SOYBEANS for OIL in ALABAMA

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CONTENTS

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SOYBEAN ACREAGE planted for oil in Alabama has increased more than 13 times in the past 20 years, with present acreage more than 130,000. During the same period the State's average yield per acre has doubled to more than 20 bushels.

Three counties in southwestern Alabama and two in northeastern Alabama produce 92 per cent of the soybeans for oil. These counties are Baldwin, 85,500 acres; Mobile, 10,300; Escambia, 12,700; Jackson, 8,800; and Madison, 4,800.

VARIETY COMPARISON EXPERIMENTS

Variety tests have been conducted by the Auburn University Agricultural Experiment Station in cooperation with the U.S.D.A. Southeastern Regional Soybean Laboratory, Stoneville, Mississippi. Much of this research has been on evaluating new breeding lines. However, only varieties released and named are included in this report.

Yields obtained at five locations in Alabama and at certain locations in Georgia, Mississippi, and Florida representing Alabama conditions are given in Table 1. Varieties are grouped into early, midseason, late, and very late maturing, and the relative expected harvest date of each is given. Yield differences of varieties were 20 per cent or more at most locations. Important factors other than yield considered in selecting soybean varieties include oil content, date of maturity, height, disease resistance, and shattering resistance.

TABLE 1. YIELD OF SOYBEAN VARIETIES AT NINE LOCATIONS REPRESENTING NORTHERN, CENTRAL, AND SOUTHERN AREAS[1]

Variety	Average maturity	Northern locations				Central locations		Southern locations			Average yield all locations
		Belle Mina 1952-57	Experiment, Ga. 1952-55	Crossville 1946-49	State College, Miss. 1952-57	Tallassee 1946-57	Camden 1953	Fairhope 1944-57	Walnut Hill, Fla. 1952-57	Marianna, Florida 1952-57	
	Date	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Early Varieties											
Dorman	9-30	16.6	18.0	--	24.1	--	--	--	--	--	27.9
Dortchsoy 67	9-29	16.7	18.4	--	29.2	--	--	--	--	--	24.6
Midseason Varieties											
Hood	10-5	19.4	27.3	--	21.6	26.9	9.9	25.7	32.1	34.9	25.2
Lee	10-17	17.1	25.7	--	24.9	31.4	15.3	28.6	35.2	35.3	27.2
Dortchsoy 2	10-7	20.1	--	29.7	--	31.4	--	28.1	--	--	26.6
Hale Ogden 2	10-7	18.7	26.3	31.3	27.5	37.2	--	31.9	33.2	35.0	27.9
Ogden	10-7	17.7	22.2	29.7	24.1	29.4	7.3	24.9	33.0	34.2	24.7
Late Varieties											
Jackson	10-30	--	24.2	--	24.1	32.8	12.6	28.2	33.3	34.0	26.7
Roanoke	10-28	18.7	24.8	30.7	24.8	35.0	11.3	26.7	32.9	31.9	26.3
Dortchsoy 31	10-24	18.9	23.1	28.3	28.6	38.5	14.2	27.1	34.1	24.6	25.8
Very Late Varieties[2]											
Bienville	11-1	--	--	--	--	30.2	--	--	33.8	--	32.0
Improved Pelican	11-3	--	--	--	--	24.6	--	--	26.6	--	25.6
J.E.W. 45	11-1	--	--	--	--	26.9	--	--	28.6	--	27.7
Yelnando	11-2	--	--	--	--	23.0	--	--	29.7	--	26.3

[1] Ogden has been carried at all locations for the periods indicated. Yields of other varieties have been equated to Ogden so that all data are comparable.

[2] Two-year average both locations 1956 and 1957 for very late varieties.

All of the reported varieties have oil content of 21 to 22 per cent. The varietal characteristics other than yield and oil content are discussed in the maturity groups.

Early varieties, such as Dorman and Dortchsoy 67, that mature in late September are considered too early for extensive planting in Alabama. However, in the northern tier of counties, there may be situations where a 1- to 5-bushel lower yield may be justified in order to obtain early harvest.

Midseason varieties that mature in mid-October are adapted throughout the State. Ogden has been the standard variety for a number of years and yields well in most sections of Alabama. It is not as resistant to shattering as Lee and Hood. The mature beans of Ogden and two selections from Ogden, Dortchsoy 2 and Hale Ogden 2, have a green seedcoat. This is a disadvantage on the export market as compared with other varieties that are yellow. Lee and Hood are recently released varieties (Lee in 1954 and Hood in 1958). In addition to yielding well, they have yellow seedcoats, are shatter resistant and resistant to the more common diseases, such as bacterial pustule and frogeye. Hood matures about 12 days earlier than Lee and is adapted to the northern third of the State. Lee is best adapted to the southern two-thirds.

Late varieties are adapted to the southern two-thirds of the State and mature in late October. Jackson and Roanoke are 6 to 10 inches taller than Ogden and Lee. This is an advantage on the sandier soils and for late plantings. They are shatter resistant and resistant to common soybean diseases. Dortchsoy 31 is shorter than Ogden and Lee, making harvest difficult.

Very late varieties may be of some value in Baldwin and Mobile counties. These varieties include Bienville, Improved Pelican, J. E. W. 45, and Yelnando, all maturing in early November. They grow taller and can be planted later than Jackson. Yields of these varieties are usually lower than Jackson except Bienville, which most nearly resembles Jackson.

DATE of PLANTING EXPERIMENTS

Studies to determine the best planting dates were conducted at 11 locations in Alabama during 1953-1957. The data for five locations in northern Alabama are given in Table 2 and for six locations in southern Alabama are reported in Table 3. In general, average yields for this period were unsatisfactory. A minimum yield of 15 bushels per acre is required for production to be

TABLE 2. YIELDS OF JACKSON, LEE, AND DORMAN SOYBEANS FROM VARIOUS PLANTING DATES AT FIVE LOCATIONS IN NORTHERN ALABAMA, 1953-57

Location, soil type, and variety	Planting dates and yield per acre[1]							
	April		May		June		July	
	1	15	1	15	1	15	1	15
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
CROSSVILLE-HARTSELLS fsl								
Jackson	6	9	11	11	11	6	3	--
Lee	11	10	13	16	16	10	10	6
Dorman	22	15	17	14	13	7	12	5
BELLE MINA-DECATUR cl								
Jackson	--	11	11	12	11	6	--	4
Lee	--	10	12	14	13	16	10	12
Dorman	--	11	15	16	19	17	6	13
ALEXANDRIA-LEE sil								
Jackson	--	--	15	18	18	12	5	6
Lee	--	9	17	20	18	13	9	6
Dorman	--	11	11	12	10	8	9	4
WINFIELD-PRENTISS sl								
Jackson	--	--	--	--	--	--	--	--
Lee	--	--	--	19	--	16	--	--
Dorman	--	--	--	13	--	11	--	--
ALICEVILLE-STOUGH sl								
Jackson	11	6	8	7	3	4	8	8
Lee	10	10	12	10	8	12	10	4
Dorman	7	8	6	11	5	9	6	--
AV. NORTHERN ALABAMA								
Jackson	8	9	11	12	11	9	5	6
Lee	10	10	13	16	14	13	10	7
Dorman	14	11	12	13	12	10	8	7

[1] Jackson: 3-year average on Hartsells and Stough, 2-year average on Decatur, and 1-year average on Lee. Lee: 5-year average on Hartsells and Stough, 4-year average on Decatur, 3-year average on Lee (test conducted on Decatur clay 1953-54 at Alexandria failed), and 2-year average on Prentiss 1956 and 1957. (Test conducted on Savannah sandy loam 1953 and 1954 at Winfield failed.) Dorman: 2-year average at all locations.

profitable. However, it is pointed out that yields of all summer crops were very low in 1953 and 1954 because of inadequate rainfall.

Crop yields statewide were good in 1955, 1956, and 1957, but not good at several locations where soybean experiments were conducted.

These data show that for most of the State, May is the best month for planting. However, for Baldwin and Mobile counties the planting date should be between May 15 and June 15. These results agree with those reported by Hartwig *(1)*.

TABLE 3. YIELDS OF JACKSON AND LEE SOYBEANS FROM VARIOUS PLANTING DATES AT SIX LOCATIONS IN SOUTHERN ALABAMA, 1953-57

Location, soil type, and variety	Planting dates and yield per acre[1]							
	April		May		June		July	
	1	15	1	15	1	15	1	15
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
CAMDEN-NORFOLK sl								
Jackson	10	11	9	6	8	--	--	--
Lee	13	18	12	10	10	--	--	--
PRATTVILLE-GREENVILLE sl								
Jackson	13	13	13	12	15	13	14	10
Lee	12	12	13	15	14	12	12	9
AUBURN-NORFOLK ls								
Jackson	21	21	20	24	17	17	11	10
Lee	17	20	16	14	18	12	13	8
TUSKEGEE-BOSWELL fsl								
Jackson	10	9	11	10	11	13	10	10
Lee	6	9	11	10	12	11	13	9
BREWTON-KALMIA sl								
Jackson	18	22	24	22	18	15	10	9
Lee	12	14	17	17	16	14	8	5
FAIRHOPE-MARLBORO sl								
Jackson	22	25	31	33	36	35	27	23
Lee	19	23	30	33	31	31	25	22
AV. SOUTHERN ALABAMA								
Jackson	16	17	18	18	17	18	14	12
Lee	13	16	16	16	15	16	14	11

[1] Camden test is 3-year average yield. All other locations 5-year average yield.

Factors other than yield affecting harvested value under farm conditions pointed up by these studies were:

(1) Beans planted before May 1 produced short plants with pods close to the ground. This resulted in considerable cutter-bar loss when harvesting.

(2) These plantings throughout the State, and including those of May 1 at Fairhope, produce beans of lower quality than those from later plantings. This lower quality resulted both from increased purple stain and increased rotting in the pods.

RATE-OF-SEEDING and ROW-WIDTH EXPERIMENTS

A survey conducted by the National Soybean Crop Improvement Council in 1955 showed that most oil varieties of soybeans are planted in 36- to 42-inch rows. However, Wiggins *(4)*, reporting on studies conducted in New York, concluded that the nearer the arrangement of plants on a given area approaches a uniform

TABLE 4. EFFECT OF ROW WIDTH, SEEDING RATE, AND VARIETY ON YIELD OF LATE-PLANTED SOYBEANS[1]

Row width	Seeding rate per/a	Variety	Stand at harvest				Yield per acre					
			1954	1955	1956	Av.	1954	1955	1956	Av.	Av. for seeding rate	Av. for row widtth
In.	*Lb.*		*%*	*%*	*%*	*%*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
					June 1st planting							
30	30	Lee	83	99	96	93	19	40	47	35		
30	30	Jackson	45	89	82	72	17	44	44	35	35	
30	60	Lee	87	99	100	95	18	31	40	30		
30	60	Jackson	76	95	90	87	23	29	55	35	32	34
40	30	Lee	86	99	97	94	13	36	40	33		
40	30	Jackson	57	95	88	80	10	27	42	26	29	
40	60	Lee	97	100	100	99	16	29	34	26		
40	60	Jackson	82	100	98	93	15	32	39	29	27	28
					July 1st planting							
30	30	Lee	81	91	97	90	15	34	36	28		
30	30	Jackson	75	76	87	79	13	32	35	27	27	
30	60	Lee	92	99	99	97	14	32	38	28		
30	60	Jackson	88	88	97	91	18	31	38	29	28	28
40	30	Lee	94	96	98	96	13	28	38	26		
40	30	Jackson	85	82	93	87	13	28	32	24	25	
40	60	Lee	97	99	98	98	14	27	34	25		
40	60	Jackson	98	94	100	97	15	24	35	25	25	25

L.S.D. (.05)—Row width 1.8 bu., seeding rate N.S., row width × seeding rate N.S.

[1] Kalmia sandy loam, Plant Breeding Unit, Tallassee, Alabama.

TABLE 5. EFFECT OF ROW WIDTH, SEEDING RATE, AND VARIETY ON YIELD OF LATE-PLANTED SOYBEANS[1]

July 1 planting			Stand at harvest				Yield per acre					
Row width	Seeding rate per/a	Variety	1955	1956	1958	Av.	1955	1956	1958	Av.	Av. for seeding rate	Av. for row width
In.	*Lb.*		*%*	*%*	*%*	*%*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
10	240	Lee	99	100	100	100	26	53	38	39		
10	240	Jackson	95	97	100	97	27	56	40	41	40	
10	60	Lee	84	97	100	94	50	57	56	54		
10	60	Jackson	72	85	100	86	42	59	71	57	55	48
20	120	Lee	100	100	100	100	29	45	37	37		
20	120	Jackson	90	97	100	96	29	40	40	36	36	
20	60	Lee	96	97	100	98	29	50	42	40		
20	60	Jackson	87	97	100	95	30	42	50	41	40	38
30	90	Lee	99	100	100	100	24	40	37	34		
30	90	Jackson	94	97	100	97	33	44	45	41	37	
30	60	Lee	99	100	100	100	24	38	35	32		
30	60	Jackson	91	100	100	97	32	40	43	38	35	36
40	60	Lee	100	100	100	100	27	36	37	33		
40	60	Jackson	94	97	100	97	26	39	44	36	34	34

L.S.D. (.05)—Seeding rate 13 bu., row width 9 bu.

[1] Kalmia sandy loam, Plant Breeding Unit, Tallassee, Alabama.

distribution, the greater will be the yield. He reported yield increases of 20 to 30 per cent by decreasing the row width from 32 to 8 inches, and concluded that for the variety he was using one plant each 3 inches in 8-inch rows would result in optimum yield. Weber and Weiss *(3)* summarized data from four Corn Belt states that showed rows spaced 21 inches apart gave slightly higher yields than 7-, 14-, 28-, 35-, or 42-inch rows. In contrast, studies in the Southeastern States have not shown an advantage from row-spacing less than about 36 inches *(2)*.

Most of these studies have been conducted with plantings made at the optimum date. Since late-planted beans, such as those planted after small grains when weather did not permit planting in early June, seldom reached sufficient size to completely cover the ground, indications were that an advantage might be found from using closer row spacings.

Results given in Table 4 are from a 3-year study comparing late-planted beans (about June 1 and July 1) in 30- and 40-inch rows at 30- and 60-pound seeding rates for Lee and Jackson varieties. These data show a 3- to 5-bushel advantage for 30-inch rows over 40-inch rows. The same advantage prevailed for June 1 plantings over July 1 plantings. There was no difference between 30- and 60-pound seeding rates or between varieties.

Data in Table 5 are those of a study comparing 10-, 20-, 30-, and 40-inch rows seeded at 60 pounds per acre and at 240-, 120-, and 90-pound rates on the 10-, 20-, and 30-inch rows, respectively. This study showed a marked increase in yield from decreasing row width. Yields were highest when the seeding rate was 60 pounds per acre. Three-year average yields at the 60-pound rate were 34 bushels per acre in 40-inch rows and 55-bushels in the 10-inch rows. These studies show that on land not heavily infested with weeds or where weeds are controlled beans planted in narrow rows produce higher yields. On some soils satisfactory weed control can be obtained in late June plantings by one or two timely cultivations with a rotary hoe without damage to stand.

FERTILIZER and LIME EXPERIMENTS

In 1952, very few data on soybean fertilization in Alabama were available. Data on fertilization of similar soils in other states, especially North Carolina, indicate that soybeans on old cultivated fields respond only to lime or potassium. A survey of 22 fields was made in the summer of 1952 in Baldwin County to

determine the fertility level at which soybeans were growing. This county was selected because it was the leading producer in the State. The condition of the plants was evaluated visually, and where possible approximate yields from previous years were obtained. Soil samples were collected and analyzed to determine pH, available potassium, calcium, and magnesium. Leaf samples were collected and analyzed for potassium, calcium, and magnesium. Appearance was affected more by soil pH and available calcium than any other factor measured. On most locations where plants appeared below normal in vigor, the pH was below 4.9 and/or the available calcium below 200 pounds per acre. Soils with pH as low as 4.4 and calcium as low as 120 pounds per acre were observed. The majority of soil and plant samples were low in magnesium, except where dolomitic limestone had been applied recently. Soils in most locations tested medium or high in potassium, and leaf samples showed adequate potassium. At one location the plants appeared not to be inoculated. In general, it appeared that present fertilizer practices were adequate but liming practices were probably limiting yields on a number of fields in Baldwin County.

In 1953, 1954, and 1955, a total of 13 soybean fertility experiments were harvested from farmer fields in Jackson County. The average yield was only 14 bushels; however, a response was obtained to potassium at five locations, to phosphorus at five, and to lime at two. Soil test values and leaf analyses indicated a higher number of responses might have been obtained with more optimum growing conditions.

Fertility experiments were begun at the Lower Coastal Plain Substation, Camden, and at the Gulf Coast Substation, Fairhope, in 1952, and at the Brewton Experiment Field, Brewton, in 1953.

The experiment at the Lower Coastal Plain Substation was on a Norfolk sandy loam soil low in phosphorus and medium in potassium, with a pH of 6.0. Yields were very low for the period 1952-56 mainly because of dry weather and associated conditions. Yields never exceeded 15 bushels during the period.

The experiment at Brewton was on Kalmia sandy loam high in phosphorus and low in potassium, with a pH of 5.3. The 5-year average yield, Table 6, shows a 50 per cent increase from 50 pounds of potassium and a 20 per cent increase from lime. The combined application of lime, phosphorus and potassium resulted in an increase of more than 100 per cent (12 to 26 bushels per acre). No increase in yield was obtained from nitrogen.

TABLE 6. EFFECT OF LIME AND FERTILIZER ON YIELD OF SOYBEANS (1954-1958)

No.	Lime and fertilizer application per acre				Yield per acre (5-year av.)	
	Lime	N	P_2O_5	K_2O	Kalmia sandy loam[1]	Marlboro fine sandy loam[2]
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Bu.*	*Bu.*
1	0	0	0	0	12	31
2	2,000	25	0	100	25	34
3	2,000	25	25	100	26	32
4	2,000	25	50	100	25	35
5	2,000	25	100	0	17	33
6	2,000	25	100	25	23	35
7	2,000	25	100	50	27	35
8	2,000	25	100	100	27	34
9	2,000	0	100	100	26	34
10	2,000	25[3]	100	100	27	35
11	0	25	100	100	22	34
L.S.D. (.05)					2	N.S.
L.S.D. (.01)					3	N.S.

[1] Brewton Experiment Field soil test pH 5.3, P_2O_5 high, K_2O low.

[2] Gulfcoast Substation soil test pH 5.1, P_2O_5 high, K_2O medium. At this location only treatment No. 11 was limed.

[3] This treatment also received 25 pounds of N as a sidedressing at the early bloom stage.

The experiment at the Gulf Coast Substation was on Marlboro sandy loam high in phosphorus and medium in potassium, with a pH of 5.1 Although no single element increased yield, a 10 per cent increase was obtained where lime, phosphorus, and potassium were applied, Table 6.

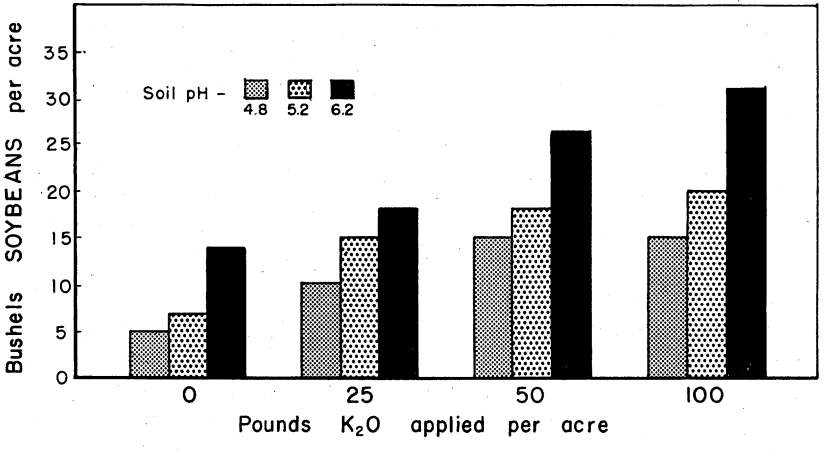

FIGURE 1. Soybean yields as influenced by pH level and four rates of potassium on soil low in potassium are shown in the above chart.

An experiment was conducted at Auburn on Norfolk sandy loam at three pH levels. The effect of potassium at each pH level was determined. These data, Figure 1, show that soybeans respond to lime and potassium applications when reserves in the soils are low.

Liming increased yields from 15 to 31 bushels per acre where the high rates of potassium were applied. On plots with a pH of 6.2 potassium increased yields from 14 to 31 bushels per acre.

FERTILIZER PLACEMENT EXPERIMENTS

When placed in contact with seeds, soluble fertilizers damage seedlings. An experiment comparing drill with broadcast application of 400 pounds of 0-14-14 was conducted at the Plant Breeding Unit, Tallassee, in 1955 and 1956. The stand was 25 per cent less when the fertilizer was applied in the drill than when broadcast, Figure 2. Correspondingly, a yield reduction of 10 bushels per acre resulted. This shows that if the fertilizer is drilled, care must be taken to ensure placement of fertilizer 2 to 3 inches to the side of the seed to avoid stand and yield reduction.

FIGURE 2. The effect of fertilizer placement on soybean stand is shown in above plots. Both plots of soybeans received 400 lbs. of 0-14-14 at planting. At left fertilizer was drilled too near the seed; at right fertilizer was applied broadcast.

SUMMARY

1. Recommended varieties and planting dates for Alabama are:

Northern counties	Hood, Lee	May 1-30
Central counties	Lee, Jackson	May 1-30
Baldwin and Mobile counties	Lee, Jackson	May 15-June 15

The above variety recommendations are based on availability of certified seed, high oil content, shattering resistance, and disease resistance.

2. Soybeans should be planted in rows as narrow as weed and grass control will allow. The seeding rate should be approximately 60 pounds of viable seed per acre.

3. Soybeans respond to lime and fertilizer when there is a deficiency of these materials in the soil. Soil test recommendation should be followed and the fertilizer either broadcast or placed 2 to 3 inches to the side of the seed if drilled at planting.

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[1] Resigned.
[2] Retired.

LITERATURE CITED

(1) HARTWIG, E. E. Factors Affecting Time of Planting Soybeans in the Southern States. U.S.D.A. Circular No. 943. 1954.

(2) ---------- Row Widths and Rates of Planting Soybeans in the Southern States. Soybean Digest 17: 13-15. 1956.

(3) WEBER, C. R., AND WEISS, M. G. Let's Push up Soybean Yields. Iowa Farm Science 2 (10): 10-12. 1948.

(4) WIGGINS, R. G. The Influence of Space and Arrangement on the Production of Soybean Plants. Journ. Amer. Soc. Agron. 31: 314-321. 1939.