic is apparently a simple recessive.

KILOGA

Kiloga is an improved variety released in 1960. The variety resulted from bulking the seed of 29 progeny rows each tracing to single plant selections from the experimental strain, Purdue-3. The plants are bushy and range with locations and seasons from 16 to 31 inches in height when planted in 40-inch rows. The medium-size leaflets are medium in texture, with the length of the odd leaflet averaging 1.15 times its width. The black pods are produced on peduncles from 6 to 22 cm. long. Pods of Kiloga range from 6 to 11 cm. in length with about 11 shiny seed per pod. Under favorable conditions the number of seed per pound range from 8,700 to 11,000. The seed does not shatter readily when mature. Pods mature more uniformly than Oklahoma 12.

Origin and History

Purdue-3, the experimental strain from which OAEM56-Composite (Kiloga) was selected, was one of several experimental strains obtained by Hi W. Staten in the late thirties from Dr. G. H. Cutler, Professor Emeritus, Agronomy Department, Purdue University. Purdue-3 was selected by Dr. Cutler from material obtained through Dr. W. J. Morse, United States Department of Agriculture. It was maintained by the Oklahoma Agricultural Experiment Station under the designation of Purdue-3 until 1956 when the seed from 29 single plant progeny rows were composited and designated OAEM56-Composite.

The Purdue-3 entry looked very promising in 1955 tests, but contained mixtures. In 1956, 125 single plants were selected and threshed separately. Single plant progeny rows were grown in 1957. Each progeny row was harvested separately, and on the basis of vegetative and seed characteristics the seed from 29 progeny rows were composited. This provided 27 pounds of breeder's seed, 25 of which was presented to Foundation Seed Stocks, Inc., in March of 1958.

The strain designated as OAEM56-Composite, later named Kiloga, is a composite of the following plant rows grown from single plants: OAEM56-261*, -264, -266, -267, -270, -272, -273, -274, -275, -276, -277, -278, -279, -280, -283, -284, -285, -286, -288, -291, -292, -293, -294, -295, -296, -297, -298, -299, and -300.

* OAEM56-261, etc. refers to Oklahoma Agricultural Experiment Station mungbean number assigned single plant selections.

OKLAHOMA 12

Oklahoma 12 was increased for distribution in 1945 (1). Since seed of the certified classes was not available in 1956, a program to purify the variety was initiated.

From 26 single plant selections made in a field of Oklahoma 12 in 1957, seed from four single plant progeny rows (OAEM57-6, OAEM57-10, OAEM57-20, and OAEM57-25) were composited in 1958 to obtain new breeder's seed of Oklahoma 12.

Subsequent tests comparing the new Oklahoma 12 with the original lot indicated the strains had identical performance but that the new source possessed seed that were more uniform in color and size.

The bushy plants of Oklahoma 12 range from 15 to 22 inches tall. Leaflets are small with the length of the odd leaflet averaging 1.25 times its width. The black pods are borne on peduncles 12 to 19 cm. long with an average of six pods per raceme. The pods range from 6 to 10 cm. long and contain 9 to 12 seed per pod. There are 10,000 to 14,000 small shiny seed per pound. The pods mature early but shatter if not harvested promptly.

Oklahoma 12 shows good tolerance to bacterial blight but appears susceptible to root-knot nematode.

Results

Yield, seed size, seed shatter and quality scores, plant height, lodging score, and other data comparing Berken with Kiloga, Oklahoma 12 and other strains are shown in Tables I to IV. The data were obtained from test plots planted in rows spaced 40 inches apart and planted to one crop per season.

Seed Yield

The mean seed yields of Berken in the three tests on the research station near Perkins were similar to those for Oklahoma 12, Kiloga, and M-45, but lower than those of M-6 and M-44 (Table I).

The mean seed yields of M-3, M-6, M-44, M-45, and M-47 were significantly higher at the 5 percent level of significance than Berken (M-339) and Kiloga (M-1) at Perkins in 1960. The mean yields of M-6 and M-44 were significantly higher than M-3, M-1, and M-339 in the 1961 test at Perkins. Mean seed yields for Kiloga, Berken, and

Table I. Comparative seed yields of certain mungbean strains in trials at four locations.

Okla. M-No.	Strain	Seed Yields (pounds of seed/acre)							
		Perkins				Para-Strat-Heav- Mean 6			
		1960	1961	1962	Year Avg.	dise 1962	ford 1962	ener 1962	Years Station
3	Okla. 12	872	868	789	843.0	551	734	224	673
1	Kiloga	615	790	1064	823.0	621	547	593	705
339	Berken	582	800	1008	796.7	774	719	655	756
6	OAEJM56-Composite 3	1207	1300	703	1070.0	---	---	---	---
44	OAEJM56-Composite 2	1022	1549	656	1075.7	422	406	---	---
45	OAEJM56-Composite	1050	715	707	824.0	---	---	---	---
46	Jumbo	689	---	---	---	---	---	---	---
47	Jumbo	1209	697	---	---	---	---	---	---
344	Jumbo	---	---	693	---	334	840	169	---
322	8B	---	433	1038	---	579	392	---	---
	Mean	906	894	832	---	547	606	410	---
	L.S.D.(.05)	159	117	253	---	142	110	140	---
	C. V. (%)	11.9	9.3	20.6	---	13.8	10.5	20.6	---

M-322 were significantly higher at the 5 percent level of significance than M-6, M-44, M-45, and M-344 at Perkins in 1962. It should be noted that severe plant lodging of M-6, M-44, M-45 and M-344 would have reduced seed yields if harvested with a combine (Table III).

At Paradise in 1962, the mean seed yield of Berken was significantly higher than each of the other five strains in the test (Table I).

At Stratford in 1962, the mean seed yields of Berken and Oklahoma 12 did not differ significantly, but their mean yields were significantly higher than Kiloga (Table I).

Berken and Kiloga mean seed yields were significantly higher than those of Oklahoma 12 and M-344 in the 1962 test near Heavener (Table I).

Seed Size

The seed of Oklahoma 12, Kiloga, and Berken averaged 3.8, 4.5, and 6.1 grams per 100 seed, respectively, for six station years (Table II and Figure 1).

Table II. Mean seed size, seed shatter score and seed quality score for mungbean strains in variety trials at four locations.

Okla. M-No.	Strain	Mean Seed Size (grams/100 seed)							Shatter* Score Para- dise 1962	Seed Quality Score**		
		Perkins			Para- dise	Strat- ford	Heav- ener	Mean 6 Station Years		Perkins		Strat- ford
		1960	1961	1962	1962	1962	1962	1962	1962	1961	1962	1962
3	Okla. 12	3.7	3.7	3.3	3.5	4.6	3.8	3.8	3.0	1.0	2.0	2.0
1	Kiloga	4.6	4.7	4.1	4.1	5.2	4.1	4.5	1.0	1.0	2.0	1.0
339	Berken	6.0	5.9	6.1	6.0	6.6	6.2	6.1	1.0	1.0	1.3	1.7
6	OAEJM56-Composite 3	6.3	5.7	5.1	--	--	--	--	--	2.0	2.0	--
44	OAEJM56-Composite 2	6.3	6.0	6.0	5.5	5.1	--	--	2.0	2.0	1.7	2.0
45	OAEJM56-Composite	6.1	6.1	5.8	--	--	--	--	--	2.0	1.7	--
46	Jumbo	5.8	--	--	--	--	--	--	--	--	--	--
47	Jumbo	6.0	5.7	--	--	--	--	--	--	1.0	--	--
344	Jumbo	--	4.9	3.6	5.7	3.7	4.3	--	2.0	1.0	--	2.3
322	8B	--	8.2	3.4	4.4	5.5	--	--	3.0	2.0	1.0	1.0

* Plants in border were rated according to the amount of shattering 10 days after harvest. 1=no shattering . . . 5 = severe shattering.

**Seed quality score represents an estimate of the development of seed, wrinkling, damage and brightness, and is rated according to the following scale:
1 = excellent, 2 = good, 3 = fair, 4 = poor, and 5 = very poor.

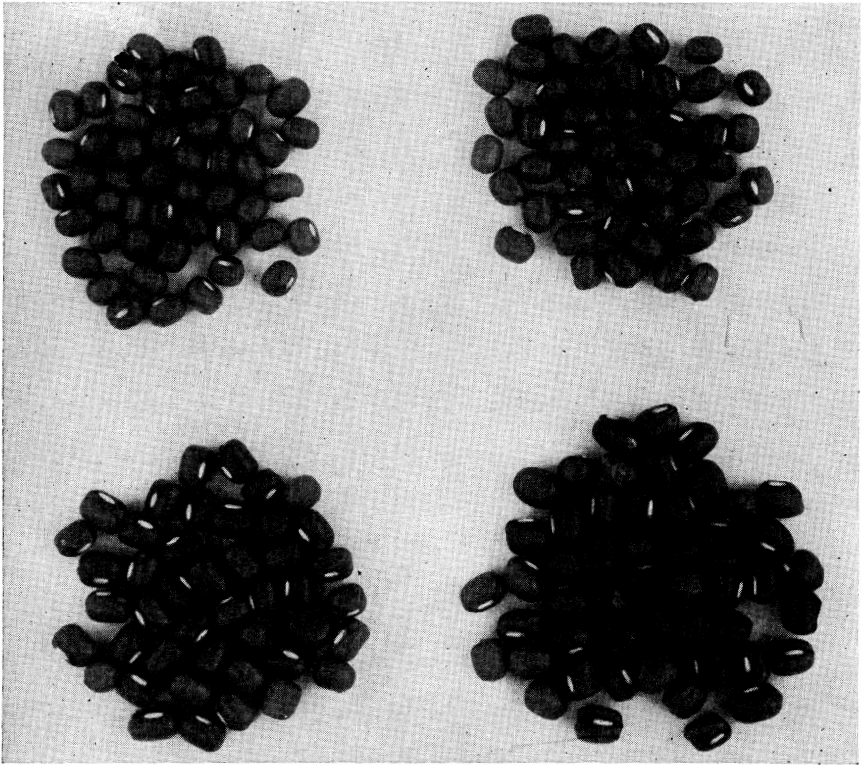


Figure 1. Comparative seed size of four mungbean strains. Upper left: Oklahoma 12 (M-3), Upper right: Kiloga (M-1), Lower left: OAEJM56-Composite 3 (M-6), and Lower right: Berken (M-339).

Seed and Pod Shattering

Both Berken and Kiloga had excellent seed holding qualities, whereas Oklahoma 12 tended to shatter seed more readily (Table II). Some pod drop was noted following heavy winds, but differences among strains were not discernible regardless of pod size (Figure 2).

Seed Quality

Each strain had an acceptable seed quality rating in the three tests where the data were obtained (Table II). In general, large-seeded strains tend to produce more undesirable wrinkled seed under moisture stress conditions than small-seeded strains. However, Berken did not produce wrinkled seed coats in these tests.

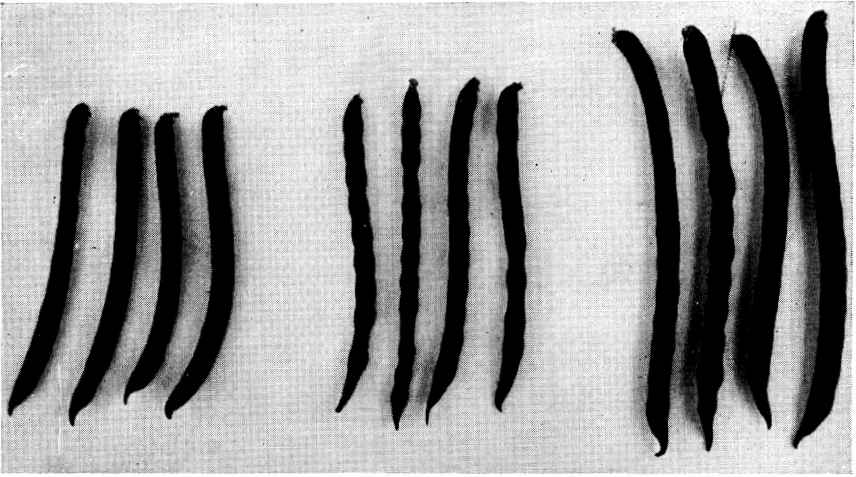


Figure 2. Left to right: Comparative length of four pods each of Oklahoma 12 (6 to 10 cm.), Kiloga (6 to 11 cm.), and Berken (7 to 12 cm.).

Plant Height

The mean height of Oklahoma 12, Kiloga, and Berken plants for five station years were 18.6, 20.8, and 25.2 inches, respectively (Table III and Figure 3).

Lodging

An outstanding characteristic of Oklahoma 12, Kiloga, and Berken was their resistance to lodging. Plants of M-6, M-44, M-45, and M-47

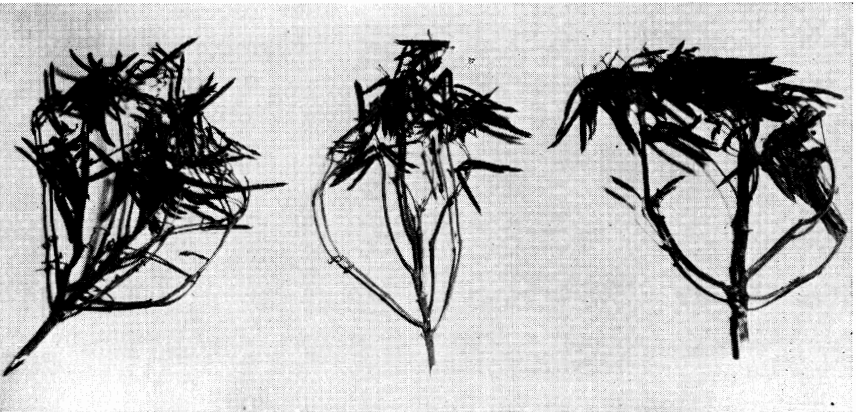


Figure 3. Left to right: Mature plants of Oklahoma 12, Kiloga, and Berken, showing the bush habit of growth and plant height.

Table III. Comparative plant height and lodging score of certain mungbean strains in variety trials at three locations.

Okla. M-No.	Strain	Mean Plant Height (inches)						Mean Lodging Score*				
		Perkins			Para- dise 1962	Strat- ford 1962	Mean 5 Station Years	Perkins		Para- dise 1962	Strat- ford 1962	Mean 4 Station Years
		1960	1961	1962				1962	1961			
3	Okla. 12	18	15	22	21	17	18.6	1.0	2.0	1.5	1.0	1.4
1	Kiloga	17	16	19	31	21	20.8	1.0	1.0	1.7	1.0	1.2
339	Berken	28	23	31	25	19	24.2	1.0	2.0	2.0	1.0	1.5
6	OAEJM56-Composite 3	26	22	21	--	--	--	5.0	3.7	--	--	--
44	OAEJM56-Composite 2	26	24	23	28	15	23.2	4.0	3.7	4.7	4.0	4.1
45	OAEJM56-Composite	29	24	25	--	--	--	3.0	3.0	--	--	--
47	Jumbo	--	--	--	--	--	--	3.0	--	--	--	--
344	Jumbo	--	--	--	38	--	--	--	2.3	4.0	4.0	--
322	8B	--	29	--	20	27	--	1.0	1.3	2.0	2.0	--

* Lodging notes are recorded on the following scale: 1= plants erect, 2 = all plants leaning slightly or a few plants down, 3 = all plants leaning moderately or 25 to 50 percent of the plants down, 4 = all plants leaning considerably or 50 to 80 percent of the plants down, and 5 = all plants down badly.

showed considerable lodging. Lodging resistance is important when combine harvesting mungbeans for high yields and superior quality.

Maturity

When planted in late May or early June, Oklahoma 12, Kiloga, and Berken were 90 percent mature in 75 to 105 days. The varieties reached maturity 10 to 20 days earlier and more uniformly than other strains of the jumbo type.

Shelling Percent

The pods were hand picked in the test near Heavener. Mean percentages of seed obtained from the pods of Oklahoma 12, Kiloga, and Berken were 50.4, 54.5, and 67.8, respectively.

Disease Resistance

Oklahoma 12 was consistently rated free of bacterial leaf blight symptoms while Kiloga and Berken were rated intermediate. McCracken (2) reported that both Oklahoma 12 and Kiloga showed severe galling from three populations of root-knot nematodes in greenhouse tests. No information is available for Berken.

Sprouting

Triplicate fifty gram samples of each of four mungbean strains were allowed to soak 14 hours in lukewarm water. The soaked seed were then placed in a bean-sprout grower described by Wang (3). Each container was irrigated daily at 7 a.m., 12 noon, and 5 p.m. with lukewarm tap-water. Room temperature was maintained at 75 degrees F.

On the sixth day the sprouts were weighed. The length and diameter at the thickest point was determined for five sprouts selected at random in each container. The percentages of hard and rotted seed in each container were determined.

Sprouting data are summarized in Table IV for Oklahoma 12, Kiloga, OAEJM56-Composite 3 and Berken. Results show the sprout weight divided by the dry seed weight was 9.2, 9.0, 8.2, and 8.1 for M-3, M-1, M-339, and M-6, respectively, which was generally higher than results obtained in previous tests.

It was noted that Berken had the longest and thickest sprouts (Table IV and Figure 4). The sprouts of Oklahoma 12 were slightly longer and thinner than Kiloga.

Oklahoma 12 had more hard seed than Kiloga, while Berken did not contain hard seed. Berken and M-6 contained slightly more rotted seed than Oklahoma 12 and Kiloga.

Good quality seed of the strains in the study should make high quality bean-sprouts when harvested, cleaned, stored and sprouted properly.

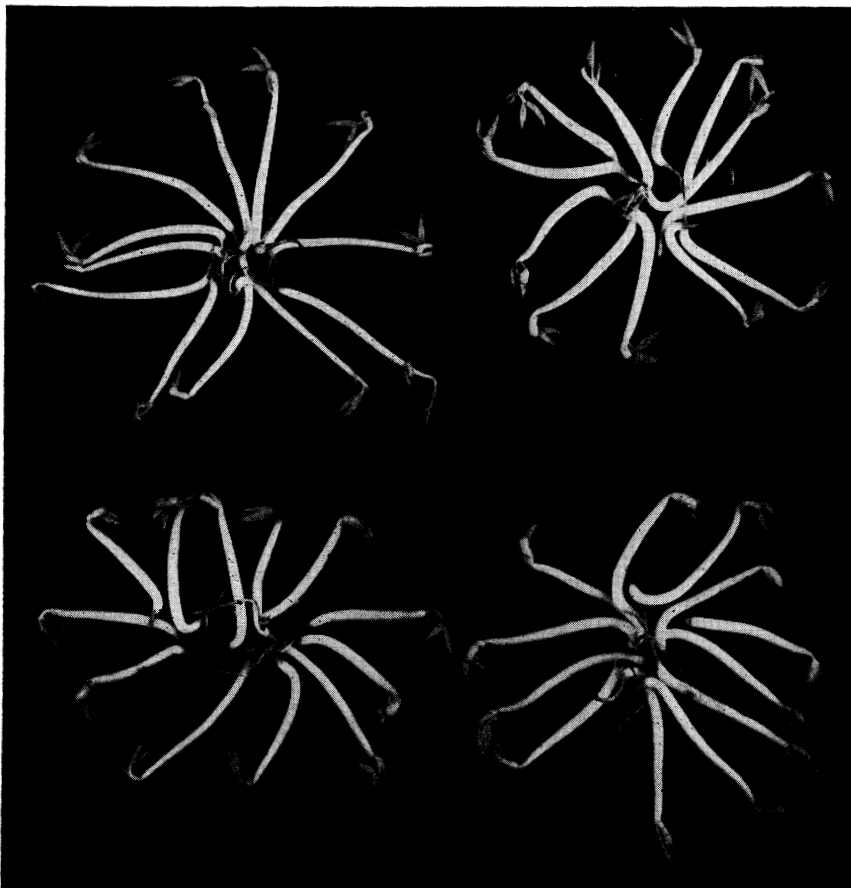


Figure 4. Twelve sprouts of each of four mungbean strains in sprouting study. Upper left: Oklahoma 12, Upper right: Kiloga, Lower left: OAEJM56-Composite-3, and Lower right: Berken.

Table IV. Results of mungbean sprouting study, October, 1962.

Okla. M-No.	Strain	Seed per 50 grams (number)	Wt. of sprouts (grams)	Ratio of sprout weight to dry seed weight	Length of Sprout (mm.)	Diameter of Sprout (mm.)	Percentage by wt.	
							Hard seed	Rotted seed
3	Okla. 12	1365.0	460.0	9.2	56.7	3.3	1.7	1.6
1	Kiloga	1193.3	448.8	9.0	52.7	3.6	0.5	2.1
6	OAEJM56-Composite 3	993.3	404.2	8.1	53.5	3.6	0.2	3.0
339	Berken	676.6	409.0	8.2	60.4	3.7	0.0	4.6

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Oklahoma's Wealth in Agriculture

Agriculture is Oklahoma's number one industry. It has more capital invested and employs more people than any other industry in the state. Farms and ranches alone represent a capital investment of four billion dollars—three billion in land and buildings, one-half billion in machinery and one-half billion in livestock.

Farm income currently amounts to more than \$700,000,000 annually. The value added by manufacture of farm products adds another \$130,000,000 annually.

Some 175,000 Oklahomans manage and operate its nearly 100,000 farms and ranches. Another 14,000 workers are required to keep farmers supplied with production items. Approximately 300,000 full-time employees are engaged by the firms that market and process Oklahoma farm products.