SOUTHEAST MISSOURI

AGRICULTURAL RESEARCH

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AGRICULTURAL EXPERIMENT STATION

Contents

Irrigation of experimental plots, Diehlstadt.

Agricultural Engineering

Charles F. Cromwell, Jr.

A dry period the last 3 weeks in May and first week in June focused attention on irrigation early last spring. More irrigation systems were noted during this period than were seen during the entire 1957 season as more growers tried this method of getting crops to come up.

Uniformity of distribution of water with sprinkler systems was a serious problem, since dry southwest winds were blowing during much of this period. The wind effect is more pronounced with increased spacing. One irrigation of 1″ to 1½″ was sufficient for germination on sands and sandy loam soils. Two were required on cloddy, "gumbo" type soils due to the drying effect of the wind.

At least one grower used gated pipe on uneven fields and obtained a good stand where the water reached. This cotton was about 10 days ahead of cotton on areas missed by the irrigation water.

The potential value of land graded fields was doubly demonstrated. Graded fields were ready for seed bed preparation at least 10 days prior to uneven fields on sharkey clay at the Bragg City field. This benefit at planting time, plus possibility of more timely cultivations, helps offset charges against the irrigation system.

The cotton planted in the irrigation trial at Bragg City received two irrigations of about 1 inch each during the last week in May by sprinkler. After a stand was obtained, one irrigation treatment was irrigated following a day when visible signs of moisture stress occurred before noon. This treatment received 1 irrigation on August 7. A second treatment was to be irrigated 5 days after wilt was observed. This treatment was not irrigated. The third set of plots consisted of check plots. A medium season variety, Delfos, and a short season variety, Rex, were planted. The three treatments were repeated in four test plots. One plot was planted on an area without sufficient grade for adequate drainage; its yields were not counted.

These results show 19 pounds per acre increase in Rex yields at first picking, and 126 pounds per acre total increase in Rex of plots receiving 1 irrigation over non-irrigated plots. A more significant result is the decrease

SEED COTTON YIELDS ON BRAGG CITY IRRIGATION TEST

Variety	First Pick	Second Pick	Total
Irrigated Rex	1323 #/Acre	438	1761 #/Acre
Irrigated Delfos	841	557	1398
Not Irrigated Rex	1304	331	1635
Not Irrigated Delfos	1120	436	1556

Irrigated - average of 3 test plots
Not Irrigated - average of 6 test plots

in Delfos yields of irrigated plots compared with non-irrigated plots. This decrease amounted to 279 pounds per acre at first picking, but only 158 pounds per acre total for the year.

It seems from this year's results that irrigation both delayed maturity and reduced yields on Delfos cotton, while it increased yields on Rex, and possibly hastened maturity slightly.

These plots were on sharkey clay. The Bragg City field has a particularly dense soil below plow depths. Internal drainage is poor, and root development is restricted to a shallow zone. During days of high temperature these plants show moisture stress much earlier than plants which are deeper rooted. At the time of the irrigation application on the "wet" treatment at Bragg City, the 0 to 6 inch zone had a moisture content of 37 percent, and the 6 to 12 inch zone was at 41.2 percent. These figures are both greater than the ⅓ atmosphere tension moisture percentage figures obtained for undisturbed samples from this field, which is considered to be an approximation of field capacity.

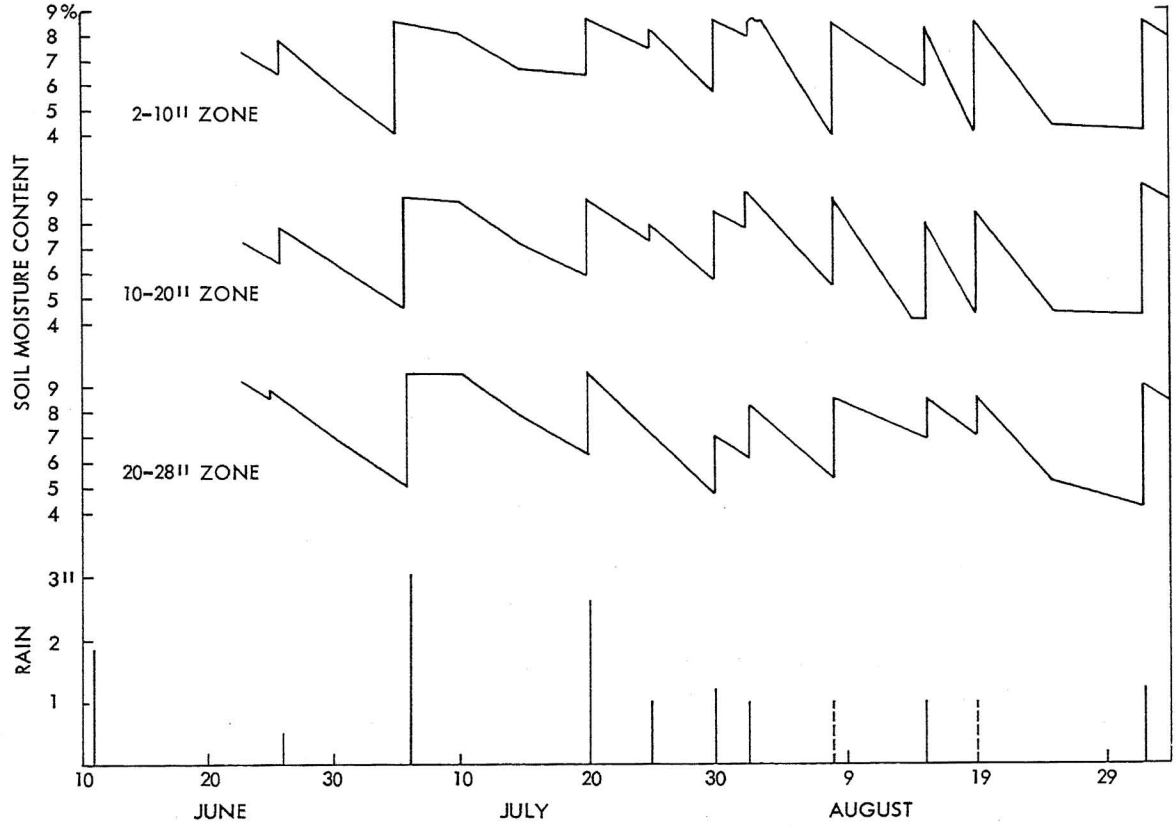
Moisture Content @ ⅓ Atmosphere, 0-6" 30.7%*
Bragg City, Missouri 6-12" 34.6%*
*(Dr. Earl Kroth, USDA)

Furrow irrigation was also used in an irrigation trial on Malden sand. Auburn 56 cotton was planted May 14. Three irrigation treatments were to be used. These were: (1) non-irrigated check plots, (2) irrigated near 50% of field capacity, and (3) irrigated 3 days after wilt observed.

Due to the good distribution of rainfall this season, the third treatment was not made. The test was duplicated in four plots. Two of the treatment plots received two irrigations and two received only one irrigation. Yield differences were small, and increases were not significant this season. Average yield without irrigation, was 2360 pounds of seed cotton per acre. Average for irrigated cotton was 2428 pounds per acre, a difference of 68 pounds or less than 3 percent.

The following chart shows moisture available during the peak growing season in the top two feet of soil.

Average moisture loss from evaporation and transpiration was about 0.12 inch per day in early July and about 0.21 inch per day in early August. Peak rates could not be determined with the equipment at hand. *(Project 227)*



Insects and Diseases

The watermelon roots on the left were grown on the untreated check. The roots on the right were grown on soil fumigated for nematode control.

Cotton Insect Research

Keith Harrendorf

Fungicide-Systemic Insecticide Seed Treatment

Previous work at this station has indicated that the combined use of an in-the-furrow fungicide and a systemic insecticide seed treatment lessens adverse effects of the systemic insecticide on seedling cotton. This experiment was designed to give additional information.

Procedure. Small plots were used with each treatment being repeated four times. The plots were 12 rows wide and 95 feet long. The treatments were:

1. Di-Syston—1 pound technical per 100 pounds of seed.
2. Thimet—2 pounds technical per 100 pounds of seed.
3. Captan—3 pounds technical per acre, sprayed in-the-furrow at the rate of 15 gallons total liquid per acre.
4. Di-Syston plus Captan—Same dosage for both materials as given above.
5. Thimet plus Captan—Same dosage for both materials as given above.
6. Toxaphene plus Captan—Toxaphene was applied as a spray at the rate of 1 pound technical per acre on May 26th and June 4th. Captan was applied in-the-furrow at the same dosage given above.
7. Check—No treatment

The systemic insecticides were applied to the seed in a rotating metal drum seed treater on April 21, 1958.

The seed was Delfos 9169, hill dropped May 13 at the rate of 5 to 10 seeds per hill.

One blanket application of endrin at 0.3 pound technical per acre was applied September 8 for bollworm control.

Results—See Table 1.

TABLE 1--RESULTS OF SYSTEMIC INSECTICIDE - FUNGICIDE TREATMENTS AT SIKESTON, MISSOURI, 1958

Criteria and Date	Thimet	Di-Syston	Captan	Thimet + Captan	Di-Syston + Captan	Check	Toxaphene + Captan	LSD .05	LSD .01
Thrips per 20 plants									
June 13	1.25	4.15	10.50	3.13	4.19	12.19	4.25	4.35	5.97
June 23	4.75	5.50	13.50	4.25	7.25	4.50	8.00	NS	NS
Aphids per 20 plants									
June 13	11.56	16.31	498.56	14.25	13.88	753.25	962.19	659.45	NS
June 23	529.00	198.00	3423.00	319.00	304.00	2369.00	2257.00	NS	NS
July 3	14.50	12.00	19.50	15.00	8.25	23.25	35.25	12.87	NS
Stand count per 100' row									
June 16	118.25	146.75	287.00	189.00	201.75	239.75	263.25	43.89	60.28
Plant heights (Average 20 plants)									
June 13	7.25	7.33	8.33	7.69	7.69	8.14	8.14	NS	NS
June 27	8.15	8.38	9.57	9.46	9.28	8.34	9.09	NS	NS
July 3	11.42	12.13	12.58	11.99	12.23	11.73	12.49	NS	NS
Square count (Average 20 plants)									
July 3	49.50	69.50	68.50	50.05	59.00	60.25	62.75	NS	NS
Yields seed cotton per acre									
Oct. 8	785	1032	1299	998	1080	1006	1256	NS	NS
Nov. 4	718	655	632	754	663	624	643	NS	NS
Total	1503	1687	1931	1752	1743	1630	1899	NS	NS

NS = Not Significant

Thrips Counts. Thrips counts were made June 13 and June 23. Counts were made by close inspection of 20 plants, selected at random from the four center rows of each plot. The Thimet and Di-Syston treatments, alone and in combination with Captan, resulted in a highly significant reduction in thrips population for approximately four weeks after planting. Toxaphene also gave highly significant control of thrips approximately four weeks after planting. Counts on June 23, six weeks after planting, showed no significant difference between treatments.

Aphid Counts. Aphid counts were made June 13 and 23 and July 3. Twenty plants were selected at random from four center rows of each plot for close inspection. Counts on June 13 showed that Thimet and Di-Syston alone and in combination with Captan gave significant control of aphids four weeks after planting, compared to the check. Captan and Toxaphene plus Captan did not differ significantly from the check. Counts June 23 did not show a significant difference between treatments, even though the averages indicate considerable reduction in the Thimet, Di-Syston, Thimet plus Captan and Di-Syston plus Captan treatments. Counts on July 3 showed only Di-Syston giving significant reduction in aphids. The number of aphids in the Toxaphene plus Captan treatment was significantly higher than in any of the other treatments except the check and was almost significantly higher than the check. Aphid populations July 3 were decreasing rapidly due to an extremely heavy build-up of lady beetles.

Stand Count. A single stand count was made June 16. Counts were made from 25 feet of row from each of the four center rows of each plot. Thimet and Di-Syston alone resulted in a highly significant reduction in stand when compared to the check. Captan alone gave a significant increase over the check. Thimet plus Captan resulted in a significant reduction compared to the check and a highly significant reduction when compared to Captan alone. Di-Syston plus Captan resulted in a highly significant reduction when compared to Captan alone, but was not significantly different from the check.

Plant Heights. Plant height measurements were taken June 13 and 27 and July 3 from 20 plants selected at random from the four center rows of each plot. Measurements on June 13 were taken by measuring from the tip of the tap root to the apex of the terminal bud. Measurements June 27 and July 3 were made by measuring from the soil surface to the apex of the terminal bud. There were no significant differences among treatments in heights of plants.

Square Count. A single square count was made July 3. Counts were made from those plants selected for plant height measurements consisting of 20 plants selected at random per plot. There were no significant differences among the treatments.

Yields. Yields were taken from the two center rows of each plot. There was no significant difference in yield at first picking or in total yield among the treatments.

Discussion. The systemic insecticides Thimet and Di-Syston, alone and in combination with the fungicide Captan, controlled thrips and aphids for a period of four weeks after planting. Both Thimet and Di-Syston reduced stands. Addition of the fungicide, Captan, lessened this reduction and, in the case of Di-Syston, the addition of Captan resulted in a stand comparable to the check. Captan alone increased the stand significantly over the check, even though the soil was warm and dry at and following planting. Plant height measurements indicated that under these conditions there were no adverse effects upon plant growth resulting from the treatments. Square counts and first picking yields indicate no delay in fruiting and maturity resulting from the treatments. There was no significant difference in total yields among the treatments, illustrating the ability of the cotton plant to recover from the attacks of thrips and aphids and to set a normal crop. *(Project 214)*

Insect Population in Sprayed and Unsprayed Fertilizer Plots

The influence of fertilizer upon insect populations in cotton was indicated at this station in 1957. The following is a similar test designed to give additional information on the effects of three levels of fertilization on insect populations under sprayed and unsprayed conditions.

Procedure. A split plot design was used. The main plots consisted of three rates of fertilizer. Each of the main plots were split into two sub-plots, one sprayed regularly and one unsprayed. Each treatment was repeated 8 times. The sub-plots were 12 rows wide and 100 feet long.

The fertilizer treatments were: (1) High—800 pounds of 12-12-12. (2) Medium—400 pounds of 12-12-12. (3) Low—200 pounds of 12-12-12. The fertilizer treatments were applied under the bed prior to planting.

The spray treatments were: (1) sprayed—10 weekly applications of Endrin beginning on June 30th and ending on September 4th (2) Unsprayed—received no insecticide. All spray applications were made using 0.25 pounds of Endrin applied with a high clearance spray machine. The first application, June 30, was applied using one nozzle per row calibrated to deliver 2 gallons of total material per acre. All other applications were applied using three nozzles per row calibrated to deliver 6 gallons of total material per acre. Treatments began when cotton was in the first square stage.

The plots were hill dropped May 15 with D&PL Fox. Rainfall during the season was adequate and irrigation was not needed.

TABLE 2--MEAN SEASONAL INFESTATION PER 20 PLANTS IN SPRAYED AND UNSPRAYED FERTILIZER PLOTS

Insect	Fertilizer Treatment	Unsprayed		Sprayed	Fertilizer Means
Bollworm	High	.59		.98	.79
	Medium	.66		.79	.73
Eggs	Low	.63		.88	.76
	Mean	.63		.88	.76
	L.S.D. .05		.13		NS
	L.S.D. .01		.18		NS
	High	.38		.21	.30
	Medium	.36		.20	.28
Larvae	Low	.25		.15	.20
	Mean	.33		.19	.26
	L.S.D. .05		.07		NS
	L.S.D. .01		.10		NS
	High	45.29		39.24	42.27
	Medium	40.34		37.25	38.80
Aphids	Low	40.99		44.68	42.84
	Mean	42.21		40.39	41.30
	L.S.D. .05		NS		NS
	L.S.D. .01		NS		NS
	High	.38		.30	.34
	Medium	.30		.18	.24
Mirid	Low	.23		.20	.22
Complex	Mean	.30		.23	.27
	L.S.D. .05		NS		NS
	L.S.D. .01		NS		NS
	High	2.76		2.64	2.70
	Medium	2.43		2.85	2.64
Beneficial	Low	2.65		2.80	2.73
	Mean	2.61		2.76	2.69
	L.S.D. .05		NS		NS
	L.S.D. .01		NS		NS

NS = Not Significant

TABLE 3--YIELDS OF SEED COTTON PER ACRE FROM SPRAYED AND UNSPRAYED PLOTS RECEIVING DIFFERENT RATES OF FERTILIZER

Date	Fertilizer	Treatment Unsprayed		Sprayed	Fertilizer Means
Oct. 15	High	1112.10		1208.46	1160.28
	Medium	1389.30		1673.10	1531.20
	Low	1549.68		1785.30	1667.49
	Total	4051.08		4666.86	4358.97
	Spray Means	1350.36		1555.62	1452.99
	L.S.D. .05		133.32		357.06
	L.S.D. .01		181.50		NS
Nov. 12	High	904.86		982.08	943.47
	Medium	619.08		642.84	630.96
	Low	517.44		471.24	494.34
	Total	2041.38		2096.16	2068.77
	Spray Means	680.46		698.72	689.59
	L.S.D. .05		NS		122.76
	L.S.D. .01		NS		170.94
Total	High	2016.96		2190.54	2103.75
	Medium	2008.38		2315.94	2162.16
	Low	2067.12		2256.54	2161.83
	Total	6092.46		6763.02	6427.74
	Spray Means	2030.82		2254.34	2142.58
	L.S.D. .05		151.01		NS
	L.S.D. .01		205.46		NS

NS = Not Significant

All records were taken from the four center rows of each plot. Insect counts, other than aphids, were made by examining 20 plants selected at random from each plot. Aphid counts were made by examining 20 leaves selected at random per plot.

Results—See Tables 2 and 3.

Discussion

Insect Populations—The mean seasonal infestations of bollworm eggs, bollworm larvae, aphids, mirids and beneficial insects did not differ significantly among the fertilizer treatments.

Bollworm egg counts were significantly higher in the sprayed plots than in their unsprayed counterparts. The high larvae number in the unsprayed plots compared with their sprayed counterparts was highly significant.

Aphid, mirid, and beneficial insect counts were not significantly different in the sprayed and unsprayed plots.

Yields—There was no significant difference in total yield among the fertilizer treatments; however, at first picking the high treatment yielded significantly less seed cotton than the medium or low treatments, indicating a delay in maturity. At second picking, the high fertilizer treatment produced significantly more seed cotton than the medium and low treatments.

First picking yields show a highly significant increase in sprayed plots compared to their unsprayed counterparts in the medium and low fertilizer treatments. The yields of the sprayed and unsprayed plots in the high fertilizer treatment did not differ significantly.

Second picking yields did not differ significantly between the sprayed and unsprayed plots of each fertilizer treatment.

Total yield of seed cotton was significantly higher in sprayed plots than in unsprayed counterparts for all fertilizer treatments. *(Project 214)*

Effects of Continuous Insecticide Application Upon The Cotton Plant

Observations in the past have indicated that perhaps certain insecticides, when used continuously or under some conditions might cause a response of the cotton plant, unrelated to insect control. This response has appeared under some conditions in hastened or delayed maturity, increased or decreased vegetative growth, hastened natural defoliation and increased yields which do not seem to be correlated with insect control.

Experiments at two locations at Sikeston, were designed to evaluate several materials in common use as to their effects on the cotton plant.

Procedure. Small plots were used at each location. The plots were 8 rows wide and 95 feet long. Treatments at Location I were repeated four times and at Location II,

five times. The treatments and rates were:

Location I

Calcium Arsenate Dust—10 pounds per acre.
Toxaphene Spray—2 pounds technical per acre.
Malathion Spray—1 pound technical per acre.
Check—No treatment.

Location II

Calcium Arsenate Dust—10 pounds per acre.
Toxaphene Dust—10 pounds per acre.
Inert Dust—10 pounds per acre.
Endrin Spray—0.25 pounds technical per acre.
Dry Run—Machine driven through—no material applied.
Check—No treatment.

Both locations received identical fertilizer applications of 400 pounds of 12-12-12, broadcast before planting. At both locations seed was hill dropped on 12-14 inch centers with Delfos 9169 on May 12.

Treatments began on June 26, when the cotton was in the first square stage, and continued at 4 or 5 day intervals until September 9. Location I received 16 applications and Location II received 15 applications. In addition to the regular treatments, both locations received a blanket application of Malathion for aphid control on August 3 and blanket applications of Endrin for bollworm control on August 19 and 26.

Dust applications were made with a rotary hand duster and spray applications were made with a high clearance spray machine using three nozzles per row and calibrated to deliver 6 gallons per acre. The inert dust was one of the clay type diluents used in dust formulations. All other materials were commercial insecticide formulations.

Insect population counts were made just prior to each treatment. Counts were made by inspecting 20 plants selected at random from the four center rows of each plot for bollworm eggs, bollworm larvae, mirids and beneficial insects. Aphid counts were made by inspecting 20 leaves selected at random per plot. Mirid complex counts included the cotton fleahopper, the tarnished plant bug and rapid plant bug. Beneficial insect counts include lady beetles, insidious flower bugs, nabids, big-eyed bugs and lacewing larvae.

Plant height measurements were made September 12 by measuring from the soil surface to the tip of the terminal bud. Measurements were taken from 20 plants selected at random from the four center rows of each plot.

Yields were taken from the two center rows of each plot. First picking was made October 14 when approximately two-thirds of the bolls were open. Second picking was made four weeks later on November 11.

Results—See Tables 4 and 5.

Discussion. The mean seasonal insect infestations, with the exception of aphids, did not differ significantly among the treatments. Aphid infestations in the calcium arsenate treatments at both locations showed a highly significant increase over the check. Aphid populations in the toxaphene spray, Malathion spray and check did not differ significantly at Location I. At Location II, aphid populations in both calcium arsenate and toxaphene dust treatments showed a highly significant increase over all other treatments. There was no significant difference in aphid populations among the other treatments.

Plant height measurements at Location I on September 12 showed a highly significant reduction in plant height from the calcium arsenate treatment. There was no significant difference between other treatments at Location I. Plant height measurements at Location II on September 12 showed no significant difference among the treatments.

Yields in seed cotton did not differ significantly at

TABLE 4--EFFECTS OF CONTINUOUS INSECTICIDE APPLICATIONS UPON THE COTTON PLANT
SIKESTON, MISSOURI - 1958
LOCATION I

	Calcium Arsenate Dust	Toxaphene Spray	Malathion Spray	Check	LSD .05	LSD .01
Mean Seasonal Infestation						
Bollworn (Per 20 plants)						
Eggs	1.50	1.87	1.81	1.76	NS	NS
Larvae	.21	.21	.21	.44	NS	NS
Aphids (Per 20 leaves)	183.70	49.10	24.20	36.20	49.00	70.40
Mirid Complex (Per 20 plants)	.38	.32	.33	.44	NS	NS
Beneficial Insects (Per 20 plants)	3.75	2.72	2.59	3.30	NS	NS
Plant Height (Ave. In.)						
September 12	50.08	56.63	54.90	56.05	2.62	3.77
Yields - Seed Cotton						
1st pick Oct. 14	1496	1278	1184	1303	NS	NS
2nd pick Nov. 11	528	600	624	627	NS	NS
Total	2024	1878	1808	1930	NS	NS

NS = Not Significant

TABLE 5--EFFECTS OF CONTINUOUS INSECTICIDE APPLICATIONS UPON THE COTTON PLANT
SIKESTON, MISSOURI - 1958
LOCATION II

	Calcium Arsenate Dust	Toxaphene Dust	Inert Dust	Endrin Spray	Dry Run	Check	LSD .05	LSD .01
Mean Seasonal Infestation								
Bollworn (Per 20 plants)								
Eggs	1.20	1.23	.80	1.00	.89	.95	NS	NS
Larvae	.21	.20	.20	.11	.35	.27	NS	NS
Aphids (Per 20 leaves)	68.40	60.10	25.30	24.20	30.20	25.40	19.80	26.20
Mirid Complex (Per 20 plants)	.25	.12	.17	.19	.21	.21	NS	NS
Beneficial Insects (Per 20 plants)	2.46	2.00	1.97	1.75	1.81	2.09	NS	NS
Plant Height (Ave. In.)								
September 12	45.22	49.12	50.80	48.50	50.58	46.39	NS	NS
Yields - Seed Cotton								
1st pick Oct. 14	1116	1214	1319	1456	1139	1050	NS	NS
2nd pick Nov. 11	739	622	681	696	632	664	NS	NS
Total	1855	1836	2000	2152	1771	1714	291	NS

NS = Not Significant

either first or second picking; however, at Location II the total yield for the two pickings was significantly higher in the Endrin spray treatment than in the Dry Run treatment or the Check. There was no significant difference in yields among the other treatments at Location II.

There was no indication of hastened natural defoliation resulting from the treatments at either location. *(Project 214)*

Boll Weevil Hibernation Studies

Boll weevil survival from hibernation cages placed at Malden, Bucoda (2), Sikeston and Cline's Island was negative. No live weevils were recovered from the cages in the spring of 1958.

Hibernation cages were again placed near suitable hibernation areas at Sikeston, Malden, Bucoda and Campbell in the fall of 1958. Two hundred and fifty field collected weevils were placed in each cage. A sample of the weevils used in the cages showed that approximately 60 percent of the population was in an advanced state of diapause.

Winter survival of these weevils will be determined in the spring of 1959. *(Project 214).*

Boll Weevil Resistance

A cooperative project with the Texas Agricultural Experiment Station has shown Missouri boll weevils are *not* resistant to the chlorinated hydrocarbon insecticides at present. Toxicity tests have shown samples of field collected Missouri weevils to be very susceptible to the chlorinated hydrocarbon insecticides when the recommended dosages are used. *(Project 214).*

Nematode Control

Lee Jenkins

Cotton:

In 1957 the field at Diehlstadt used in these experiments was planted to a variety of cotton susceptible to the nematode-fusarium wilt complex. The crop was severely damaged by the combination of root knot nematodes and fusarium wilt. This field was chosen for the study of variety resistance to nematodes and disease and to test chemicals for the control of nematodes.

Two varieties of cotton were used in the experiments on chemical control for nematodes. Auburn 56 was chosen as the resistant variety and Fox as the susceptible variety. Four rows of Fox cotton and four rows of Auburn 56 were included in each test plot. The two center rows were harvested from each variety.

The following chemicals were used as soil treatments: DD; Dowfume; Nemagon or Fumazone; 18133 (0, 0-diethyl 0-2-pyrazinyl phosphorothioate). All of the chemicals were used in the liquid form except the Nemagon which was used in the granular form on some plots. A soil chisel was used to put the liquid fumigants down to a depth of about 6 inches, using a single chisel to the row and planting directly over the chisel mark.

Nemagon granules were applied several ways: (1) With a horn seeder and bedding; (2) with a fertilizer attachment on a cotton drill as a side dressing; (3) using a corn planter with the Nemagon granules in the seed box.

All applications of Nemagon granules were made at 50 pounds per acre of the 17½% formulation. Each of 12 plots was replicated three times. Two applications of 200

Fusarium wilt in a farmer's cotton field near Poplar Bluff. The severity of plant killing by the combination of nematodes and fusarium wilt can be seen in the foreground.

A portion of the two-row test plots at Sikeston for the in-the-furrow method of applying fungicides. (a) Seed inoculated with a grain culture of seedling diseases to increase disease severity, also given Dupont fungicide spray. (b) Seed was inoculated and no fungicide was added. (c) Seed was not inoculated and no fungicide was added. (d) Seed inoculated, and plants given Captan-Terachlor dust treatment.

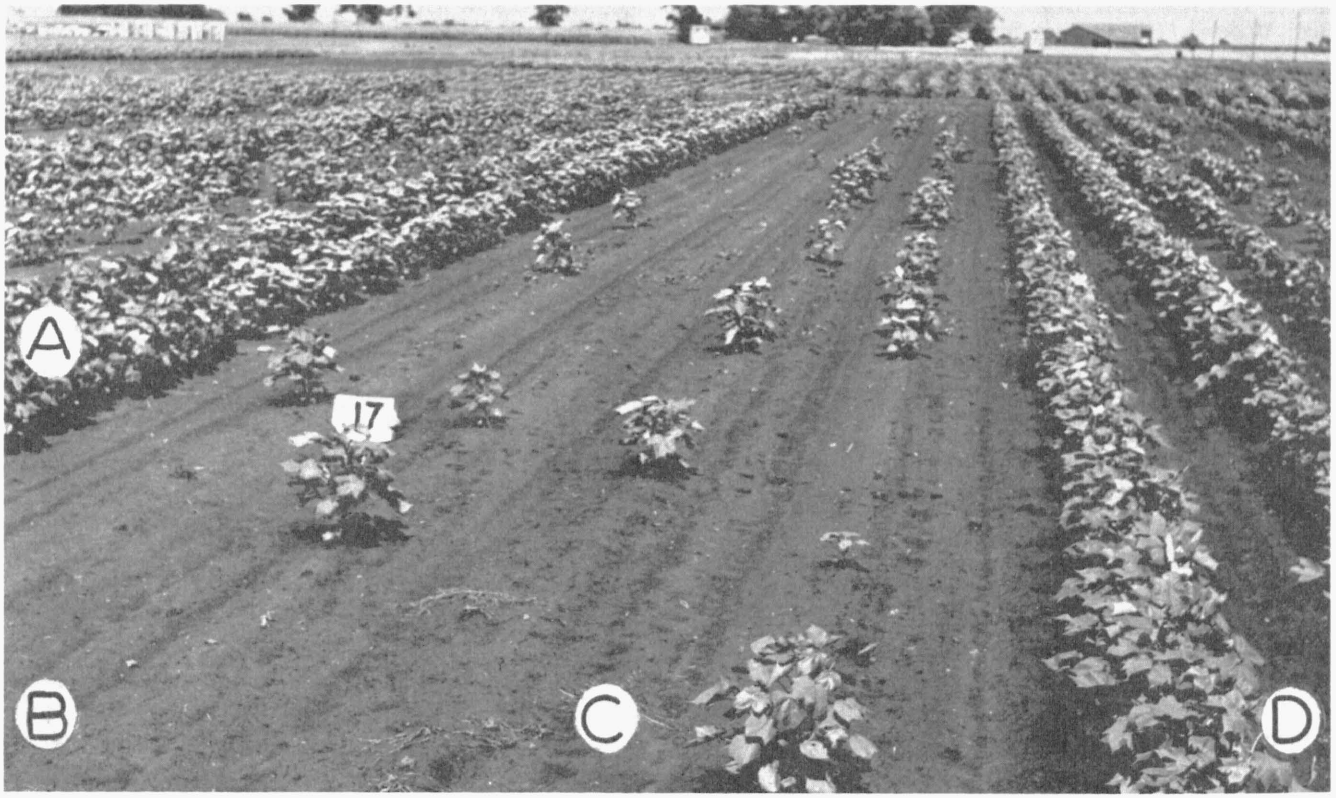


TABLE 1--YIELD ON FUMIGATION EXPERIMENT, DIEHLSTADT, 1958

Pounds per Acre, Total Yield				
Auburn 56		D&PL Fox		
Seed Cotton	Lint	Seed Cotton	Lint	Treatment
2990	1097	2126	801	DD, 8 gallons
2938	1052	2106	733	Nemagon Liquid, 1/4 gallon
3015	1088	2451	882	Nemagon Liquid, 1/2 gallon
2683	974	1966	719	Nemagon Liquid, 3/4 gallon
2892	1058	1991	723	Dowfume W85, 2-1/2 gallons
2790	971	1439	508	American Cyanamid 18133, 8 pounds
2816	1019	1736	616	Nemagon Granules, Fertilizer Attachment
3096	1108	1390	495	Nemagon Granules, Fertilizer Attachment
2894*	1074	1400*	491	Nemagon Granules, Horn Seeder, Bedded
3118	1094	1425*	507	None
2974	1091	2174	765	Nemagon Liquid, 1/2 gallon
3037	1090	2186	769	Nemagon Liquid, 1/2 gallon, Bedded
----	----	2886	995	Nemagon granules in planter seed box

* Average of two replications only.

TABLE 2--RECORDS OF DEAD AND WILTED COTTON PLANTS DURING THE GROWING SEASON AS RECORDED ON SEPTEMBER 11, 1958

Average of Replications 2 and 3 per 160 Foot Row

Treatment No.	D&PL Fox		Auburn 56	
	Dead	Wilted	Dead	Wilted
1	41.00	63.00	3.00	2.50
2	13.00	41.00	0.00	3.00
3	7.25	24.75	1.25	0.75
4	1.75	13.50	1.00	2.50
5	22.25	35.00	1.00	2.50
6	48.25	52.25	3.50	0.50
7	31.75	51.75	1.25	0.50
8	69.50	77.25	2.00	0.75
9	56.00	48.50	3.00	1.25
10	76.00	61.25	4.00	1.25
11	5.75	18.75	1.25	0.75
12	20.25	40.25	0.75	0.75
13*	115.50	75.00	---	---

1. DD, 8 gallons
2. Nemagon liquid, 1/4 gallon
3. Nemagon liquid, 1/2 gallon
4. Nemagon liquid, 3/4 gallon
5. Dowfume W85, 2-1/2 gallons
6. American Cyanamid 18133, 8 pounds
7. Nemagon Granules (equivalent of 1/2 gallon liquid), Fertilizer Attachment
8. Nemagon Granules (equivalent of 1/2 gallon liquid), Fertilizer Attachment
9. Nemagon Granules (equivalent of 1/2 gallon liquid), Horn seeder, bedded
10. Check. No treatment
11. Nemagon liquid, 1/2 gallon
12. Nemagon liquid, 1/2 gallon, bedded
13. Average from two untreated border rows

* Border row.

pounds of 12-12-12 fertilizer were made as side dressings to the cotton during the growing season.

The soil was treated two weeks before planting except where the granules were applied as a side dressing at planting time.

The yields from the various treatments are shown in Table 1. Table 2 indicates the number of dead and wilted plants on September 11. *(Project 312)*

Vegetables:

Nematode controls were tested with vegetable crops at the Babb Farm near Diehlstadt.

Muskmelon rows that were untreated had severe injury to the roots by root knot nematodes. Many of the plants died before harvest was completed on the treated rows.

Cabbage plants of the variety Copenhagen were set May 9. By June 3 the plants in the treated area were noticeably larger than those plants in the check. Heads began forming on the plants in the treated row about one week ahead of those in the check. At harvest time there was not as much difference in the appearance of the treated and untreated rows as was indicated by the weight of the heads. The cabbage heads on the treated rows were 31 percent heavier than the check and were much more compact, indicating a marked difference in quality. Plants were pulled from both the treated and untreated rows at harvest time. There was severe root knot damage in the

TABLE 3--AVERAGE HEIGHT OF COTTON PLANTS IN INCHES

Treatment No.	Replications 1, 2 & 3		Replications 2 & 3				Rate per Acre
	6-24-58		7-15-58		8-13-58		
	Fox	Auburn 56	Fox	Auburn 56	Fox	Auburn 56	
1	8.8	10.2	20.3	23.0	36.2	44.7	DD, 8 gallons
2	8.5	10.25	17.5	20.5	37.0	44.0	Nemagon Liquid, 1/4 gallon
3	8.3	11.2	20.2	23.7	36.0	41.2	Nemagon Liquid, 1/2 gallon
4	7.1	8.9	17.2	20.8	36.7	41.2	Nemagon Liquid, 3/4 gallon
5	7.5	9.9	17.5	23.8	36.2	43.2	Dowfume W85, 2 1/2 gallons
6	7.4	8.7	16.7	20.2	32.5	47.0	American Cyanamid 18133, 8 pounds
7	8.5	9.2	17.7	22.0	33.7	40.7	Nemagon Granules, Fertilizer Attachment
8	8.7	10.2	16.6	20.5	25.7	43.2	Nemagon Granules, Fertilizer Attachment
9*	6.5	9.5	18.0	20.7	31.0	42.7	Nemagon Granules, Horn Seeder, Bedded
10	7.7	9.8	17.1	22.0	30.2	45.0	Check
11*	7.7	9.7	18.7	21.6	37.0	38.7	Nemagon Liquid, 1/2 gallon
12	8.3	9.9	18.0	20.6	34.0	43.2	Nemagon Liquid, 1/2 gallon, Bedded

* Replications 2 and 3 only.

RESULTS OF SOIL TREATMENT FOR NEMATODE CONTROL

Crop	Treatment per Acre -	Percent Increased Yield		Percent Decreased Yield
		Weight	No. of Fruits	
Muskmelons	*Nemagon, 1/2 Gal.	39%	28%	0
Cabbage	Nemagon, 1/2 Gal.	31%	--	0
Peppers	Nemagon, 1/2 Gal.	--	--	14%
Sweet Corn	Nemagon, 1/2 Gal.	18%	--	--
Sweet Potatoes	Nemagon, 1/2 Gal.	--	--	20%
Tomatoes	Nemagon, 1/2 Gal.	17% per plant		

* Nemagon was used at the same rate per foot of row as when used at 1/2 gallon per acre on rows 40 inches apart. These rows were 80 inches apart making the actual rate per acre 1 quart.

check but no evidence of damage in the treated row.

Pepper plants of the variety California Wonder were set on May 9. On June 4 the pepper plants in the treated row looked smaller than the check and were slightly yellow. As the season progressed the treated plants seemed to recover and were producing about as many peppers in mid August as the check. Nematode damage on the check was very slight. The Nemagon fumigant was injurious to pepper plants when used at ½ gallon per acre.

Sweet corn of the Golden Bantam variety was planted May 15. On June 3 observations indicated that the plants were stunted on rows where ½ gallon and 1 gallon of Nemagon per acre was applied with a soil injector, at planting time. No injury was observed where the soil was treated with ½ gallon of Nemagon per acre two weeks before planting. The use of either ½ or 1 gallon of Nemagon at planting time reduced the yield 35 percent.

Sweet potato plants of the All Gold variety were set May 15. Nemagon at ½ gallon per acre reduced the yield. The potatoes in the treated rows were long and slender in many of the hills of the treated rows. Most of the good potatoes were developed on the outer edges of the row. Those in the center of the row were mostly so stringy that they were of no value. The potatoes in the check rows produced potatoes more in the center of the row.

Tomato plants of the Rutgers variety were planted May 9. By June 10 no difference could be detected in the appearance of the treated and untreated rows. On June 27 the plants in the treated rows were slightly larger and more vigorous than the untreated.

The early season production was higher on the treated rows. Late season production was higher on the check. Nematode damage was light on the check rows. Nemagon at ½ gallon per acre applied two weeks before planting caused some browning on the roots and appeared to cause injury to the plants. *(Project 312)*

Corn Insects

Don C. Peters and R. D. Jackson

The emphasis upon European corn borer research was continued in spite of relatively low field populations, particularly for the first two broods of corn borers. Emphasis was placed on biological studies. Data are being summarized and should be of considerable interest when available. Chemical control of the European corn borer under field conditions was extremely limited.

Fall armyworm control with granular insecticides again proved effective, particularly in late corn.

The program to develop earworm resistant corn is progressing.

Regional Corn Borer Survey

The long range study of annual changes in corn borer abundance in New Madrid County continued. The number of cooperators was increased to the desired 24 in 12 surveyors' townships. Results to date are summarized in Table 1. This is the first year that we have had the full complement of 24 cooperators.

The spring census counts in New Madrid County indicated that crop production practices of the area, in combination with high parasitic fly *(Lydella grisescens)* populations had reduced the overwintering populations to virtually zero in most of the fields surveyed. Due to the heavy amounts of rainfall the last of March and the first of April, most of the corn in New Madrid County was planted after the middle of April. Only the corn which was planted before this time was large enough to be attractive to the overwintering generation as a place to lay eggs. The increase in number of borers from the first to the second brood was less this year than in former years. Apparently, there was a considerable increase in third brood borers over second brood in the few fields that were attractive for third brood egg laying sites. But this increase did not make up for the low first or second brood populations. Consequently, overwintering numbers in clean plowed fields should be expected to be near zero.

1958 EUROPEAN CORN BORER CENSUS SUMMARY FOR NEW MADRID COUNTY, MISSOURI

Cooperator	Variety	Planting Date	First Brood Census[1] Borers[2]	First Brood Census[1] Empty Tunnels	Second Brood Census[1] Borers	Second Brood Census[1] Empty Tunnels
Bader	US 523W	May 5	37.5	27.5	5.0	55.0
Bennett	Indiana 9	May 20	*	*	55.6	20.0
Blankenship	Pfister 347	Apr. 7	*	*	5.6	0.0
Burk	Zimmerman 909	Apr. 25	2.9	8.6	14.3	7.1
Campbell	Pioneer 313		5.4	0.0	3.1	6.3
Chartraw	Pfister 347	May 15	---	---	10.3	10.3
Crouthers Farm	Pfister 347	May 3	---	---	2.6	10.5
J. B. Crouthers	Pfister 387	Apr. 30	*	*	0.0	1.9
Gardner	Ind. 909	Apr. 21	41.0	35.9	0.0	46.7
Halford	Funks White	May 5	2.2	2.2	0.0	2.8
Hulshof			*	*	0.0	0.0
Jones	Pfister	Apr. 15	25.0	31.3	3.8	23.1
Keaster	Pfister 347	May 20	*	*	3.0	6.1
LaPlant	Funks 193	Apr. 15	6.5	16.1	0.0	6.3
Leirer	US 523W Dekalb 803	Apr. 19	4.0	8.0	6.5	12.9
Lumsden			*	*	0.0	2.8
Mullin	McMullin 148	Apr. 18	*	*	81.3	11.6
Penman	Funks G134	Apr. 21	36.8	36.8	0.0	46.7
Rogers			*	*	12.9	0.0
Scott	Dekalb 3x2 Dekalb 803A	Apr. 18	0.0	11.1	0.0	21.6
Scott, Jr.	Pioneer 300 Dekalb 847		*	*	26.1	23.6
Sisk	US 523W	Apr. 30	*	*	16.7	30.0
Smith	Pfister	Apr. 20	---	---	1.9	7.4
Terry	Pfister 347	May 10	5.4	5.4	8.6	0.0
Average			8.3	9.1	10.7	14.7

[1] Figures converted to per 100 plant basis.

[2] Larvae, pupae, and pupa cases.

* Late corn not sampled or nothing found in sample.

Cotton and Soybean Diseases

Marvin D. Whitehead, Oscar H. Calvert
L. F. Williams, W. P. Sappenfield, Norman Brown

Plant pathologists are trying hard to determine all the diseases of economic importance to cotton and soybeans in Missouri. Crop yield loss estimates due to disease are made to aid in this determination. Resistance ratings of present breeding lines and varieties to the common diseases are made each season to help find high types of resistance.

The pathologists cooperate with plant breeders in the development of new, more productive and disease-resistant varieties. Farmers need to know just what conditions are necessary for certain diseases to develop. So pathologists try to determine these conditions. Then they seek ways to control the diseases through cultural methods and the established and newly developed chemicals.

Cotton

In cotton we have an excellent basis for estimating the Missouri cotton yield loss due to disease. The cotton breeder planted several lines in heavily disease infested plots that differed primarily in susceptibility to the different diseases. His results are already showing evidence that different soils and areas are troubled by different diseases. The fusarium wilt nematode, for example, infests the lighter soils of over 25 percent of the total acreage in Southeast Missouri.

Verticillium wilt has been considered confined to the heavier soils adjacent to the Mississippi river from Charleston, Mo., to the Arkansas line. Nearly 40 percent of the fields in this area show evidence of wilt. During the 1958 season many new infestations were observed. Some of these newer severe infestations were observed in relatively light sandy loam soil.

The major cotton diseases that occurred in Missouri during 1958 were:

Fusarium wilt	causing 5.0% reduction in yield
Verticillium wilt	causing 3.0% reduction in yield
Bacterial blight	causing 7.5% reduction in yield
Boll rots	causing 2.0% reduction in yield
Seedling diseases	causing 1.0% reduction in yield
Ascochyta blight	causing 0.2% reduction in yield

Root knot and other
Nematodes causing 5.0% reduction in yield

Other parasitic diseases causing 1.0% reduction in yield or a total of 24.5 percent reduction in yield. This amounted to a loss of $16,130,000 income in 1958 to the farmers of Southeast Missouri. Besides the pounds of cotton lost, disease is a major factor in grade reduction.

This loss due to diseases occurred even though the growing conditions were generally considered good for the cotton plant and unfavorable for disease development. Early rains prevented planting until the soil had warmed to almost the ideal temperature for rapid plant development. Heaviest loss to seedling diseases occurs during seasons when planting is made while the soil is cold and wet. There was no shortage of soil moisture during the summer. The dry, clear harvest period prevented excessive losses from boll rotting microorganisms.

During 1958 an area of 20 acres was acquired near Bertrand for breeding, testing, and chemical fumigation in fusarium wilt and root knot nematode studies. This area is probably the most uniformly and severely infested of any area of similar size and has permitted rapid expansion of work related to this severe disease. Forty-two commercial varieties and experimental strains and more than 500 experimental lines were evaluated. Soil fumigation tests included 12 treatments of different fumigants and rates with both a susceptible and a resistant variety. In the variety test, 2 percent of the plants of the Auburn 56 variety developed symptoms while 80 percent of the plants of Fox and Deltapine 15 developed symptoms. Earlier maturing Missouri lines had from 2 to 6 percent of the plants showing symptoms.

The verticillium wilt disease nursery is located near Dorena. In verticillium wilt, the resistance available appears to be merely good tolerance. Being able to use only early maturing wilt tolerant varieties for Southeast Missouri more than complicates the problem. The known varieties that express tolerance are much too late for Southeast Missouri. During the 1958 season, many varieties and strains were tested. Auburn 56 was nearly as tolerant as any of the varieties. Forty-four percent of the plants of Fox developed symptoms while Auburn 56 had only 26 percent showing symptoms.

Heavy driving rains resulted in severe natural infection of bacterial blight. Much of the initial boll rot started by bacterial blight failed to develop fully due to the dry harvest period. Bacterial blight resistance is now being bred into the best Missouri lines and strains. Both Race 1 and Race 2 resistance from various sources are being used. Approximately six acres of field planted nurseries for bacterial blight study were inoculated with hand held nozzles from a tractor mounted sprayer. The spray was directed toward the undersurface of the leaf. The spray contained a water suspension of bacteria and was applied at 120 pounds per square inch during the mid-morning when the plants were in the six to eight leaf stage. Readings were made approximately 2 weeks after inoculation when there was maximum expression of the disease but prior to defoliation of the plant.

Efforts are being made toward combining resistance to bacterial blight, fusarium wilt, root knot nematode and tolerance to verticillium wilt.

Thirty-four chemical combinations were tested in the Regional Cottonseed Treatment Test. Reginned and delinted seed were used. Captan dust or Captan slurry at 2 and 4 ounces per 100 pounds of delinted seed and reginned seed produced the most consistent results. Ceresan 100 at 2 and 4 ounces, applied to delinted and reginned seed respectively, and Dow 9B at 3 ounces also gave good results. A new chemical, Hercules 3944E, showed promise.

The fungicidal seed treatments alone, however, failed to give sufficient protection from soil borne seedling diseases of cotton. The in-the-farrow method of application of fungicides has been tested for possible extended control. The 1958 Missouri in-the-furrow fungicide tests were planted in the sandy soil at Malden on April 24 and 25, and in the sandy loam soil at Sikeston on April 30. The soil temperature at the three-inch depth at planting was 70 to 71 degrees. Excessive early rains had prevented planting until the soil was near optimum temperature for cotton planting.

Mechanically delinted, Ceresan treated seed of Coker 100W variety was planted. The seed was inoculated just prior to planting with a mixture of cultures of *Rhizoctonia, Fusarium* and *Pythium* by the grain sorghum method.[1] These fungi are the ones usually found to cause nearly all soil borne seedling troubles. The fungicides were applied in the furrow and in the covering soil at planting by dusting or by spraying. A by-pass agitator sprayer applied 10 gallons of water per acre with one nozzle. A pressure type duster applied the dust treatments. Four two-row plots 200 feet long were used. When it was considered that all danger of damping-off had passed, stand counts were made on July 1 and an average number of plants per foot of row was calculated.

Platings of random samples of seedling damage encountered showed *Fusarium* caused 50 percent of the damage, *Pythium* 25 percent and *Rhizoctonia* 10 percent damage at Sikeston. At Malden, *Fusarium* incited 60 percent of the damage, *Pythium* 8 percent and *Rhizoctonia* 6 percent. Of course other fungi were found but were considered of lesser importance than the above.

A *Streptomyces* culture mixed with corn starch was used to slurry treat the seed of one treatment. Species of *Streptomyces* are one of the main antibiotic producing fungi used in medicine. Spores of a heavily sporulating culture of *Streptomyces* were used. We thought it might be possible to apply the fungus to the seed and the anti-

[1]Whitehead, Marvin D. Sorghum grain, a medium suitable for the increase of inoculum for studies of soil borne and certain other fungi. Phytopathology 47: 450. 1957.

Check plot showing 4 rows of D.P.L. Fox cotton in the center of the picture and Auburn 56 on the far right.

Phytophthora root rot infection showing all stages of killing from emergence to near plant maturity.

biotic would be produced in the soil around the seed instead of commercially producing the antibiotic and applying it to the seed. The results received were encouraging. They indicated that an intensive search for antibiotic-producing fungi and bacteria to be used as seed treatments might pay.

Captan spray (5 lbs. 50% wettable powder per acre) and Captan dust (35 lbs. 7½ percent per acre) treatments at Malden and the Captan-terraclor dust treatment (15 lbs. 10-10% per acre) at Sikeston were the only treatments that were outstanding this year. These chemicals produced highly significant increases in the number of plants per foot of row of inoculated treatments. The one nozzle application of the spray treatments may have given insufficient distribution of the chemicals. Nabam that in the past has produced highly significant results failed to produce significant results with the one nozzle system.

All plants in the test at Sikeston were pulled after completion of harvest to check root development. Nub-root plants (no tap root or fragmentary root development) do not produce as well nor do they have the drouth tolerance of plants with a deep tap root. The Captan treatments, Nabam treatments and Actidione spray treatment produced a lower percentage of plants showing nub-root symptoms. No significant differences were noted. Captan and Nabam gave highly significant control of this root deficiency in the 1956 test[2] when the seeds were planted in 10 degree cooler soil. *(Project 322)*

Soybeans

A 427-mile survey was made (July 23, 24) in Southeast Missouri to observe the type, incidence and severity of root rot as well as the presence and severity of other soybean diseases.

Cultures were made of diseased tissues in all infected fields noted. *Phytophthora, Fusarium, Rhizoctonia* and *Verticillium* species of fungi were cultured from all root rot infected fields. *P. glycines* was the main cause of root rot in the area. Resistance to phytophora root rot is known and plant breeders are in the process of putting this resistance into acceptable varieties for Southeast Missouri. A new, surer method of inoculation was found this year.

No plant symptoms of soybean cyst nematode damage were observed in Southeast Missouri. At the West Tennessee Station at Jackson, Tenn. severe stunting and plant yellowing symptoms were present. It was apparent that the infestation was sufficiently heavy to observe varietal and cultural differences.

Rhizobium nodule bacteria toxicity was evident as severe chlorosis of the top leaves of a considerable area of late planted beans. The plants apparently recover from this chlorosis as they mature.

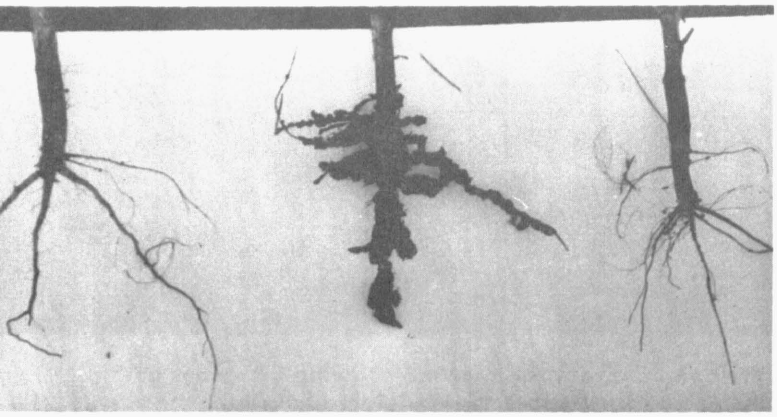
One field near Anniston, Mo. was observed severely infected with southern blight, *Sclerotium rolfsii.* The infection occurred as one to five foot sections of killed plants in the rows. One-tenth of the plants in this field were affected. No source of resistance is known.

Rootknot nematodes were found to cause severe knotting of certain varieties. Yield reductions were proved by tests conducted at Bertrand. Resistant varieties are known and this resistance is being put into varieties that will yield well in Southeast Missouri.

Bacterial diseases and downy mildew were generally present in light to severe proportions.

An extensive regional survey of the races of downy mildew was made from incrusted seed samples. Races were identified from 28 locations, one-half of them from the southeast area. Ten races were identified from Missouri and only three were found in the other North Central States. Two of the races found in the other North Central States were not observed in Missouri. It was noted that the races apparently tend to build up locally within a state. This survey indicates the complexity of breeding for resistance to downy mildew. It was considered that one would need to strive for total resistance rather than resistance to a single race. Resistance is found in Kenrich, a vegetable variety unsuitable for field beans.

[2]Whitehead, Marvin D. and Norman Brown. In-the-furrow application of fungicides for the control of cotton seedling disease damping-off and nub-root. Pl. Dis. Reptr. 41: 419-423. 1957.



Left to right: Scott from treated soil, Scott from non-treated soil, Anderson from non-treated soil.

This resistance is being bred into useable varieties by the plant breeders.

The resistance to stem canker that is considered best apparently broke down completely this season. The resistant *gracilis* lines gave more severe readings than the ones available commercially. *(Project 127)*

Bacterial blight developed heavy in the uniform nursery from natural infection while 100 yards away in a planting of bacterial blight breeding material only light infection was encountered and artificial inoculations had no effect.

Bacterial pustule has regularly been the most severe bacterial leaf disease in Missouri. Only light natural infection was observed during the 1958 season. It is one of the bacterial diseases that can generally be inoculated successfully by artificial means. An abundance of good quality inoculum was used during the 1958 season with no increase in infections over natural development of the disease. There are good sources of resistance to this disease in commercial varieties. The varieties cover the full range of growing conditions in the Southeast. These are the Scott, Hood, and Lee varieties. A new variety soon to be named and released is also resistant to bacterial pustule (D53-526).

Field Crops

Cotton Research

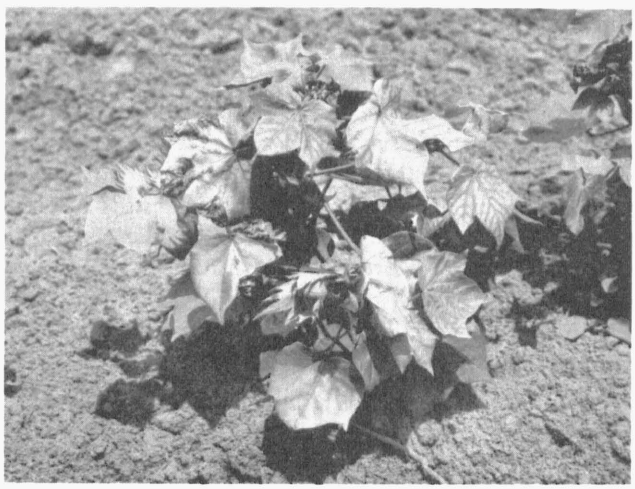
Cotton Variety Tests

W. P. Sappenfield

Establishment of permanent test fields has permitted a most complete analysis of cotton varieties in Southeast Missouri. This provides a basis for specific recommendations of varieties adapted to cope with diseases and other production hazards.

Nine varieties were grown in yield tests at seven locations:

1. Sikeston: Sandy loam ridge soil.
2. Diehlstadt: Light sandy soils infected with fusarium wilt and root knot nematodes.
3. Malden: Light sandy soils infected with fusarium wilt and root knot nematodes.
4. Bucoda: Light sandy soils infected with fusarium wilt and root knot nematodes.
5. Dorena: Clay loam soils infected with verticillium wilt.
6. Bell City: Heavy clay gumbo soils.
7. Bragg City: Heavy clay gumbo soils.



Cotton plants infected with fusarium wilt and root knot nematodes, Diehlstadt.

An eighth location will be added for 1959 in the Cottonwood Points area in which verticillium wilt is also very severe.

The Diehlstadt field provided outstanding results with varieties resistant to fusarium wilt. The excellent performance of Auburn 56 was obvious to the eye and its desirability over Rex was more apparent than the final figures reveal. For the first time a clear-cut separation between Auburn 56 and Coker 100A(WR) was obtained. The additional Auburn tolerance to root knot probably was responsible for its additional yields. The differences are presented in Table 1 and 2

TABLE 1--YIELD PERFORMANCE OF COTTON VARIETIES GROWN AT DIEHLSTADT, MALDEN AND BUCODA, MISSOURI, 1958, (FUSARIUM WILT TESTS).

Variety	Total Lint Yields - Lbs./Acre 1958			Average Yields - Lbs./Acre 1958		1957-58[3/]
	Diehlstadt[1/]	Malden[2/]	Bucoda[3/]	Lint	Seed Cotton	Lint
1. Auburn 56	873	524	882	760	2152	699
2. Rex	818	414	914	716	2067	697
3. Coker 100A (WR)	606	386	755	582	1624	563
4. Fox 4	478	350	752	527	1472	500
5. Delfos 9169	412	409	670	497	1459	475
6. Delfos 9219	370	345	743	486	1307	---
7. D.P.L. Smooth Leaf	188	255	775	406	1062	331
8. Fox	106	325	761	397	1127	377
9. D.P.L. 15	67	346	611	342	903	379
Average	435	373	763	524	1464	503

[1/] Diehlstadt: Planted May 9; Fertilizer 72-72-72 split applications; Irrigated; 1st Pick Oct. 2.

[2/] Malden: Planted May 7; Fertilizer 100-100-100 split applications; Irrigated; 1st Pick Oct. 7.

[3/] Bucoda: Planted May 17; Fertilizer 90-60-60 split applications; Non-irrigated; 1st Pick Oct. 10.

[4/] 1957 Results - Bucoda Test Only.

TABLE 2--AVERAGE AGRONOMIC CHARACTERISTICS OF COTTON VARIETIES GROWN AT DIEHLSTADT, MALDEN, AND BUCODA, MISSOURI, 1958.

Variety	Earliness Lint - 1st Pick		Lint %	Bolls per Lb.	Staple 1/32"
	Lbs./Acre	% of Crop			
1. Auburn 56	569	75	35.4	74	34+
2. Rex	522	73	34.8	68	34
3. Coker 100A (WR)	386	66	36.1	74	34+
4. Fox 4	371	70	36.0	79	34+
5. Delfos 9169	324	65	34.4	71	35+
6. Delfos 9219	362	74	37.4	83	34
7. D.P.L. Smooth Leaf	306	75	38.5	87	35
8. Fox	296	75	36.0	81	34+
9. D.P.L. 15	260	76	38.0	80	35
Average	377	72	36.3	78	34+

TABLE 3--YIELD PERFORMANCE AND AGRONOMIC CHARACTERISTICS OF COTTON VARIETIES GROWN AT DORENA, MISSOURI, 1958. (VERTICILLIUM WILT TEST).

Variety	Total Yields - Lbs./Acre 1958		Average 1957-58	Earliness Lint - 1st Pick		Lint %	Bolls Per Lb.	Staple 1/32"
	Lint	Seed Cotton	Lint	Lbs./Acre	% of Crop			
1. Rex	565	1666	706	392	69	33.9	72	35
2. D.P.L. 15	528	1432	616	362	69	36.9	81	36
3. D.P.L. Smooth Leaf	516	1367	589	384	74	37.8	78	35
4. Fox	497	1334	518	360	72	37.3	73	35
5. Fox 4	484	1375	568	302	62	35.2	76	35
6. Auburn 56	475	1378	---	297	63	34.5	76	35
7. Delfos 9219	434	1192	---	305	70	36.4	80	34
8. Coker 100A (WR)	389	1119	485	222	57	34.8	74	36
9. Delfos 9169	260	781	388	163	63	33.3	72	36
Average	461	1294	553	310	67	35.6	76	35+

Dorena: Planted May 14; Clay loam soil; Fertilizer 42-42-42 side dressed; Non-irrigated; 1st Pick Oct. 16.

The combined results of tests at Diehlstadt, Malden, and Bucoda will provide for future variety recommendations for light sandy soils infected with fusarium wilt.

Both Auburn and Rex are definitely earlier in maturity than Coker 100A(WR). Earliness is essential to Missouri cotton production. Rex tends to be weaker stalked and is not as storm resistant as Auburn 56. The extreme hairiness of Rex leaves may also cause more trash and account for some reduction in grade. Auburn 56, however, may exhibit difficult picking tendencies dur-

Auburn 56 D.P.L. 15 DPL Smooth Leaf Mo. 57-577

New strains and varieties resistant to fusarium wilt and root knot nematodes, Diehlstadt.

ing wet seasons and occasionally the top crop may be slightly difficult to pick. On the other hand, varieties that hand pick very easy may shatter with machine picking. Auburn 56, when grown on severe wilt ground, will still produce high yields of easily picked cotton.

Late plantings, the slow early growth, and the late season occurrence of verticillium wilt probably explains the smaller differences noted among the varieties at Dorena. However, these small differences appear significant, especially in relation to the two-year averages for 1957-58. Rex and D.P.L. 15 possibly possess some tolerance to verticillium wilt. They produce acceptable but not completely satisfactory yields under these severe conditions. A search for better yielding varieties tolerant to this wilt continues. Test data are presented in Table 3.

The necessity of extra early maturing cotton varieties for production on our heavier soils has been most apparent during the past two seasons. Wet ground may prevent early planting. Rapid drying out and cloddy conditions may delay germination and emergence. Nearly all commercial varieties available still are not early enough to meet these demands of production. D.P.L. Smooth Leaf, Delfos 9219, and Rex produced more lint cotton at first picking than other varieties (Table 4). Seed of Delfos 9219 is very limited and additional information is needed. The combined test results obtained at Bell City and Bragg City given in Table 4 provide a basis of future variety recommendations specific for non-wilt gumbo soils.

Frequently, on sandy loam ridge soils, such as the Sikeston Ridge, and when large amounts of fertilizer are used, our present cotton varieties may grow rank and mature the total crop too late. Here, earlier and shorter growing varieties are desired. During 1957, Rex appeared to possess these characteristics along with its resistance to bacterial blight. However, it is surprising to note its inconsistent response expressed during the 1958 season. Generally, Rex has not exhibited the earliness this season as noted during 1957. Usually Delfos 9169 appears later than most but during 1958 it produced the highest first pick yields. This inconsistency is not desirable. Delfos 9219, a new strain, may show improvement in this respect. The difference in yield required for significance, however, is expected to be rather large for the 1958 data presented in Table 5, and for this reason definite conclusions cannot be drawn at this time.

TABLE 4--YIELD PERFORMANCE AND AGRONOMIC CHARACTERISTICS OF COTTON VARIETIES GROWN AT BELL CITY AND BRAGG CITY, MISSOURI, 1958.

Variety	Total Lint Yield Lbs./Acre		Average Yields Lbs./Acre		Earliness Lint - 1st Pick		Lint %	Boll per Lb.	Staple 1/32"
	Bell City[1]	Bragg City[2]	Lint	Seed Cotton	Lbs./ Acre	% of Crop			
1. D.P.L. Smooth Leaf	510	495	502	1306	385	77	38.3	83	35
2. Delfos 9219	463	522	492	1326	366	74	37.1	82	34
3. Rex	539	416	478	1347	373	78	35.6	72	35
4. D.P.L. 15	446	434	440	1158	334	76	38.0	81	34+
5. Fox 4	427	443	435	1232	316	73	35.4	77	35
6. Fox	425	445	435	1288	331	76	33.8	83	34+
7. Auburn 56	403	410	407	1151	284	70	35.4	77	35
8. Delfos 9169	422	327	374	1106	244	65	34.0	72	36
9. Coker 100 A (WR)	378	327	352	1013	265	75	35.8	75	35
Average	446	424	435	1214	322	74	35.9	78	35

[1] Bell City: Planted May 18; Gumbo soil; Fertilizer 83-50-50 split applications; Irrigated; 1st Pick Oct. 28.

[2] Bragg City: Planted May 20, Gumbo soil; Fertilizer 60-60-60 split applications; Irrigated; 1st Pick Nov. 6.

TABLE 5--YIELD PERFORMANCE AND AGRONOMIC CHARACTERISTICS OF COTTON VARIETIES GROWN AT SIKESTON, MISSOURI, 1958.

Variety	Total Yield - Lbs./Acre 1958 Lint	1958 Seed Cotton	Average 1957-58 Lint	Earliness Lint - 1st Pick Lbs./ Acre	% of Crop	Lint %	Bolls per Lb.	Staple 1/32"
1. Delfos 9219	785	2217	602	416	53	35.3	74	34
2. D.P.L. Smooth Leaf	766	2042	506	423	55	37.4	80	35
3. Delfos 9169	734	2242	512	468	64	32.6	66	36
4. Fox 4	730	2156	534	405	55	33.7	76	35
5. Coker 100A (WR)	718	2063	512	415	58	34.7	74	35
6. Auburn 56	702	2077	520	411	59	33.5	76	34
7. Fox	697	1931	568	407	58	35.9	80	35
8. Rex	609	1861	593	349	57	32.5	68	35
9. D.P.L. 15	597	1690	460	324	54	35.3	83	35
Average	704	2031	534	402	57	34.5	75	35

Sikeston: Planted May 11; Sandy loam soil; Fertilizer 50-50-50 split application; Non-irrigated; 1st Pick Oct. 11.

Variety Recommendations

Information to date pertaining to the newer varieties is insufficient to warrant drastic changes in variety recommendations for 1959. With the additional information obtained during 1959 several changes may prove desirable.

Data are inadequate concerning Delfos 9219, D.P.L. Smooth Leaf, and Rex to determine their worthiness for the 1959 recommendations.

Auburn 56 probably possesses the highest resistance to fusarium wilt and tolerance to root knot nematodes of any of the commercial cotton varieties. On light sandy soils, where this disease is present, Auburn 56 produces high yields of good quality fiber. Some hand picking difficulties may be noted, but this variety will produce more easily picked cotton than easy picking, susceptible varieties. Auburn 56 is recommended only for light sandy soils where fusarium wilt and nematodes are present. It should not be grown on the heavier soil.

Coker 100A(WR) is resistant to fusarium wilt but appears susceptible to nematodes. It produces good yields where wilt is only moderate. Coker 100A(WR) matures later than either Auburn 56 or Rex. Results of future tests may warrant the deletion of this variety from the list of future recommendations. Coker 100A(WR) is recommended only for light sandy soils where fusarium wilt is only moderate. It should not be grown on heavier soils.

Deltapine 15 shows some tolerance to verticillium wilt and, therefore, produces acceptable yields in areas along the Mississippi River. It is highly susceptible to fusarium wilt and nematodes found on sandy soils. Through our central Delta area, on heavy soils free of wilt diseases. this variety also produces good yields of quality fiber. Its high turnout is of significance to many producers.

Fox 4 is an improved strain of Deltapine Fox, especially in fiber quality. It will replace the original Fox variety after the 1959 season. It is less determinate in growth habit, grows slightly taller, lacks storm resistance, but produces comparable to the original Fox variety. The fiber quality of Fox 4 compares with that of Deltapine 15. It is susceptible to all major cotton diseases and should be grown only on non-diseased land and where early maturity is desired.

Fox consistently produces early crops on non-diseased land in Southeast Missouri. Fox tends to "string-out" if left unpicked and frequently shatters when picked with machines. It will be deleted from these variety recommendations for 1960 production, but maintained for 1959. It should be used only as a second choice if seed supplies of Fox 4 are limited.

Delfos 9169 is intermediate to late in maturity. Varieties later than Delfos should not be grown in Southeast Missouri. It consistently produces good yields of a longer stapled fiber than other Missouri varieties. Its disease susceptibility restricts its production to non-diseased soils.

Performance of New Strains

During the 1958 season, more than 40 new strains were tested for yield and quality at several locations in Southeast Missouri. Most of these have been derived from the cotton breeding program at the Southeast Missouri Research Center. Definite progress has been obtained toward developing earlier maturing and higher yielding strains. Disease resistance has been incorporated into some of these. During the 1959 season the best of these will be grown at all locations to determine their areas of best adaptability. Table 6 gives a comparison of these with standard recommended varieties.

Breeding Better Cotton Varieties For Southeast Missouri

During 1958, 1090 new lines of cotton were grown in the breeding nurseries at Sikeston, Diehlstadt, and Dorena. They were evaluated for disease resistance,

TABLE 6--YIELD PERFORMANCE AND AGRONOMIC CHARACTERISTICS OF NEW STRAINS, 1958.

Variety or Strain	Total Yields - Lbs./Acre		Earliness		Lint %	Bolls per Lb.	Staple 1/32"
	Lint	Seed Cotton	Lint - 1st Pick				
			Lint	% of Crop			
			Sikeston[1/]				
Mo. 17-24	982	2856	713	73	34.3	71	34
Stoneville 7-44134	890	2372	576	65	37.3	81	35
Mo. 16-10	885	2668	617	70	32.2	73	35
Mo. 17-14	842	2404	545	65	34.9	73	34
Mo. 17-50	842	2481	562	67	33.9	76	35
Mo. 16-15	839	2537	584	70	32.9	72	35
Mo. 57-473	839	2455	576	69	34.2	80	34
Fox 4	730	2156	405	55	33.7	76	35
			Diehlstadt[2/]				
Mo. 57-577	973	2636	756	78	36.9	69	34
Auburn 56	873	2398	645	74	36.4	73	34
D.P.L. 15	67	180	54	80	37.3	89	35

[1/] Sikeston: Planted May 11; Sandy loam soil; Fertilizer 50-50-50 split applications; Non-irrigated; 1st Pick Oct. 11.

[2/] Diehlstadt: Planted May 9; Sandy soil with Fusarium Wilt; Fertilizer 72-72-72 split applications; Irrigated; 1st Pick Oct. 2.

earliness, agronomic characteristics, productivity and other factors. From these, more than 200 lines were selected and presently are being evaluated in the laboratory for fiber quality. The best of these will be grown in preliminary yield tests at either Sikeston, Diehlstadt, or Dorena during the coming season to single out the very best. All of these have been obtained from the Missouri cotton breeding program, designed to develop cotton varieties specifically adapted to Southeast Missouri.

From new hybrids, more than 2000 single plant selections were made at harvest time. These also are being processed in the laboratory and the best will be grown in progeny rows this season. In all, over 40 acres of experimental varieties, strains, and breeding material were grown during 1958. This combined with winter growing facilities in Mexico permits the most rapid progress possible and is expected to reap great dividends in future years for Southeast Missouri cotton producers.

Additional studies significant to the development of improved cotton varieties are also in progress. These are related to (1) fiber spinning quality as affected by season, variety, and culture, (2) agronomic and cultural studies, (3) chemicals that affect boll retention and growth rates, and numerous others. *(Project 160)*

Soybeans

Leonard Williams and Arnold Matson

Research in soybeans in Southeast Missouri includes the following types of work: (1) Soybean variety tests in which yield and other agronomic characteristics are measured on the common varieties grown in Southeast Missouri and on the new varieties which are being introduced into the area. (2) Preliminary testing of strains to develop new varieties. (3) Uniform regional tests in cooperation with the U.S.D.A. and other states. (4) Date of planting tests. Varieties representing the three maturity groups of soybeans grown in Southeast Missouri are planted at 15-day intervals in an attempt to find the best variety-date of planting combinations. (5) Irrigation, nitrogen application, rate of planting, date of planting test. (6) Root knot nematode fumigation test. This was an attempt to control the root knot nematode by fumigating the soil so we could measure the damage done by these nematodes, and evaluate the resistance of certain varieties. (7) Inheritance studies upon different characteristics of soybeans, including a study of the inheritance of resistance to the root knot nematode. (8) A breeding program directed toward the development of adapted varieties which are resistant to the soybean cyst nematode.

Some of the more interesting data from this work is presented below.

Variety tests

Variety tests were suitable for harvest only at Sikeston and Vinson. Root knot nematodes ruined the tests at Malden, and poor stands were obtained at Bell City and Bragg City.

Varieties included in this list which may be unfamiliar to farmers are described briefly below.

Ford and Shelby are from the same cross as Clark, but are similar to Lincoln in maturity. Shelby is to be released to certified seed growers in northern Missouri in 1959. They both hold their seed better than Lincoln. Like Lincoln they have shown up favorably in Southeast Missouri in years with dry summers, but have failed to yield

	Yield							
	Sikeston	Vinson	All Locations					Seed
	1958	1958	57-58	53-58	Maturity(1)	Lodging(2)	Height	Quality(3)
Lincoln	35.9	34.9	32.7	27.4	-32	2.8	41	2.7
Ford	35.1	33.9	32.5		-33	2.8	39	2.9
Shelby	42.0	34.5	35.2		-30	2.7	42	2.4
Clark	44.4	41.6	37.8	30.2	-23	2.6	42	2.5
Scott	44.9	43.6	41.6	32.2	- 7	2.5	45	2.2
Roe	41.6	42.9			- 3	4.1	50	2.2
S-100	40.8	45.6	37.2	28.9	- 2	2.6	51	2.7
Dorman	35.0	42.1	35.4	25.3	0	4.2	41	1.3
D53-526	40.5	42.7	38.6		- 5	3.6	38	1.6
Hood	46.0	43.2	41.9		+15	3.0	41	1.4
Ogden	42.3	40.0	39.2	27.0	+15	2.5	45	1.8
Lee	50.1	43.3	41.6	29.4	+21	3.7	40	1.7

(1)Expressed as days earlier(-) or later(+) than Dorman. Dorman matured October 6.

(2)A rating of 1.0 is erect, 5 is flat.

(3)Graded 1 to 5 with 1 being the best grade.

Date Planted	April 1	April 15	May 1	May 15	June 1	June 15	July 1	July 15
					Yield			
Clark	32.5	37.2	45.6	40.7	39.2	36.4	34.0	24.2
Scott	43.9	46.3	50.7	40.1	40.4	35.4	36.2	29.9
Dorman	38.1	41.5	41.6	38.4	36.2	32.8	31.7	24.9
Hood	41.6	39.8	41.2	37.8	36.9	33.9	31.7	25.0
Lee	42.1	42.6	45.2	43.1	41.2	35.1	35.6	29.5
					Date When Mature			
Clark	Aug. 31	Sept. 5	Sept. 13	Sept. 18	Sept. 25	Oct. 3	Oct. 15	Oct. 22*
Scott	Sept. 10	Sept. 17	Sept. 26	Sept. 28	Oct. 4	Oct. 8	Oct. 18	Oct. 23*
Dorman	Sept. 27	Sept. 28	Oct. 5	Oct. 5	Oct. 11	Oct. 16	Oct. 23*	Oct. 30*
Hood	Oct. 16	Oct. 16	Oct. 17	Oct. 17	Oct. 20	Oct. 29	Nov. 4*	Frosted
Lee	Oct. 21	Oct. 22	Oct. 28	Oct. 28	Oct. 28	Oct. 30	Nov. 4*	Frosted

* Frosted on Oct. 26 in 1957 but not frosted in 1958 (although some varieties have been frosted, none have been so immature that the seed quality was harmed).

as much as later varieties in more favorable years. Lincoln, Ford, and Shelby mature earlier than is needed in Southeast Missouri and therefore are not recommended for this area.

Scott was developed as a replacement for Perry. It is resistant to bacterial pustule and wildfire. However, it is extremely susceptible to root knot nematode and should not be grown on sandy soil with a known history of root knot. It is now available from certified seed growers. In past reports it has been listed as S2-7158.

Roe has been introduced into this area by private seed sources. Since it has been tested in the variety test for only one year, a proper evaluation cannot be made at this time. However, it may be mentioned that in tests in Southern Illinois it has been very prone to lodge and has had a low oil content. This tendency to lodge was observed in the variety tests this year in Southeast Missouri.

D53-526 is a new bacterial pustule resistant strain (as yet unnamed) which is being increased for release at a later date. It is a little earlier than Dorman.

Hood is a new yellow seeded, bacterial pustule resistant variety of Ogden type and maturity. It has been released to certified seed growers and will be available from them in the fall of 1959. It has appeared in past reports as D51-4888.

Date of Planting

Data on date of planting given below are from Sikeston for the years 1957 and 1958. Growing conditions were very favorable both years during most of the growing season. In these two years, May 1 seemed to be the best planting date for all varieties. However, during the dry years of 1955 and 1956, Clark planted between April 1 and April 15 escaped most of the drouth damage, while Clark planted at later dates and later varieties planted at all dates (Scott was not included in the 1955-56 date of planting) failed to produce commercially profitable yields.

Root Knot Nematode

The results of this study at Diehlstadt indicate that the root knot nematode may cause as much as a 30 percent reduction in yield in a susceptible variety such as Scott, even when growing conditions are very favorable. When water is somewhat limited, the plants may be

stunted severely or killed. Anderson demonstrated good resistance to root knot. Since this variety possesses many desirable agronomic characteristics, it should not be too difficult to develop a good adapted variety using its resistance. Work has been started toward accomplishing this. *(Project 49)*

Hybrid Corn

M. S. Zuber, C. O. Grogan, O. V. Singleton

1958 SUMMARY OF PERFORMANCE RECORDS FOR HYBRIDS TESTED AT SIKESTON AND CARUTHERSVILLE, MISSOURI IN DISTRICT 9. (EXP. 17 AND 18)

Hybrid	Acre Yield Bu.	Moisture in Grain %	Stand %	Lodged Plant Root %	Lodged Plant Stalk %	Dropped Ears %	Ear Height Grade
US 523W*	107.9	21.4	99	0.0	4.6	0.0	3.6
Mo Pipe 4*	106.1	24.5	97	1.3	6.9	0.0	3.9
Schenk 909	103.7	19.6	99	3.8	10.2	0.0	3.6
Mo W6*	103.0	25.2	99	0.0	5.5	0.9	3.9
AES 904W*	102.6	25.2	99	0.0	3.4	0.0	4.2
Dixie 33*	102.4	23.0	94	2.7	4.5	0.5	4.3
US 619W*	101.8	23.1	96	0.0	7.0	0.0	3.7
Broadbent 402B	101.5	20.4	98	0.0	8.9	0.0	3.4
Mo 4047BW*	101.0	20.9	95	5.3	1.8	0.0	3.6
DeKalb 1028	100.5	25.5	99	4.7	13.1	0.0	4.2
DeKalb 925	100.4	22.7	95	2.6	4.4	0.9	3.6
Meachams M-5	100.4	20.7	97	0.9	3.4	0.5	3.3
Funks G711	99.5	24.6	98	0.0	11.1	0.5	3.9
Dixie 29*	99.3	23.5	99	2.5	8.0	0.9	3.9
P.A.G. 631W*	99.3	21.7	97	1.3	12.7	0.5	3.3
Ky 105	99.3	19.4	96	1.3	6.5	0.0	3.6
Ga 6029	99.1	24.6	99	6.3	5.9	0.0	4.0
DeKalb 893	98.9	21.8	96	0.0	8.3	0.0	3.9
Mo 947	98.7	19.6	98	2.5	10.2	0.5	3.3
DeKalb 1024	95.2	22.5	100	1.3	12.6	0.4	4.0
DeKalb 810	94.5	20.2	99	0.0	5.1	0.0	3.3
Mo 881	94.2	20.5	98	1.3	5.2	0.0	3.4
Meachams M-7	93.8	22.5	95	0.0	4.9	0.5	3.2
Pioneer 332-2A	93.4	21.4	94	3.8	10.7	0.0	3.6
Mo 958	93.3	22.9	94	1.3	8.7	1.9	3.6
Mo 800A	93.1	24.0	86	2.9	3.5	0.0	4.3
DeKalb 1201	92.7	24.4	100	2.5	5.4	1.3	3.9
Funks G144	92.3	20.0	96	1.3	7.7	0.5	3.2
Ky 204*	92.1	21.4	99	2.6	7.2	0.8	3.3
P.A.G. 633W*	91.8	21.4	98	2.5	15.4	1.3	3.6
Tenn 501*	91.3	21.1	97	1.3	6.1	0.5	3.2
DeKalb 1023	90.5	23.3	96	5.5	23.7	0.5	3.7
Mo 960	90.0	20.0	99	1.3	13.9	0.5	3.7
Pioneer 319	88.1	19.4	98	0.0	7.6	1.3	2.9
Pioneer 302	87.1	20.7	99	0.0	12.3	0.0	3.1
Meachams M-33Y	87.0	19.9	96	0.0	10.4	0.9	3.1
Ohio C92	86.6	18.3	93	4.5	9.9	0.5	3.1
MFA 2120	86.4	18.0	98	1.7	13.2	0.5	2.9
Funks G706	86.1	21.5	98	2.6	12.4	0.0	3.2
Funks G134	85.1	20.9	99	0.0	9.8	0.0	3.0
US 13	85.0	19.1	98	1.3	11.1	0.0	3.1
Kan 1639	84.6	18.9	99	3.0	15.2	0.4	2.9
Meachams M-99Y	84.0	19.7	97	0.0	16.0	0.9	2.8
Mo 880	83.2	22.3	91	0.0	2.8	0.9	2.9
MFA 118	81.9	18.2	98	0.0	21.9	0.5	2.9
Schenk S66	81.1	20.2	97	0.0	11.6	0.5	2.7
Mo 843	80.6	19.8	91	2.3	24.0	0.0	2.9
Schenk S70	80.5	17.3	99	1.3	22.1	0.4	2.9
Ky 106A	80.2	19.2	97	0.0	11.7	0.0	3.1
Syn S57	75.2	25.6	94	2.2	5.8	0.0	4.1
Iowa 4376	74.7	17.6	100	2.5	9.7	0.4	2.9
MFA 120A	73.5	20.2	94	0.5	25.0	0.5	3.0
Mo 804	71.0	21.2	64	0.0	8.8	0.0	3.7
Syn C57	67.7	22.0	93	2.8	13.2	0.0	3.9
Mean	91.4	21.4	96	1.6	10.0	0.4	3.4

* White Hybrids

Yield Tests

Excellent soil combined with intensified farming have contributed to Southeast Missouri becoming important as a corn growing area. In 1958, the rainfall was the lowest of any district in the state. The rainfall from May 1 to September 15 was 6.6 inches below the state average. The low total rainfall accompanied by two dry periods at Sikeston and three at Caruthersville contributed materially to corn yields in test plots being below the state average. Caruthersville also had 70 days (38 above average) with temperatures above 90 degrees.

US 523W continues to prove the best year to year hybrid for Southeast Missouri, ranking at the top at Sikeston and fourth at Caruthersville in the state yield tests. Other white hybrids among the top yielders in 1958 were Mo. Pipe 4, Mo. W6, AES 904W, US 619W, and Mo. 4047BW. Top yielding yellow hybrids in Southeast Missouri were Mo 947, Mo 881, Mo 958, and Mo 800A. Mo. Pipe 4 appears to be a good yielder for Southeast Missouri as indicated in the yield tests for the past several years. However, this hybrid has a shelling percentage 5 to 10 percent lower than the normal hybrids.

Experimental Hybrids

Work has been in progress for the past several years to find improved lines and crosses for use in Southeast Missouri. New lines under test include a number developed by the Missouri Agricultural Experiment Station and others by experiment stations in surrounding states. Performance records of various experimental hybrids in 1958 include uniform early double crosses (Southern Corn Conference); uniform late double crosses (900 Series); midseason yellow double crosses (900 Series); late yellow double crosses (900 Series); uniform white three-way crosses (900 Series); late white double crosses, and uniform three-way crosses (900 Series). A number of inbred lines and hybrids have been found especially suited to Southeast Missouri. If they continue to perform well, they will be released.

Popcorn

There is some indication that popcorn acreage may be increased in Southeast Missouri since the area lends itself to excellent popcorn production. If adapted hybrids are developed and commercial outlets are found, popcorn could become very important.

Several new Purdue hybrids were grown at Sikeston in 1958 with exceptionally good yields ranging from 3674 pounds per acre to 4267 pounds. In addition to the Purdue hybrids, a number of Iowa hybrids and the widely known K4 continued to give very good yields, ranging from 3000 pounds to 3600 pounds per acre.

Corn Earworm Synthetic

Gradual progress is being achieved in the development of an earworm synthetic with a rather low earworm infestation. The ultimate use of the synthetic will be as parent material from which to extract earworm resistant lines. The progress for the past three years has been from 3 to 5 percent earworm-free ears. This is significant considering the material is grown in an isolated block.

The date of planting results will not be completed in time for this publication. *(Project 310)*

Small Grains

J. M. Poehlman, Arnold Matson, Charles Hayward, and D. T. Sechler

Winter barley, winter oats, winter wheat, and spring oats were tested at the Southeast Missouri Research Center at Sikeston in 1958. Heavy precipitation during October and November resulted in extremely vigorous fall growth of the winter grains. A low temperature of five degrees below zero was reached in February, but snow cover prevented serious damage to any of the grains. Spring seeded oats were planted late due to wet weather during March and early April and as a result yields were rather low. Soil moisture was deficient during the latter part of May and the early part of June. This was a factor in the yields of all small grains being lower than normal.

Comparisons of the standard commercial varieties of the small grains grown in yield tests at Sikeston in 1958 are reported here. *Caution: The average figures for several years are far more reliable for comparison than the single year figures.*

Winter Barley

Seven varieties and 29 experimental strains of winter barley were tested at Sikeston in 1958. Yields were lower than usual as a result of dry weather during the latter part of May and the test plots being located on a soil area that was less fertile than in previous years. Very little lodging was observed. No serious diseases affected performance, except loose smut in some of the susceptible varieties. Comparative figures were available for a 10-year period for four varieties and for a two-year period for five varieties.

Mo. B-475 and *Mo. B-400* have been the highest yielding varieties over a period of years and are the recommended varieties in Southeast Missouri. *B-475* threshes cleaner and has better test weight than B-400. It is resistant to loose smut. *B-400* is resistant to loose smut and is earlier than B-475 in maturity.

Hudson and *Decatur,* tested for shorter periods of time, have been much lower in yield and are very susceptible to loose smut. Both are relatively stiff-strawed varieties. *Kenate* was tested for the first time in 1958. *(Project 90)*

PERFORMANCE OF BARLEY VARIETIES IN SOUTHEAST MISSOURI TESTS

Variety	Yield Bushels per Acre: 10 Yr.* Average	2 Yr.† Average	1958	Height Inches (1958)	Test Weight 2 Yr. Av.†
Mo. B-475	46.5	46.8	41.3	37	43.8
Mo. B-400	45.0	48.7	42.2	35	41.8
Reno	41.3	41.9	40.5	36	40.8
Mo. Early Beardless	33.0	41.1	46.0	36	39.8
Hudson		35.9	29.5	35	45.5
Decatur			32.0	34	44.0
Kenate			41.1	34	

* 1948 to 1958 (no data in 1955).
† 1957 and 1958.

Winter Wheat

Eight varieties and 24 experimental strains of wheat were tested at Sikeston in 1958. Yields were slightly lower than in 1957. Lodging was not severe and only a light infection of leaf rust was observed late in the season. Considerable loose smut was observed in the Knox variety; other varieties were relatively free of smut.

The soft wheat varieties, *Knox, Vermillion,* and *Dual,* are recommended in Southeast Missouri. Hard wheat varieties have consistently been lower in yield than soft wheat varieties in this area. Production of hard wheats in Southeast Missouri would result in the marketing of mixed wheat in an area of Missouri which has always maintained a reputation for the production of high quality soft wheat.

Knox is a short, early, stiff-strawed variety, high in soft wheat quality and resistant to leaf rust, but it is susceptible to certain races of loose smut.

Vermillion is similar to Knox in all respects except that it has greater smut resistance and averages one day later in heading.

Dual is a very high yielding variety of soft wheat with stiff straw, leaf rust resistance, moderate smut resistance, and resistance to Hessian fly. The fly resistance makes it possible to plant Dual earlier in the fall when early seeding is desirable. For this reason Dual is recommended when wheat is sown for fall pasture. Dual has a low test-weight and will usually grade lower than Knox or Vermillion as a result. It is later in maturity than either Knox or Vermillion. *(Project 202)*

Winter Oats

Eight varieties and 24 experimental strains of winter oats were tested at Sikeston in 1958. Yields averaged about 20 bushels below those of 1957, reflecting lower fertility in the area where the variety test was located. In some of the preceding years the fertility level of the winter oats plots was so high that excessive lodging resulted and in some years the plots were abandoned before harvest. In 1958, fertility treatments were reduced to avoid this situation.

Dubois, Forkedeer and *Bronco* are the recommended varieties for Southeast Missouri. Inasmuch as the winters are less severe in the Southeast Delta than in other areas of the state, varieties of winter oats may be grown there with less winter injury. Some varieties may be grown in the Delta that are inadequate in hardiness for the remainder of the state. Le Conte from Tennessee is such a variety. The grain yields of Le Conte never equal those of Dubois, but it does have stiffer straw and is sometimes grown for that reason.

Dubois is a hardy, high yielding variety with good straw, heavy test weight, and resistance to smut.

PERFORMANCE OF WINTER OAT VARIETIES IN SOUTH MISSOURI TESTS (SIKESTON AND PIERCE CITY)

Variety	Yield Bushels per Acre: 5 Yr. Av.*	1958†	Height Inches	Lodging Per cent	Test Weight Bu./Acre
Dubois	59.4	34.3	36	12	36.0
Bronco	57.0	28.5	36	16	31.0
Forkedeer	56.0	29.3	37	23	32.0
Cimarron	61.8	33.3	35	93	32.5
Wintok		32.9	35	38	35.0
Le Conte		30.4	38	28	31.5

* Seven tests at Sikeston and Pierce City, Missouri.
† 1958 at Sikeston.

PERFORMANCE OF WINTER WHEAT VARIETIES IN SOUTHEAST MISSOURI TESTS

Variety	Yield Bushels per Acre: 3 Yr. Av.* 1956-'58	1958†	Test* Weight Lbs./Bu.	Height* Inches	Lodging* Per Cent	Leaf Rust† Per Cent	Smut† Heads per 10 Ft. Row
Soft Wheat Varieties							
Knox	42.4	36.6	58.7	44	10	1	26
Dual	42.3	40.0	56.2	47	9	1	6
Vermillion	40.4	36.7	58.0	45	13	1	2
Hard Wheat Varieties							
Triumph	40.0	32.4	59.2	44	12	7	0
Pawnee	38.8	37.3	60.0	46	11	13	0
Ponca	37.6	34.8	59.8	45	15	2	0

* 3 year average, 1956 to 1958.
† 1958 only.

Bronco is comparable to Dubois in hardiness but is lower in yield, has lower test-weight, and has slightly weaker straw. Bronco is resistant to smut.

Forkedeer is similar to Dubois in yield but is generally taller and weaker strawed than Dubois. Forkedeer is susceptible to smut.

Cimarron is a high yielding, early variety but is very weak strawed and is susceptible to smut. *(Project 203)*

Spring Oats

Spring oats are generally less adapted to the Southeast Delta area than the winter seeded grains. For best yields they must be planted early. In 1958 seeding was delayed until mid-April by wet weather. The late seeding, followed by dry weather in late May and early June, resulted in rather low yields.

Twelve varieties and 22 experimental strains were tested in 1958. Crown rust developed late in the season but did no extensive damage. Very little lodging occurred.

Only early maturing varieties can be recommended for southeast Missouri. The most productive early varieties at Sikeston have been *Mo. 0-205, Macon,* and *Andrew.* Minhafer, which is another early variety, has superior crown rust resistance and would produce good yields in years with heavy crown rust infection. Burnett, Clintland, Newton, Fayette, and Clintland 60 are too late for best yields in Southeast Missouri in most seasons. Although the yield of Burnett was high in 1956 and the two-year average for this variety compares favorably with Macon and Andrew, yields were lower in 1958.

Mo. 0-205 has been the highest yielding variety at Sikeston. It has moderate resistance to most crown rust races but is susceptible to some of the newer races found in Missouri. Grain is heavy but dark in color.

Macon is a new variety being distributed in 1959 by the Missouri Agricultural Experiment Station. Macon is superior to Mo. O-205 in resistance to the newer races of crown rust. It produces heavy, light-colored grain.

Andrew is an early variety that produces good yields in Southeast Missouri. *(Project 203)*

Sorghum Performance Trial

M. S. Zuber, A. C. McBride, C. O. Grogan, and O. V. Singleton

The increasing importance of grain sorghum in Missouri is revealed in Table 1. The grain sorghum acreage has increased yearly since 1953. The 10-year average (1947-1956) amounted to 0.8 percent of the total United States acreage. The 1957 acreage was 3 percent and in 1958 the estimated Missouri acreage amounted to 4.3 percent of the U.S. acreage. The steady increase in acreage points out the importance of grain sorghum in Missouri.

TABLE 1--THE AVERAGE NUMBER OF ACRES, TOTAL PRODUCTION, ACRE YIELD FOR GRAIN SORGHUM AND THE AVERAGE ACRE YIELD FOR CORN DURING THE 5 YEAR PERIOD 1953 TO 1957 AND ESTIMATED FOR 1958

Year	Acreage Number	Total Production Bu.	Acre Yield Avg.	Corn Yield Per Acre Bu.
1953	34,000	510,000	15.0	33.5
1954	66,000	1,056,000	16.0	20.0
1955	93,000	2,325,000	25.0	40.0
1956	187,000	5,610,000	30.0	48.0
1957	590,000	25,960,000	44.0	44.0
1953-1957 Avg.	194,000	7,092,500	26.0	37.1
1958	720,000*	37,440,000*	52.0*	55.0*

* Estimated as of November 1, 1958.

Another interesting comparison is the comparative yields of grain sorghum and corn. The five-year average (1953-1957) for these two crops differed by 11.1 bushels, while in 1958 corn outyielded grain sorghum 3.0 bushels per acre.

The estimated percentage of all sorghums planted with hybrid seed was 47 percent in 1957 and 68 percent in 1958. Figures are not available for grain sorghum alone.

The comparison of acre yields for 1958 of grain sorghum and corn taken from the official yield trials located at Columbia, Sikeston, and Pierce City is in Table

PERFORMANCE OF SPRING OAT VARIETIES IN SOUTHEAST MISSOURI TESTS

Variety	Yield Bushels per Acre: 2 Yr. Av.* 1956 and 1958	Yield Bushels per Acre: 1958† Only	Test† Weight Lbs./Bu.	Height† Inches	Crown† Rust Per Cent	Groats* Per Cent
Mo. 0-205	65.4	45.1	31.3	30	25	74.3
Burnett	63.3	35.9	32.5	31	25	74.0
Macon	62.5	42.9	32.5	32	25	73.0
Andrew	60.3	42.2	31.3	31	25	75.0
Columbia	59.3	43.6	31.5	31	40	74.5
Clintland	58.3	37.4	31.5	28	5	75.2
Minhafer	56.6	33.9	32.0	30	5	76.0
Cherokee	52.9	25.9	31.8	30	10	73.8
Fayette	52.8	33.0	30.3	30	10	72.0
Newton	52.7	26.0	30.0	30	10	73.3
Clintland 60		40.5		28	5	
Nehawka		39.6		30	25	

* 2 year average, 1956 and 1958. (Test not harvested in 1957.)

† Data in 1958 only.

2. The average corn yield exceeded grain sorghum at all three locations. However, the yield of the two crops was very close at Sikeston. Also at this location, the highest grain sorghum hybrid exceeded the highest yielding corn hybrid by one bushel and the lowest grain sorghum exceeded the yield of the lowest corn hybrid. In making these comparisons, several factors should be taken into consideration such as different planting dates and different sites of testing plots. *(Project 351)*

TABLE 2--1958 RESULTS OF COMPARATIVE ACRE YIELD FOR GRAIN SORGHUM AND CORN AT THE THREE TESTING LOCATIONS

Testing Location	Grain Sorghum Avg. Yield Bu.	Grain Sorghum High Yield Bu.	Grain Sorghum Low Yield Bu.	Corn Avg. Yield Bu.	Corn High Yield Bu.	Corn Low Yield Bu.
Columbia	99.2	122.3	72.7	126.5	154.8	101.0
Sikeston	94.5	117.5	76.0	98.5	116.7	62.8
Pierce City	74.9	98.6	39.8	122.3	140.4	91.3

TABLE 3--1958 PERFORMANCE RECORD FOR THE SORGHUM TEST CONDUCTED IN NEW MADRID COUNTY NEAR SIKESTON, MISSOURI. (EXP. S71)

Hybrid or Variety	Acre Yield	Plant Height	Planting to 50% Bloom	Threshing	Moisture	Plants per 40 Ft. Row	Off-Type Heads	Tall Plants	Lodging	Head Compactness	Head Exertion
	Bu.	Inch	Days	%	%	No.	%	%	%	1-5	1-5
DeKalb D50a	117.5	63.8	70.5	80.0	26.2	133.5	1.3	0.6	0.0	5.0	4.3
AMAK R12	116.9	57.8	73.3	83.0	30.8	138.5	0.5	0.0	0.0	1.3	3.3
Garst & Thomas Med. Early Mat.	109.5	54.3	72.0	83.0	26.6	109.5	1.6	0.2	0.0	3.8	3.0
P.A.G. 435S	108.6	52.8	72.3	83.5	28.1	135.0	1.7	0.2	0.0	4.0	3.8
DeKalb E56a	106.6	58.5	70.5	82.3	26.7	172.0	0.1	0.0	0.0	4.8	4.0
RS 610	106.1	54.8	71.0	83.5	33.5	163.5	1.2	0.9	0.0	2.8	3.3
AMAK R10	104.9	55.0	70.3	83.7	23.0	153.5	0.2	0.2	0.0	4.0	4.0
Northrup NK 140	101.4	58.3	71.3	83.0	26.7	206.5	2.5	0.4	0.0	2.8	3.5
RS 608	100.5	53.8	72.3	81.9	27.4	144.5	0.3	0.2	0.0	4.3	3.3
DeKalb Exp. 66	100.2	47.8	78.3	82.5	37.0	131.5	0.0	0.2	0.0	4.0	1.0
Frontier 400	99.2	55.0	71.8	80.1	31.0	133.0	2.3	0.6	0.0	2.8	3.3
Martin	99.2	55.5	72.8	82.8	25.2	205.0	0.1	0.1	0.0	2.8	3.3
Northrup NK 310	98.9	52.8	79.8	76.2	24.5	89.0	19.4	4.2	0.0	3.8	1.5
DeKalb D55	97.2	57.5	72.8	83.7	34.7	107.5	1.6	0.9	0.0	3.8	2.8
RS 620	96.9	58.5	72.3	83.7	31.8	172.0	0.3	0.4	0.0	1.8	3.5
Garst & Thomas RS 610	96.2	53.8	72.0	80.1	29.9	107.3	0.5	0.2	0.0	3.3	2.5
RS 650	96.1	52.8	72.8	83.1	31.8	138.0	0.9	0.9	0.0	1.3	2.8
P.A.G. 515S	94.8	54.5	73.8	82.3	35.4	129.0	0.8	0.8	0.0	2.3	3.3
Steckley GG 107	94.8	52.0	72.5	82.2	33.5	95.0	1.8	0.3	0.0	3.3	3.0
P.A.G. 605S	94.7	59.0	72.0	83.1	31.0	124.5	0.0	0.0	0.0	1.5	3.0
MFA Milo 105	93.8	54.3	72.0	81.5	28.7	120.0	1.9	1.2	0.0	2.0	2.8
McCurdy 80	93.2	54.0	74.5	82.1	31.9	95.5	1.3	0.5	0.0	2.8	3.0
P.A.G. 465S	93.1	50.8	72.8	82.7	28.9	131.5	0.4	0.4	0.0	1.0	3.3
Garst & Thomas Med. Mat.	92.9	54.5	73.5	82.7	29.5	116.5	0.4	0.2	0.0	1.8	3.5
Steckley GG 105	92.3	59.0	72.0	82.9	29.4	127.0	1.2	1.0	0.0	4.5	3.5
Steckley GG 112	92.1	54.5	75.0	82.0	32.8	103.0	0.7	0.5	0.0	3.3	3.0
Plainsman	91.3	48.8	73.0	80.4	31.5	161.0	0.2	0.0	0.0	2.3	2.8
MFA Milo 100	91.1	59.0	73.8	83.8	35.1	136.8	0.9	0.7	0.0	3.3	3.5
Garst & Thomas Med. Late Mat.	90.0	55.8	73.5	83.8	30.1	100.0	0.2	0.0	0.0	2.8	2.8
Redlan	89.8	59.0	76.8	83.7	36.1	191.0	0.1	0.1	0.0	1.0	2.3
Redbine 60	87.7	54.3	72.0	80.2	26.7	133.5	0.0	0.0	0.0	4.8	3.0
Frontier 410	87.3	53.0	74.8	82.0	29.3	110.5	1.6	0.9	0.0	1.5	2.5
Steckley GG R103	86.3	51.8	73.8	81.1	34.2	95.5	0.8	1.0	0.0	4.3	3.0
Westland	85.7	49.0	72.0	81.9	28.7	160.0	0.9	0.6	0.0	4.0	3.5
RS 590	83.6	55.0	72.3	82.6	39.2	140.5	2.3	1.4	0.0	2.0	3.0
McCurdy 40	80.5	54.3	70.3	82.7	32.2	121.0	2.9	0.0	0.0	4.5	2.5
Steckley GG R104	77.5	52.8	74.8	82.2	32.2	77.0	1.0	0.3	0.0	4.3	3.0
Northrup NK 230	77.0	50.8	75.0	80.8	35.7	98.5	0.8	0.3	0.0	3.3	2.8
Steckley GG 109	76.6	50.8	76.3	80.2	32.7	90.5	1.4	0.6	0.0	1.5	2.8
Midland	76.0	52.3	72.3	81.8	24.5	125.0	0.2	0.2	0.0	3.3	2.0
Mean	94.5	54.6	73.1	82.1	30.6	130.6	1.4	0.5	0.0	3.0	3.0

Differences in yield between any two entries of less than 14.8 bushels are not considered significant.

Alfalfa Variety Trials

E. L. Pinnell, Raymond Hicks, and J. D. Baldridge

Hay yields were obtained on 11 varieties at the Sikeston field. This trial was seeded in late summer, 1957. Table 1 gives results for 1958. The analysis of variance revealed that there were no significant differences for forage yield. However, the variety A600 which had the highest yield in this trial also was the high yielding variety in new trials at Pierce City in Southwest Missouri and at Lathrop in Northwest Missouri. This variety was developed at Purdue University. In addition to having high forage yield and good disease resistance, it is one of the few varieties carrying resistance to the spotted alfalfa aphid. Seed of this variety is not yet available for farm use.

A trial seeded at Bell City in late summer of 1957 was lost as a result of water damage.

Two new trials were seeded in 1958. One of these is at Bragg City, the other at Sikeston. Included are the recommended varieties, Buffalo, Vernal, and Ranger, to be compared with Lahontan, Rhizoma, Buffalo synthetic (selected for spotted aphid resistance), four leaf disease resistant varieties from North Carolina, and two selections from Stoneville.

The varieties recommended by the Missouri Agricultural Experiment Station for 1959 are Buffalo, Vernal, and Ranger. Many other varieties are equally good in forage yield for stands intended to be left down only 2 or 3 years. But where long term stands are desired these three varieties are superior because of their resistance to bacterial wilt. *(Project 241)*

AVERAGE FORAGE YIELDS OF ALFAFLA VARIETIES FOR 1958 AT SIKESTON. TOTAL HAY YIELDS IN TONS PER ACRE AT 12% MOISTURE. RANDOMIZED BLOCK, FOUR REPLICATIONS, BROADCAST 5' x 20' PLOTS, SEEDED LATE SUMMER 1957.

Variety	6/2	7/11	8/23	12/1	Total	Stand 7/24/58 [1]
A 600	1.74	1.17	1.02	0.45	4.38	71
Atlantic	1.68	1.25	1.01	0.39	4.33	74
Buffalo	1.59	1.24	1.12	0.39	4.34	78
Kan. Common	1.74	1.22	0.95	0.39	4.30	82
Narragansett	1.72	1.22	0.94	0.36	4.24	80
Okla. Comm.	1.53	1.25	1.00	0.41	4.19	86
Ranger	1.67	1.17	0.86	0.35	4.05	77
Sevelra	1.69	1.17	0.83	0.41	4.10	75
Socheville	1.42	1.15	0.99	0.55	4.11	76
Vernal	1.71	1.14	0.85	0.30	4.00	80
Williamsburg	1.69	1.25	0.96	0.42	4.32	82
Average	1.65	1.20	.96	.40	4.21	78
Least Significant Difference 5%					NS*	

[1] Counts taken with point quadrat and expressed as the number of hits on alfalfa out of 100 possible.

* Not Significant.

Pasture Improvement

E. Marion Brown

Steers grazing orchardgrass and ladino during the four-year period 1955 through 1958 have gained at the average annual rate of 342 pounds an acre and 2.1 pounds per steer daily. They gained only 284 pounds an acre and 2.2 pounds per steer per day during 1958 because maximum gain was sacrificed to preserve the stand of grass and clover on the newly seeded one-half of this pasture.

Steers grazing orchardgrass and alfalfa during the three-year period 1956 through 1958 gained 342 pounds an acre annually and 1.9 pounds per steer per day. The gain made on this pasture during 1958 was 404 pounds per acre and 2.2 pounds per steer per day.

The orchardgrass-ladino pasture was sown March 16, 1954, the orchardgrass-alfalfa pasture September 13, 1955. *(Project 213)*

Weed Control

The Value of Some Chemicals for Pre-emergence Weed Control in Cotton.

O. Hale Fletchall and Raymond D. Hicks

Objectives

Diuron and CIPC leave something to be desired for pre-emergence weed control in cotton. This experiment is being conducted to discover more effective or economical methods of early weed control in cotton.

Materials and Methods

Experiments are being conducted at the Southeast Missouri Research Center fields located at Sikeston, Malden, and Bell City. The soil types varied by location from a Dexter sand at Malden to brown sandy loam at Sikeston and sharkey clay at the Bell City Field.

Fertilization: 500 pounds 12-12-12 broadcast at Sikeston and Bell City.

600 pounds 12-12-12 at Malden; applied 200 pounds at planting and 400 pounds sidedress.

Test Plant: Cotton

Variety: D and Pl Fox

Date Planted:

Malden—May 12

Sikeston—May 13

Bell City—May 26

Plot Size:

Malden—2 rows 40 inches x 111 feet

Bell City—2 rows 40 inches x 165 feet

Sikeston—2 rows 40 inches x 107 feet

Planter Type: 2-row, hilldrop on 14-inch center

Planting rate: 7 seeds/hill

Herbicide Application: The materials listed in Table 1 were

TABLE 1--THE INFLUENCE OF CERTAIN PRE-EMERGENCE CHEMICALS ON THE STAND OF COTTON, PERCENT WEEDS, AND HOEING TIME, SIKESTON FIELD, 1958.

Treatment	Rate Lbs/A	Hoeing Time Hrs/A	Plants per Foot			
			Stand Count	Grass	Brd-lvd Weeds	Total Weeds
Geigy 444E	10.0	4.4	2.96	.50	.19	.68
Geigy 444E	8.0	4.4	2.90	.71	.09	.80
Geigy 444E	6.0	8.7	2.84	2.50	.28	2.78
CIPC	10.0	4.9	2.86	.35	.35	.70
CIPC	7.0	6.7	3.08	1.39	.53	1.92
Simazin	2.0	5.4	3.02	1.16	.25	1.41
Simazin	1.0	10.5	2.74	2.52	.26	2.78
Simazin	0.5	10.8	3.24	2.98	.52	3.50
Diuron	1.5	7.2	2.92	1.23	.32	1.55
Diuron	1.0	6.2	3.18	.73	.39	1.12
Diuron	0.5	10.3	2.88	1.80	.79	2.59
Neburon	2.0	8.7	2.66	1.80	.24	2.04
Neburon	1.5	9.8	3.04	1.68	.40	2.08
Neburon	1.0	10.5	2.70	1.99	.28	2.27
Check	---	17.0	3.14	4.09	2.65	6.74
LSD	5%	4.0	NS	1.35	.48	1.49
LSD	1%	5.3	NS	1.81	.64	1.99

TABLE 2--INJURY[1] TO COTTON BY PRE-EMERGENCE CHEMICALS. SIKESTON FIELD, 1958[2]

Treatment	Rate	Replications				Average
		1	2	3	4	
G. 444E	10.0	9	9	9	9	9.00
G. 444E	8.0	8	9	7	8	8.00
G. 444E	6.0	5	4	3	2	3.50
CIPC	10.0	1	1	1	1	1.00
CIPC	7.0	1	1	1	1	1.00
Simazin	2.0	9	9	9	9	9.00
Simazin	1.0	5	6	4	4	4.75
Simazin	0.5	2	3	4	1	2.50
Diuron	1.5	3	1	2	1	1.75
Diuron	1.0	2	1	1	2	1.50
Diuron	0.5	1	1	1	1	1.00
Neburon	2.0	9	9	6	8	8.00
Neburon	1.5	7	7	6	6	6.50
Neburon	1.0	4	4	1	7	4.00
Checks	---	0	0	0	0	0.00

[1] Rated on a scale of 1 to 10 with 1 representing no injury and 10 representing chloratic or other injury symptoms appearing on all plants.

[2] Estimates were made on June 3, twenty-one days after treatment.

mixed with water and applied as a spray, at an overall rate of 40 gallons of mixture per acre, in a 12-inch band at planting.

Stand Counts: Every plant was counted in each plot during the period between June 7 and 11, 1958.

Weed Counts: Weeds occurring within the 12-inch band were counted at the same time stand counts were made.

Hoeing Time: Each plot at each of the two servicing locations was hoed by the same two persons and minutes per plot recorded on June 10 to 12.

Harvesting:

Malden—Picked by hand on 10/10 and on 10/29.

Sikeston—Picked by hand on 10/3 and on 10/29; picked by machine on 12/8.

Weather Conditions: During the four weeks following planting there was a total of .47 inches of rain causing delayed germination of seed planted in heavy soil and incompletely covered. This condition was followed by heavy rain and local showers resulting in the abandonment of the test on the Bell City location. The excessive rain and low temperature continued during the remainder of the month of June and the first 25 days of July resulting in delayed fruiting. The remainder of the growing season was generally favorable for cotton production.

Observations and Results:

Table 1 gives the data on stand counts, percentage weeds and hoeing time.

Data on stand counts show that there was no significant reduction in the stand of cotton from any chemical treatment.

Weeds present were mostly crabgrass, pigweed, morning glory, carpet weed, and smart weed with crabgrass predominant. Of the chemicals tested neburon appeared to be least effective in controlling weeds; however, it is noticeable that at the Sikeston location all materials gave increased weed control over the check. Also, the highest rate of neburon gave better weed control than the lowest rate of diuron or simazin. Weeds at the Malden location were few and inconsistent in distribution, resulting in no clearcut measurement of the chemicals on early weed control.

The hoeing time required is a good measurement of weed control particularly at the Sikeston location, Table 1. It is noticeable that all treatments significantly reduced the hoeing time, compared with the check. Geigy 444E, at 8 or 10 pounds per acre, reduced the hoeing time 12.6 hours per acre. Other materials, such as CIPC, Simazin at the 2 pound rate and diuron at the 1 lb rate gave similar reductions in hoeing time ranging from 12.1 to 10.3 hours per acre less than the check. There was no significant statistical difference between these top seven materials and rates.

In the past, simazin, at rates of 2 pounds per acre, had indicated it might delay the maturity of cotton. This test was picked by hand early in the harvest season so any real difference in earliness might be detected. No defoliating materials were used.

At the Sikeston location there was a difference in the earliness due to treatment. Simazin at the 2 pounds per acre rate resulted in slightly less cotton than some other treatments during the first two pickings. The lowest rates of all materials and both the 7 and 10 pound rate of CIPC resulted in significantly higher early picking yield than the check.

These data and the estimated injury shown in Table 2 indicate the higher rates of neburon, Geigy 444E, and simazin might have caused early injury to cotton, resulting in less than optimum yields on the first and second pickings. By the end of the season the cotton had recovered, and there was no significant difference in the yield of cotton under any treatments, Table 3. *(Project 332)*

TABLE 3--THE INFLUENCE OF CERTAIN PRE-EMERGENCE CHEMICAL TREATMENTS ON THE EARLINESS AND YIELD OF COTTON. SIKESTON FIELD, 1958.

Treatment	Rate/A	1st Picking Lbs/A	2nd Picking Lbs/A	1st & 2nd Picking Lbs/A	Total Yield Lbs/A
G 444E	10.0	817	786	1602	2458
G 444E	8.0	825	909	1734	2514
G 444E	6.0	1041	878	1919	2640
CIPC	10.0	1048	848	1896	2549
CIPC	7.0	1063	940	2004	2814
Simazin	2.0	755	786	1541	2430
Simazin	1.0	848	894	1741	2549
Simazin	0.5	1017	886	1904	2619
Diuron	1.5	928	863	1776	2479
Diuron	1.0	947	832	1779	2551
Diuron	0.5	962	832	1794	2596
Neburon	2.0	802	817	1618	2486
Neburon	1.5	948	894	1842	2598
Neburon	1.0	1079	894	1973	2662
Check	---	786	848	1634	2531
L.S.D.	5%	174	NS	253	NS
L.S.D.	1%	233	NS	NS	NS

The Value of Some Chemicals, Herbicidal Oils, and Flame Cultivation for Post-emergence Weed Control in Cotton.

O. Hale Fletchall and Raymond D. Hicks

Objectives

Pre-emergence chemicals normally afford weed control from 4 to 6 weeks following planting. It is the purpose of this test to discover chemicals and practices necessary for the satisfactory extension of the period of weed control.

Materials and Methods

Location: Sikeston Experiment Field and Bell City Experimental Field.

Soil Types: Brown sandy loam and sharkey clay.

Fertilization: 500 pounds 12-12-12; broadcast before planting.

Test Plant: Cotton

Variety: D & PL Fox

Date Planted: May 13 at Sikeston; May 26 at Bell City.

Plot Size:

Sikeston—2 rows, 40 inches x 107 feet;
Bell City—2 rows, 40 inches x 165 feet.

Planter Type: 2-row hilldrop on 14-inch center.

Planting Rate: 7 seeds per hill

Pre-emergence Rate: ¾ pound diuron per acre.

Weather Conditions: During the four weeks following planting, there was a total of 0.47 inches of rain, resulting in delayed germination and several ages of test plants as well as poor weed control from the pre-emergence chemical. This condition was followed by heavy rain and local showers, causing the abandonment of the Bell City test. Excessive rain and low temperatures continued during the remainder of June, and the first 25 days of July. This delayed fruiting. The growing season after July 25 was generally favorable for cotton production.

Treatment Application: Flame cultivation, treatment 18 in Table 1, was applied on July 15 and on July 28 using 40 pounds pressure and a tractor speed of 3 miles per hour. All other treatments were applied on June 17. Treatments 15, 16, and 17 were applied at the rate of 7 gallons of oil per acre. All treatments other than the exceptions above were applied at the rates given in Table 1. The active material was mixed in water and applied at an over-all spray rate of 30 gallons per acre to a 12-inch band.

Stand Counts: Every plant was counted in each of two 50 ft. center sections of each row. Counts were made on June 14 and on July 24.

Hoeing: Due to the differing ages of cotton and poor chemical weed control brought about by dry weather following planting, it became necessary to postpone the application of post-emergence treatments. This necessitated hoe removal of the large weeds prior to treating. Stand counts shown in Table 1 were made following the hoeing operation.

Harvesting: The seed cotton reported in Table 3 was picked by hand on October 10 and 29. The final picking was performed with machine on December 8.

Observation and Results

Weeds present were mostly carpet weed, pigweed, morning glory, climbing milkweed, goose grass, and crabgrass, with crabgrass predominant. Climbing milkweed was the predominant weed in part of replications 3 and 4, but was not uniformly present in any replication.

In no treatment were these weeds effectively controlled. Because climbing milkweed was not present uniformly in any complete replication, it was omitted from the weed control estimates and weed counts of Table 2. Climbing milkweed was included in the weed harvest data of Table 2. It accounted, in part, for those treatments showing low weed counts but high harvest weights.

The poor weed control of the non-fortified oils and of flame cultivation is accounted for by the delay in their application and their non-residual type of action.

TABLE 1--INFLUENCE OF CERTAIN POST-EMERGENCE WEED CONTROL TREATMENTS ON THE INJURY TO COTTON. SIKESTON FIELD, 1958.

Treatment	Rate	Estimated[1] Injury 7/14	Stand Before Treatment Stalks/A 6/14	Stand After Treatment Stalks/A 7/24	Percent Decrease Over Check
1. Diuron	3.0 lbs.	3.00	28517	16482	25
2. Diuron	2.0 lbs.	3.50	27993	19098	15
3. Diuron	1.0 lbs.	2.00	33618	23677	13
4. Monuron	1.5 lbs.	3.25	31918	20014	20
5. Monuron	1.0 lbs.	1.75	29563	22499	7
6. Monuron	0.5 lbs.	1.50	34141	28254	--
7. NPA	4.0 lbs.	.50	27732	22499	2
8. NPA	2.0 lbs.	.75	28386	22107	5
9. EPTC	8.0 lbs.	.75	34141	26293	6
10. EPTC	4.0 lbs.	.50	27732	22238	3
11. Niagra 4556	4.0 lbs.	1.00	28124	22892	2
12. Niagra 4556	3.0 lbs.	.25	28386	27732	--
13. Niagra 4556	1.5 lbs.	.25	32441	30086	--
14. Geigy 444E	10.0 lbs.	.25	30610	24985	1
15. Lion oil	7.0 gal.	.50	35580	29432	--
16. Lion oil 7.0 gal. + Geigy	3.0 lbs.	.50	30610	24723	2
17. Shell oil	7.0 gal.	.50	34795	25639	9
18. Flame	----	not treated	30217	23415	6
19. Check	----	.0	38456	31787	--

[1] Injury estimates are based on a 0 = no injury to 10 = 100% kill scale.

TABLE 2--INFLUENCE OF CERTAIN POST-EMERGENCE WEED CONTROL TREATMENTS ON WEED CONTROL IN COTTON. SIKESTON FIELD, 1958.

Treatment	Rate	Estimated Weed[1] Control 7-14	Broadleaf Weeds No/A 7-24	Grassy Weeds No/A 7-24	Total Weeds No/A 7-24	Weeds Harvested Lbs/A 9-5
1. Diuron	3.0 lbs.	9.00	0	65	65	202
2. Diuron	2.0 lbs.	8.50	105	196	301	247
3. Diuron	1.0 lbs.	8.00	562	497	1059	265
4. Monuron	1.5 lbs.	7.50	497	693	1190	248
5. Monuron	1.0 lbs.	8.50	916	916	1832	276
6. Monuron	0.5 lbs.	4.00	1570	955	2425	311
7. NPA	4.0 lbs.	0.00	2812	8830	11642	278
8. NPA	2.0 lbs.	0.00	2943	1635	4578	287
9. EPTC	8.0 lbs.	0.62	1374	1046	2420	345
10. EPTC	4.0 lbs.	0.00	3048	1478	4526	361
11. Niagra 4556	4.0 lbs.	0.00	1086	1374	2460	312
12. Niagra 4556	3.0 lbs.	0.50	1020	1478	2498	302
13. Niagra 4556	1.5 lbs.	0.00	523	523	1046	491
14. Geigy 444E	10.0 lbs.	3.25	327	1020	1347	470
15. Lion oil	7.0 gal.	0.00	1766	1308	3074	355
16. Lion oil 7.0 gal. + Geigy	3.0 lbs.	3.50	262	628	890	296
17. Shell oil	7.0 gal.	0.50	2420	1177	3597	367
18. Flame	----	not treated	2485	2093	4578	457
19. Check	----	0.00	3440	2355	5795	714
L.S.D.	1%		733	1478	6343	

[1] Estimated weed control is on a scale of 0 = no control to 10 = perfect control.

Of the treatments tested, diuron and monuron gave best over-all weed control; however, these materials also caused the greatest injury to cotton, Table 1. Although differences in yields were not statistically significant in this test, it appears that the use of these materials on cotton under 6 inches high is exceedingly hazardous.

The non-fortified herbicidal oils and flame cultivation did not give satisfactory performance in this test, partially due to their delayed application necessitated by varying plant size. NPA, EPTC, and Niagra 4556 gave generally poor weed control in this test; they show little promise. Of the treatments tested, the most promising in all measurements—low injury, good weed control, and good yield—appears to be 7 gallons of herbicidal oil fortified with 3 pounds Geigy 444E per acre. *(Project 332)*

TABLE 3--INFLUENCE OF CERTAIN POST-EMERGENCE WEED CONTROL TREATMENTS ON THE EARLINESS AND YIELD OF COTTON. SIKESTON, 1958.

Treatment	Rate	1st Picking Lbs/A	2nd Picking Lbs/A	Total Yield Lbs/A
1. Diuron	3.0 lbs.	587	469	1776
2. Diuron	2.0 lbs.	640	546	1876
3. Diuron	1.0 lbs.	798	613	2059
4. Monuron	1.5 lbs.	636	509	1776
5. Monuron	1.0 lbs.	717	570	2072
6. Monuron	.5 lbs.	863	606	2199
7. NPA	4.0 lbs.	547	534	1827
8. NPA	2.0 lbs.	632	557	1870
9. EPTC	8.0 lbs.	727	593	2067
10. EPTC	4.0 lbs.	626	490	1902
11. Niagra 4556	4.0 lbs.	646	519	1866
12. Niagra 4556	3.0 lbs.	833	707	2226
13. Niagra 4556	1.5 lbs.	946	750	2355
14. Geigy 444E	10.0 lbs.	837	623	2282
15. Lion oil	7.0 gals.	875	675	2313
16. Lion oil 7.0 gal. + Geigy	3.0 lbs.	885	661	2278
17. Shell oil	7.0 lbs.	863	632	2266
18. Flame		631	494	1878
19. Check		951	663	2282
L.S.D.		NS	NS	NS

The Influence of Various Thinning and Cultural Practices on the Yield of Cotton.

O. Hale Fletchall and Raymond D. Hicks

Objectives

Crossplowing has been successfully used in the Southern delta region to thin cotton and to reduce the amount of hand labor to control weeds in the row. Earlier research on crossplowing in Missouri showed crossplowing on a 40-inch center delayed maturity of cotton. Flame cultivation has been used to reduce hand labor in weed control in cotton. The rotary cultivation was recently introduced to Missouri with the suggestion that it would reduce hand labor needed for row weed control, particularly in young cotton. Tests are being conducted to measure the weed control and yield of cotton treated with various combinations of these cultural practices.

Materials and Methods

Location: Sikeston Experimental Field.

Soil Type: Brown sandy loam.

Experimental Design: Split plot with methods of thinning constituting the main plots. The main plots were 60 feet by 160 feet. Methods of row weed control—by flame cultivation, rotary cultivation, and conventional plowing—were sub-plots. There were 16 rows or 53.3 feet by 60 feet. There were 4 replications.

Fertilization: 500 pounds 12-12-12 broadcast before planting; 300 pounds 12-12-12 sidedressed June 21.

Test Plant: Cotton.

Variety: Delfos.

Date Planted: May 16.

Planter Type: 2-row, drill.

Planting Rate: 1 bushel per acre.

Pre-emergence Rate: An overall rate of ¾ pound diuron in a 12-inch band.

Weather Conditions: During the 25 days following planting, only .2 inch of rain fell. This deficiency of moisture resulted in spotty germination, poor pre-emergence weed control, and the delay of crossplowing until after a sufficient stand was obtained following irrigation on June 4. Conditions of high precipitation and low average temperature existed from June 11 through July 25, resulting in slow growth and development. The remainder of the growing season was favorable for cotton growth and production.

Stand Count: Randomly selected rows were counted in each thinning treatment between June 14 and June 20, and again on November 15, 1958.

Hoeing: Hoeing was applied to those main plots designated to be thinned by hoeing and to remove any weed from the crossplowed plots on June 12. No hoe thinning of the crossplowed plots was permitted.

Harvesting: Cotton was hand picked October 29 and machine picked December 8.

Application of Treatments: Crossplowing was performed on June 12. A crossplow cultivator equipped with 14-inch sweeps was used, set to thin 3 to 7 stalks per hill with hills on a 20-inch center. The cotton was sidedressed and plowed uniformly on June 21. After that the cultural treatments were applied. Due to wet weather the initiation of cultural treatments was delayed until July 16. These treatments were applied July 16 and July 28, after which time the cotton was too large for further cultivation.

Observations and Results

Test of crossplowing as a method of thinning cotton revealed there was no delay in maturity of cotton when crossplowing resulted in a sufficient number of plants in hills spaced 20 inches apart. (Table 1) There was no real difference in the total yield resulting from methods of thinning. Due to difficulties caused by the delay in crossplowing, no cost measurement of methods of thinning was made.

A comparison of three methods of row cultivation imposed on these methods of thinning revealed no difference in the yield of seed cotton. Weed control was good under all methods of row cultivation with conventional cultivation resulting in slightly fewer harvested weeds per acre. Stand counts made on November 15, 1958, showed flame cultivation resulted in the highest stalk counts per acre, indicating that properly applied

TABLE 1--INFLUENCE OF CERTAIN THINNING AND CULTURAL TREATMENTS ON THE STAND, GROWTH OF WEEDS, AND YIELD OF COTTON. SIKESTON FIELD, 1958.

Cultural Treatment	Thinning Treatment	Stand Stalks/A	Weeds Harvested Lbs/A	Yield 1st Picking Lbs/A	Yield 2nd Picking Lbs/A	Total Yield Lbs/A
		11/15	9/5	10/29	12/8	
Flame	Crossplowed	31,174	203	729	990	1719
	Hoed	30,520	216	758	861	1639
Rotary	Crossplowed	32,482	163	691	862	1553
	Hoed	26,378	226	752	854	1606
Plow	Crossplowed	24,198	155	718	963	1681
	Hoed	27,250	161	775	919	1694
Mean for Culture Treatment	Flame	30,825	210	744	933	1677
	Rotary	29,408	195	721	854	1575
	Plow	25,789	158	747	941	1688
L.S.D.	Culture	3,659	---	NS	NS	NS

flame cultivation does not reduce the stand of cotton. *(Project 332)*

The Value of Flame Cultivation for Weed Control in Cotton.

O. Hale Fletchall and Raymond D. Hicks

Objectives

Flame cultivation has been used by some planters throughout the "Cotton Belt" to reduce the hand labor required to control weeds in the cotton row. This test is designed to evaluate the cost and effectiveness of this method under Missouri farm conditions.

Materials and Methods

This test was conducted on the James R. Girvin farm, east of Portageville. To get a reliable measure of material cost per acre, a field of 70 acres was selected for treatment. At the time of treatment, this field contained a uniform stand of Delfos 9169 cotton 8 to 10 inches high. The soil type is known locally as "gumbo," official classification unknown, probably a sharkey clay with a sand component of varying percentage. The field, prior to treatment, had been pre-emerged with 1½ gallons of dinitro (Dow premerge) per acre. It was planted with a hill drop planter; no thinning had occurred. Cultivation had been performed with a conventional 4-row tractor mounted cultivator. Weeds present at the time of treatment consisted mostly of red vine, prostrate spurge, pigweed, smartweed, and crabgrass. The weeds most predominant were pigweed and red vine.

Flame cultivation was applied on July 28 using a 4-row flame cultivator in conjunction with conventional middle cultivation. The tractor speed was 4 m.p.h. Fuel pressure was kept at 65 pounds per square inch. Two plots of 4 rows each were selected randomly and left unflamed. This was accomplished by cutting off the fuel to the flame cultivator, thereby permitting middle cultivation to remain consistent over the entire field.

On July 30, the 4-row unflamed plots were hoed along with the two adjacent flamed rows on either side of the 4-row plots. Four farm laborers were used to hoe the test. The amounts of time required to hoe the treated and untreated areas were recorded separately.

TABLE 1--INFLUENCE OF FLAME CULTIVATION ON THE YIELD OF SOYBEANS. BELL CITY EXPERIMENTAL FIELD.

Replications	Conventional Cultivation Bu. per Acre: 10/28	Flame Cultivation Bu. per Acre: 10/28
1	13.6	11.0
2	22.0	13.9
3	22.6	19.3
4	23.8	19.7
5	22.7	21.0
6	24.4	20.2
7	21.3	22.1
8	25.3	19.2
Average	22.0	18.2
L.S.D. 1%	3.4	

Results and Discussion

Cost of fuel to flame cultivate under the conditions of this test was $0.50 per acre. No attempt was made to evaluate depreciation of equipment. Because the tractor and conventional cultivator were required in the treated and untreated plots alike, the cost of the tractor and operator were not computed.

The labor required to hoe the unflamed plots came to 4 hours and 44 minutes per acre; the flamed plots required 2 hours and 20 minutes. The saving attributable to flame cultivation was 2 hours and 24 minutes. With the hand labor valued at $0.65 per hour, the cash savings from flame cultivation was $1.09 per acre, less depreciation cost. *(Project 332)*

The Effect of Flame Cultivation for Weed Control on the Yield of Soybeans.

Raymond D. Hicks and Elroy J. Peters

Objective

Conventional cultivation plus hoeing or the use of chemicals has been ineffective or excessively expensive in the control of perennial vines in soybeans. Several producers have begun to use flame cultivation to control these and other weeds in the row. This experiment is being conducted to compare the yield of late planted soybeans when flame cultivated with those cultivated with conventional methods.

Material and Methods

Location: Bell City Field of the Southeast Missouri Agricultural Research Center.
Soil Type: Sharkey clay
Fertilization: 500 pounds of 12-12-12 broadcast to cotton in May.
Test Plant: Soybeans.
Variety: A mixture of the leading varieties of the area.
Date Planted: July 5, 1958.
Plot Size: 10 rows, 40 inches by 165 feet.
Planter: 2 row drill.
Planting Rate: One bushel per acre.
Flame Cultivation: Flame cultivation was performed with a 2-row agri-quip flame cultivator. Fuel pressures and tractor speeds were: 40 pounds pressure and a speed of 3 miles per hour during the first cultivation, August 9; 35 pounds pressure and 3 miles per hour, August 18; and 45 pounds pressure and 4 miles per hour, August 29. At the same time these plots were flame cultivated; the conventionally cultivated check plots were plowed.
Harvesting: Beans were combined October 28, using the conventional 2-row pull type combine.
Weather Conditions: Temperature and precipitation were generally favorable for the production of soybeans.

Observations and Results

Weeds were mostly Pennsylvania smartweed (Polygonum pennsylvanicum), carpet weed (Mollugo verticellata), prostrate spurge (Euphorbia supina), crabgrass (Digitaria sanguinalis), and red vine. Red vine (Brunnichia cirrhosa), the one perennial vine causing most difficulty in soybeans in Southeast Missouri, was found in low infestation throughout the test.

Flame cultivation resulted in satisfactory temporary control of these vines and other weeds. Observations of the test through the summer revealed some lodging of the flame cultivated beans. Lodging appeared to result from the weakening of the plant stem at approximately one-half inch above ground level, caused by excessive heat of flame cultivation. The growth and fruiting rates were not noticeably affected by cultivation treatment. However, harvest records show the yield of soybeans (Table 1) was significantly reduced by the use of flame cultivation. *(Project 332)*

Chemical Weed Control in Soybeans as Influenced by Row Spacing and Cultivation.

Raymond D. Hicks and Elroy J. Peters

Objective

This experiment was planned to evaluate the effectiveness of PCP on controlling weeds and on the yields of soybeans planted in 20-inch and 40-inch rows.

Materials and Methods

Location: Southeast Missouri Agricultural Research Center, Sikeston.
Soil Type: Dexter Sandy loam.
Planting Rate: 29 pounds per acre. Ogden soybeans were planted in sub-plots 10 feet by 50 feet. The experiment was laid out in a split-plot design with row spacings of 40-inch and 20-inch rows as main plots. Sub-plots consisted of sodium PCP with zero, one, and two cultivations, and two cultivations with no herbicide. The herbicide was applied on May 18 as an over-all treatment to the plots that received the herbicide. The chemical was applied in 40 gallons of water per acre at a pressure of 40 pounds per square inch. On June 7, the plots receiv-

TABLE 1--COUNTS OF WEEDS IN SOYBEANS AS INFLUENCED BY PRE-EMERGENCE HERBICIDE. SIKESTON FIELD, 1958. (COUNTS MADE JUNE 4.)

Main Treatment	Sub-Treatment	Horse Nettle No./A	Other Broadleaf* No./A	Grasses No./A	Total Weeds No./A
20" row	20 lbs. PCP + 0 cult.	810	727	815	2,352
	20 lbs. PCP + 1 cult.	1,425	75	600	2,100
	20 lbs. PCP + 2 cult.	819	409	1,347	2,575
	0 lbs. PCP + 2 cult.	1,303	5,795	16,821	23,919
	Mean	1,089	1,752	4,896	7,737
40" row	20 lbs. PCP + 0 cult.	1,466	125	1,688	3,279
	20 lbs. PCP + 1 cult.	2,225	75	763	3,063
	20 lbs. PCP + 2 cult.	627	335	1,436	2,398
	0 lbs. PCP + 2 cult.	1,509	4.625	18,309	24,443
	Mean	1,457	1,290	5,549	8,296

* Weeds making up the number listed as other broadleaf consist of: common ragweed, morning glory, climbing milkweed, curly dock, lespedeza, white clover, and henbit.

ing 2 cultivations and no herbicide were cultivated. The plots receiving 1 and 2 cultivations with herbicide were cultivated on June 14. The 2 cultivation plots received the last cultivation on June 28. The soybeans were harvested from one 15-foot midsection of one row per plot on October 18.

Results

The weed control due to Sodium PCP lasted until early June. A few plants of horse nettle *(Solanum carolinense)* appeared in all plots soon after treatment, but control of all other weeds was good with sodium PCP until small weeds appeared about June 10 (Table 1). The amount of weed control in plots planted in 20-inch rows and cultivated once appeared to be as good as in those planted in 40-inch rows and cultivated twice. Plots not cultivated or planted in 40-inch rows and cultivated once contained enough weedy grasses to offer competition near the end of the growing season. The yield of soybeans is given in Table 2. These yields are proportional to the amount of weed control obtained. There was no significant difference in the average yield of soybeans. However, the consistently higher yields from the plots receiving sodium PCP and one cultivation indicates that this treatment might give best results if tested under conditions of higher weed population. *(Project 332)*

TABLE 2. THE YIELD OF SOYBEANS AS INFLUENCED BY INTERRELATION OF CULTIVATIONS AND HERBICIDE. SIKESTON FIELD, 1958.

Treatment	Row Width 20"	40"	Mean
20 lbs. PCP + 0 cult.	37.4	35.1	36.2
20 lbs. PCP + 1 cult.	43.9	43.1	43.5
20 lbs. PCP + 2 cult.	39.4	39.9	39.7
0 lbs. PCP + 2 cult.	34.8	43.3	39.0
Mean	38.9	40.4	39.6

■ ■ ■

Seed Certification

L. E. Cavanah, W. E. Aslin, Carl Luper, Gene Forsyth

Seed certification in Southeast Missouri increased during 1958 from 5,074 acres to 8,185 acres. This increase was mostly in cotton and soybeans. Growing conditions were very good for seed production and this resulted in high seed yields. The break-down as to crops and crop varieties follows:

Cotton:

DPL Fox	10 growers, on 14 farms, and	994 acres
Deltapine 15	5 growers, on 9 farms, and	522 acres
Delfos 9169	4 growers, on 7 farms, and	564 acres
Rex	3 growers, on 4 farms, and	599 acres
Auburn 56	2 growers, on 42 farms, and	1281 acres
	Total	3960

Soybeans:

Clark	5 growers, on 6 farms, and	165 acres
Dorman	6 growers, on 10 farms, and	431 acres
Ogden	4 growers, on 8 farms, and	465 acres
Lee	3 growers, on 3 farms, and	200 acres
Scott	36 growers, on 36 farms, and	676 acres
	Total	1937

Corn:

Mo. 880	1 grower, on 1 farm, and	35 acres

Wheat:

Triumph	1 grower, on 1 farm, and	40 acres
Vigo	1 grower, on 1 farm, and	40 acres
Knox	10 growers, on 18 farms, and	366 acres
Vermillion	35 growers, on 42 farms, and	897 acres
	Total	1343

Barley:

Mo. B-475	10 growers, on 13 farms, and	796 acres

Winter Oats:

Dubois	3 growers, on 3 farms, and	52 acres

Rye:

Balbo	1 grower, on 1 farm, and	30 acres

Rice:

Zenith	1 grower, on 1 farm, and	32 acres

Foundation seed of Hood soybeans was increased on 502 acres; seed for D53-526 soybeans was increased on 13 acres; Auburn 56 cotton was increased on one acre. The seed will be distributed to seed growers throughout Southeast Missouri for further increase and distribution for the 1960 plantings.

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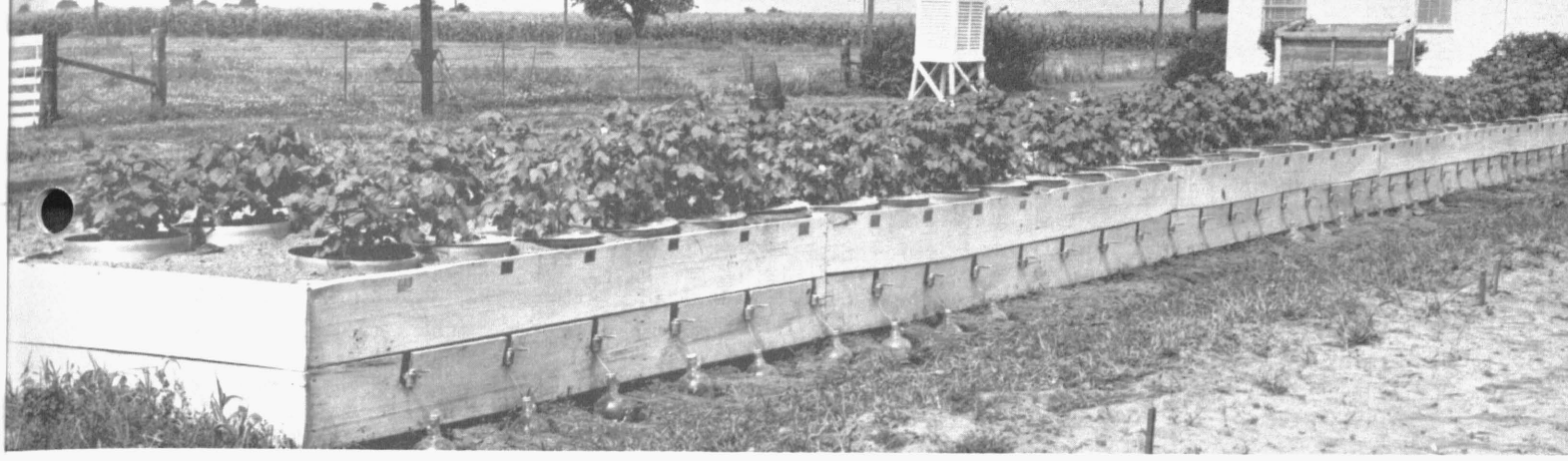

The study on nutrition and water requirements of cotton.

Soils

J. A. Roth, Frank A. Stanley and G. E. Smith

INTRODUCTION

The importance of an adequate supply of plant nutrients was emphasized during the wet season of 1958 by striking increases in cotton yields as a result of supplemental fertilization. Available nutrients apparently were at a critically low level in the Sharkey (gumbo) soils of Southeast Missouri during 1958. Long-time experimental data indicate that the preceding year's weather conditions affect the present year's corn yields. Perhaps the extremely wet season of 1957 and spring of 1958 caused a relatively low supply of nutrients to be available during the summer of 1958.

The application of a balanced fertilizer stimulated more vigorous growth during the early summer months. Result was an earlier and more normal fruiting. Cotton grown on the Sharkey clay soils without supplemental fertilization did not produce blooms until August in many cases. This late fruiting caused cotton to mature late as well as yield low.

Sandy soils also responded well to the application of a proper balance of plant nutrients. However, the better drained, loamy soils released more natural nutrients during the cool, wet season.

Cotton experiments were conducted on the Bell City, Bragg City, Diehlstadt, Malden and Sikeston experimental fields during 1958. The wet spring caused late cotton planting on the gumbo soils of the Bell City and Bragg City fields. Dry weather immediately following planting required the cotton to be irrigated to a stand. A "skippy" stand and heavy rainfall during July caused the results from the field at Bell City to be somewhat erratic. The sandy soils of the Diehlstadt and Malden fields produced very well and required little supplemental irrigation.

Cooperative cotton fertilizer experiments were conducted at eight locations in Southeast Missouri in addition to the routine work conducted on the experimental fields. Three cooperative soybean fertility experiments were conducted in 1958. Corn and wheat fertility studies were conducted on the leased experimental fields. These cooperative fertility studies permit data to be obtained from the many soil types in the Delta area. These data are used to correlate or compare soil test fertility levels and ferilizer response. This comparison can be used to develop a better soil test for the alluvial soils in the cotton-producing area.

A soils research laboratory was established at the Sikeston field during 1958. This laboratory will be used to conduct fundamental and applied research problems associated with cotton and soybean production in the area. The laboratory will be used to correlate soil test levels with fertilizer response in an effort to develop a better soil testing procedure for Southeast Missouri soils.

Fundamental studies of the response of cotton to treatment with gibberellin, a plant growth stimulator, were conducted at the Sikeston field. This study with gibberellin indicated that the hormone has a potential of increasing cotton yields, but many complicating problems prevent it from having practical application. This study will be continued during 1959.

Cotton was grown in 20 gallon pots at the Sikeston field to measure the relationships of cotton plant nutrient and water requirements and their influence on cotton fruiting habits and yield. The measurement of leachate on a sandy soil was also a part of this study.

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Acknowledgment is made to the following companies for furnishing materials that were used in some of the experiments: Allied Chemical and Dye Company; Commercial Solvents Corporation; Deering Farms Liquid Fertilizer Company; Olin Mathieson Chemical Corporation; Mississippi Lime Company; Missouri Plant Foods Company; MFA Plant Foods Division; Spencer Chemical Company; and Tennessee Corporation.

SUMMARY OF SOIL TESTS

Location of Experiment	Depth	% O.M.	P_2O_5	K	% K Saturation*	Mg	% mg Saturation*	Ca	% Ca Saturation*	pH	H	C.E.C.	Salt pH	Weak Phos.
Bell City Experimental Field, Soil Type: Sharkey Clay														
Soil Test Correlation	Top Soil	3.5	448	660	3.3	1400	22.7	5600	54.5	5.2	5.0	25.6	5.1	
	Sub Soil	2.4	244	480	2.4	1400	22.6	6500	63.2	5.6	3.0	25.8	5.4	
Bragg City Experimental Field, Soil Type: Sharkey Clay														
Soil Test Correlation	Top Soil	2.3	216	280	1.8	1200	25.8	4800	61.9	6.0	2.0	19.4	5.7	
	Sub Soil	1.5	380	660	3.1	1400	21.4	6200	57.0	5.1	5.0	27.1	5.0	
Malden Experimental Field, Soil Type: Dexter Fine Sand														
Soil Test Correlation and Time of Application	Top Soil	1.0	128	144	3.2	220	16.4	1600	71.4	6.5	0.5	5.7		
	Sub Soil	1.0	69	140	3.0	190	13.2	1400	58.6	5.7	1.5	6.2		
Wheat Exp.	0-7	1.3	122	165	3.0	180	10.9	1350	49.4	5.5	2.5	6.8	5.0	
	7-14	1.0	94	120	2.1	170	10.3	1400	51.0	5.7	2.5	6.9	4.9	
Diehlstadt Experimental Field, Soil Type: Bertrand Sand														
Cotton & Soybeans	Top Soil	1.1	262	195	4.8	270	21.8	1100	53.1	6.5	1.5	5.6	5.9	
	Sub Soil	0.9	68	185	4.3	220	16.2	990	44.0	6.2	2.0	5.6	5.5	
Reinbott - Cooperative Cotton Plot, Soil Type: Bertrand Sand														
(3 mi. West of Charleston)	Top Soil	1.4	138	130	4.0	180	17.9	500	29.9	5.9	2.0	4.2	5.1	
	Sub Soil	1.0	93	70	3.3	160	24.3	0	0	5.5	2.0	2.8	4.8	
Larkins - Cooperative Cotton Plot, Soil Type: Sarpy Silt Loam														
(3 mi. South of Big Oak State Park)	Top Soil	1.9	440	460		1000		7000		7.7	0		7.4	
	Sub Soil	2.4	390	350		1400		7000		7.2	0		7.1	
Young - Cooperative Cotton Plot, Soil Type: Dexter Fine Sandy Loam														
(1 mi. South of Sikeston)	Top Soil	1.7	134	175	3.1	200	11.7	1600	56.3	6.0	2.5	7.5	5.4	
	Sub Soil	1.4	57	110	2.8	200	16.5	800	39.8	6.0	2.5	5.5	5.4	
Gardner - Cooperative Cotton Plot, Soil Type: Dexter Fine Sandy Loam														
(4 mi. S.E. of Matthews)	Top Soil	2.3	147	235	2.5	270	9.4	4250	88.1	7.0	0	12.1	6.7	
	Sub Soil	2.0	89	150	2.0	180	8.0	3000	79.4	6.7	1.0	9.4	6.4	
Choate - Cooperative Cotton Plot, Soil Type: Sarpy Clay Loam														
(1/2 mi. West of Dorena, Merc.)	Top Soil	2.8	440	290	1.6	1400	24.6	7000	73.8	7.5	0	23.8	7.1	
	Sub Soil	2.7	404	280	1.5	1400	24.6	7000	73.9	7.4	0	23.6	7.0	
Hess - Cooperative Cotton Plot, Soil Type: Wabash Clay														
(3 mi. West of Wyatt)	Top Soil	3.1	352	480	2.3	1400	21.6	7000	64.8	6.1	3.5	27.0	6.0	
	Sub Soil	1.7	182	310	1.5	1400	21.8	7000	65.5	5.7	3.0	26.7	5.7	
Watkins - Cooperative Cotton Plot, Soil Type: Silt Loam														
(2 mi. S.W. of Rives)	Top Soil	1.5	240	280	2.2	900	22.9	3900	59.5	6.2	2.5	16.4	5.2	
	Sub Soil	1.0	192	192	1.8	880	27.3	2800	52.1	6.2	2.5	13.4	5.1	
French - Cooperative Cotton Plot, Soil Type: Clay Loam														
(5 mi. S.E. of Malden)	Top Soil	1.8	300	175	1.0	600	11.6	5100	59.3	5.7	6.0	21.5	5.3	155
	Sub Soil	1.0	202	110	.7	650	14.1	4900	64.1	5.9	4.0	19.1	5.5	80

* Potassium Saturation should be 2.5 to 5%; Magnesium 10%; Calcium 75%, for optimum cotton growth.

(Project 229)

SUMMARY OF COTTON RESPONSE TO SOIL TREATMENT

Clay and Clay Loam Soils

	Bragg City		Bell City		Hess		Choate		French		Watkins		Average	
	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint
Comparison of Starter Fertilizer														
No Fertilizer	27	149	0	128	52	367	207	316	374	514	103	215	127	282
25 + 25 + 25	154	262	36	246	124	---	349	519	481	627	198	408	224	412
50 + 50 + 50	269	486	72	389	182	---	424	649	438	642	187	387	262	511
100 + 100 + 100	318	503	51	531		846	490	712	394	631	226	650	296	646

The application of adequate starter fertilizer on clay soils is essential to stimulate rapid growth and produce early cotton fruiting. The cotton-growing season is very short in Southeast Missouri. Use of starter fertilizers aids in obtaining maximum use of the short growing and fruiting portion of the year. Most of the experimental locations listed above have heavy clay soils. During cold wet springs these clay soils release their nutrients very slowly so a starter fertilizer provides nutrients for the cotton plant until the soil becomes warm and better aerated.

The average yield of the experiments listed above indicates that even a 100 + 100 + 100 produced economical yield increases during the cool, wet growing season of 1958. Somewhat less striking responses might be expected during a more normal season, however similar results were obtained during the more favorable cotton year of 1956 on some of the same gumbo experimental plots. Since early maturity is of ultimate importance on heavy clay (gumbo) soils, the use of adequate starter fertilizers on these soils will help assure more high quality cotton harvested in addition to increased yield.

Rate of Nitrogen Application														
No Fertilizer	27	149	0	128	52	367	207	316	374	514	103	215	127	282
0 + 100 + 100	5	129	0	46	41	284	248	424	451	587	54	184	133	276
25 + 100 + 100	90	225	36	197	131	607	389	537	493	590	113	355	209	419
50 + 100 + 100	177	319	47	340	109	580	395	591	517	632	184	482	238	491
100 + 100 + 100	318	503	51	531	165	846	490	712	394	631	226	650	274	646

The addition of high rates of nitrogen to heavy clay (gumbo) soils in 1958 produced probably the most outstanding cotton yield responses that have been observed in several years. This striking response to nitrogen may have been a result of the wet weather conditions that prevailed in 1957 and spring and summer of 1958.

Detailed laboratory and greenhouse studies conducted by the Department of Soils at Columbia have shown that there is little nitrogen available in a heavy clay soil following an extremely wet period. This lack was shown both by direct soil analysis and crop response. Laboratory studies have indicated that available forms of soil nitrogen are denitrified by soil microorganisms during wet periods on clay soils with gaseous nitrogen being lost to the air.

These detailed nitrogen availability studies indicate that little or no available soil nitrogen existed in the gumbo soils at the beginning of the 1958 cotton season. The cool, wet summer was not conducive to nitrification or the formation of available forms of soil nitrogen. These conditions would indicate that the cotton plant was very dependent on the addition of supplemental nitrogen as a source of available nitrogen.

The addition of 100 pounds of nitrogen produced an average of 364 pounds of lint increase on the six clay soils listed above. The maturity was hastened at five locations as indicated by the greatest amount of lint being harvested at first picking from the plots treated with 100 pounds of nitrogen. These data indicate that the addition of adequate nitrogen on heavy soils during wet seasons will produce economical yield increase and hasten maturity. Favorable results were also obtained during the relatively dry season of 1956 on some of these same gumbo soils.

Rate of Phosphate Application														
No Fertilizer	27	149	0	128	52	367	207	316	374	514	103	215	127	282
100 + 0 + 100	301	641	14	393	73	733	487	708	330	584	260	526	244	598
100 + 25 + 100	271	649	54	527	85	758	431	640	367	579	201	677	235	638
100 + 50 + 100	279	473	65	583	96	839	501	697	450	683	183	492	262	628
100 + 100 + 100	318	503	51	531	165	846	490	712	394	631	226	650	274	646

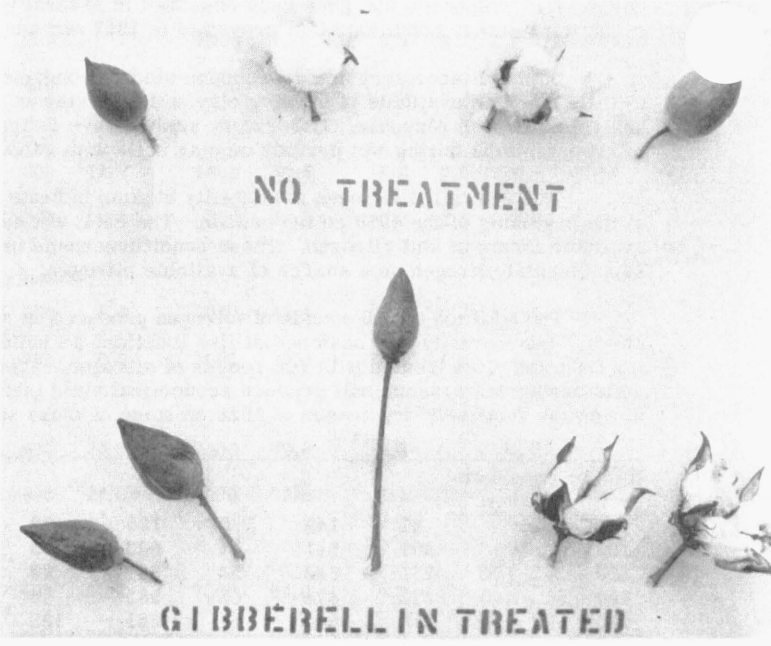
Fertilization with phosphorus increased yields and hastened maturity on four of the six experiments listed above. A study of the response to fertilization with phosphorus and the phosphorus soil test levels on the previous page indicates little or no correlation between phosphorus soil test level and yield response. However, the frequent response from phosphorus fertilization on clay soils during 1958 and previous years indicates that its use would be a sound practice. Phosphate applied at the rate of 50 pounds P_2O_5 per acre seems to be sufficient in most cases to produce the desirable yield and maturity effects.

Even though the specific need for phosphate or potash is not confirmed by varying the elements separately, as phosphate was in the experiment above, the complementary effects of these two elements when used together with nitrogen usually would justify their use.

Fertilization of cotton with adequate starter fertilizer stimulated rapid growth and earlier fruiting during the wet spring and summer months of 1958 on gumbo soils at Bragg City Experiment field.

The earlier fruiting as a result of more rapid growth during May and June produced much earlier maturing cotton and an increase in lint yield of 354 pounds. The cotton that received no starter fertilizer yielded 149 pounds of lint, and that received 100+100+100 starter yielded 503 pounds of lint.

The application of 60 pounds of nitrogen to sudan grass tripled forage yields on the heavy clay soil at the Bell City Experimental field. The soil plowed easier and contained many grass roots following the 9.1 ton yield of sudan. A management system containing sod crops may be a means of producing easier tilled gumbo soils.



The effect of Gibberellin on boll retention and yield of cotton.

	Bragg City		Bell City		Hess		Choate		French		Watkins		Average	
	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint
Rate of Potash Application														
No Fertilizer	27	149	0	128	52	367	207	316	374	514	103	215	127	282
100 + 100 + 0	251	597	69	464	108	578	381	523	423	634	234	579	244	563
100 + 100 + 25	282	674	79	489	126	860	455	675	350	611	222	483	252	632
100 + 100 + 50	300	643	72	574	116	850	420	626	383	615	195	527	248	639
100 + 100 + 100	318	503	51	531	165	846	490	712	394	631	226	650	274	646

Potash applied at a 50 pound K_2O rate increased the yield and hastened maturity on four and possibly all of the experiments on clay soils. Past experience has shown that potash response correlates to some degree with soil test potassium levels. However, even though a soil test may not show a need for potassium, the complementary benefits of potash and phosphorus, when used with adequate nitrogen, may justify the use of potash in a starter fertilizer.

The use of potassium may respond on most all clay soils in southeast Missouri during extremely wet seasons such as 1957 and 1958. The potassium needs will probably correlate better with soil test during years of near average rainfall.

Trace Mineral Application														
No Fertilizer	27	149	0	128	52	367	207	316	374	514	103	215	127	282
100 + 100 + 100	318	503	51	531	165	846	490	712	394	631	226	650	274	646
100 + 100 + 100 + 50# Trace	334	692	115	617	167	768	501	697	471	759	276	634	311	695

A trace mineral application of 50 pounds of Es-Min-El per acre produced an average lint increase of 49 pounds per acre. Similar results were obtained during 1957, but response was more erratic during the dry growing seasons preceeding 1957. It seems that more consistent response may be expected from use of trace minerals during wet growing seasons. (Project 267)

Sandy and Sandy Loam Soils

	Malden Experiment Field				Reinbott		Young		Larkin			
	No Water		Irrigated		No Water		No Water		No Water		Average	
	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint
Comparison of Starter Fertilizers												
No Fertilizer	209	405	161	347	288	392	416	565	188	391	252	420
25 + 25 + 25	265	484	206	443	407	516	318	567	322	614	304	525
50 + 50 + 50	300	560	239	551	278	415	282	576	353	654	290	551
100 + 100 + 100	257	705	213	714	387	626	253	576	228	569	268	638

Starter fertilizers are essential on some of the sandy soils for producing young healthy plants and stimulating early fruiting. The amount of starter fertilizer required is dependent upon the general fertility level of the soil. The sandy soils of the Malden experimental field possess a medium to low fertility level as indicated by the soil test data. Total lint yields were increased even where 100 + 100 + 100 starter fertilizer was used on the Malden sandy soil, but maturity was delayed where starter in excess of 50 + 50 + 50 was used.

Sandy loam and loam soils such as the Young and Larkin experimental sites, which have a medium to high fertility level, require lower amounts of starter fertilizer. A 50 + 50 + 50 starter on the sandy loam and loam soils may produce the highest total yields, but a 25 + 25 + 25 starter on many of these loamy soils with an adequate general fertility level will produce the most economical yield increase.

Rate of Nitrogen Application												
No Fertilizer	209	405	161	347	288	392	416	565	188	391	252	420
0 + 100 + 100	310	486	291	468	354	461	393	529	259	508	321	490
25 + 100 + 100	353	611	332	617	571	722	361	628	308	637	385	643
50 + 100 + 100	389	697	300	649	429	698	279	574	328	656	345	655
100 + 100 + 100	257	705	213	714	387	626	253	576	228	569	268	638

The nitrogen requirement on sandy soils for cotton seems to be somewhat consistent each year where adequate water is received. However, the nitrogen requirement of sandy loam and loam soils seems to be influenced considerably by management practices and weather conditions.

Nitrogen applied at the 50 pound rate has produced approximately the highest total yield on the sandy soil at the Malden experimental field for the past three years. However, these past data indicate that 25 pounds of nitrogen produced the most economical yield increases during the wet year of 1957 and on irrigated cotton in 1956 at the Malden location. The data from the Rienbott cooperative plot, which has a sandy soil similar to that of the Malden field, indicate that 25 pounds of nitrogen were adequate for maximum yield during 1958. If continuous cotton is grown on a sandy soil, a 50 pound nitrogen rate would probably be desirable, but rotations and good management might reduce this 50 pound requirement to a lesser amount.

The sandy loam and loam soils seem to require the least amount of supplemental nitrogen for cotton. An application of less than 50 pounds of nitrogen will probably produce the most economical yield increases on loamy soils. Good soil management practices such as rotations, including sods and cover crops, will probably further reduce the nitrogen requirement for cotton on loamy soils.

	Malden Experiment Field				Reinbott		Young		Larkin			
	No Water		Irrigated		No Water		No Water		No Water		Average	
	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint
Rate of Phosphate Application												
No Fertilizer	209	405	161	347	288	392	416	565	188	391	252	420
100 + 0 + 100	238	576	201	549	397	679	282	618	244	587	272	602
100 + 25 + 100	220	584	177	593	316	552	276	581	235	565	245	575
100 + 50 + 100	220	628	217	635	427	693	276	571	262	615	280	628
100 + 100 + 100	257	705	213	714	387	626	253	576	228	569	268	638

The average lint increase from phosphorus fertilization on the sandy and sandy loam soils indicates little response to phosphorus fertilization during 1958. But phosphate fertilization response on the Malden field showed economical yield increases with the 100 pound P_2O_5 rate producing the highest yield. The three years of cotton data on the Malden field indicate that 50 pounds of phosphate have been adequate to produce maximum yields.

There has been little or no correlation between phosphorus fertilization yield response and soil test phosphorus levels on sandy and sandy loam soils. Even though the phosphorus fertilization response is erratic, some response is usually obtained in most experiments. The data from the Young cooperative plot above indicate negative response to phosphorus fertilization; however, 0 + 40 + 40 was plowed down before planting cotton and may account for the negative response to phosphorus fertilizer in the starter.

Even though a specific need for the addition of phosphate may not be indicated by the phosphorus experiments listed above, the complementary effect of phosphorus and potassium when used with nitrogen will usually justify its use. So the frequent response from the use of phosphorus fertilizer on sandy and sandy loam soils plus the complementary benefit received when used with necessary nitrogen indicates that a 50 pound P_2O_5 rate will usually produce economical yield increases. Experimental data from previous years suggest that the use of an excessive rate of phosphate fertilizers may suppress yields below the maximum yield obtained with optimum amounts of phosphorus fertilizer.

Rate of Potash Application												
No Fertilizer	209	405	161	347	288	392	416	565	188	391	252	287
100 + 100 + 0	186	435	178	443	392	496	320	615	380	707	291	539
100 + 100 + 25	204	479	228	561	492	644	286	534	288	688	300	581
100 + 100 + 50	262	611	265	614	356	580	273	474	266	578	284	571
100 + 100 + 100	257	705	213	714	387	626	253	576	228	569	268	638
100 + 100 + 150												

The average yield of lint from the sandy and sandy loam experiments shows that the use of 100 pounds of K_2O produced the highest yield and 25 pounds of K_2O produced the earliest maturing cotton.

A review of the past three years' data at the Malden experimental field indicates that 50 pounds of potash per acre were adequate to produce a maximum yield during the dry season of 1956 where cotton was irrigated. During the relatively wet seasons of 1957 and 1958, 100 pounds of potash were required to produce maximum yield, but the maturity was slightly retarded by this high rate of potassium in some cases.

Potassium soil test levels in experiments listed above indicate some degree of correlation between potassium soil test level and potash fertilizer response. It seems that the potash fertilizer requirements on light textured soils would be influenced less by season than clay soils, but the Malden field data indicate that potassium requirements are greater on sandy soils during the years of above average rainfall. A 50 pound rate of potassium would probably be adequate on most sandy soils to produce desirable maturity benefits and near maximum yields unless the soil test indicates a critical deficiency of potassium.

Trace Mineral Application												
No Fertilizer	209	405	161	347	288	392	416	565	188	391	252	420
100 + 100 + 100	257	705	213	714	387	626	253	576	228	569	268	638
100 + 100 + 100 + 50# Traces	282	696	270	770	462	693	317	641	263	607	319	681

An average total lint increase of 43 pounds was produced on the sandy soils from the application of 50 pounds of Es-min-el. This response has been relatively consistent during the past two wet cotton seasons and on irrigated experiments during the dry season of 1956. The sandy soil at the Malden field has given rather consistent trace element response for the past years.

The cotton yield data indicate that cotton maturity may be hastened and cotton yields increased a small amount on sandy soils during wet seasons and possibly under irrigated conditions. (Project 267)

Nitrogen Alone vs. Complete Fertilizer

	Malden Experiment Field				Young		Bragg City Experiment Field		Bell City Experiment Field		Larkin		Choate	
	No Water		Irrigated		No Water		No Water		No Water		No Water		No Water	
	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint
No Fertilizer	209	405	161	347	416	565	27	149	0	128	188	391	207	316
50 + 0 + 0	253	500	212	442	371	542	174	297	0	121	369	695	321	419
50 + 100 + 100	389	697	300	649	279	574	177	319	47	212	328	656	395	591
100 + 0 + 0	221	485	209	495	293	---	198	475	0	270	360	707	316	444
100 + 100 + 100	257	705	213	714	253	576	318	652	51	403	228	569	490	712
100 + 50 + 50					304	574					391	724	393	645

These data indicate that a balanced fertilizer produces better response than nitrogen alone.

One method to determine if a particular nutrient such as phosphorus is deficient in the soil is to add various amounts of phosphorus and measure the yield response. This type of study may indicate that neither phosphorus nor potassium is deficient, yet when phosphorus and potassium are used in conjunction with nitrogen the yield is greater than where nitrogen was used separately.

The use of a complete starter fertilizer may provide complementary benefits among the various elements even on a high fertility level soil. These beneficial effects will help assure earlier maturity and higher yields than where nitrogen is used separately. (Project 267)

Source of Nitrogen

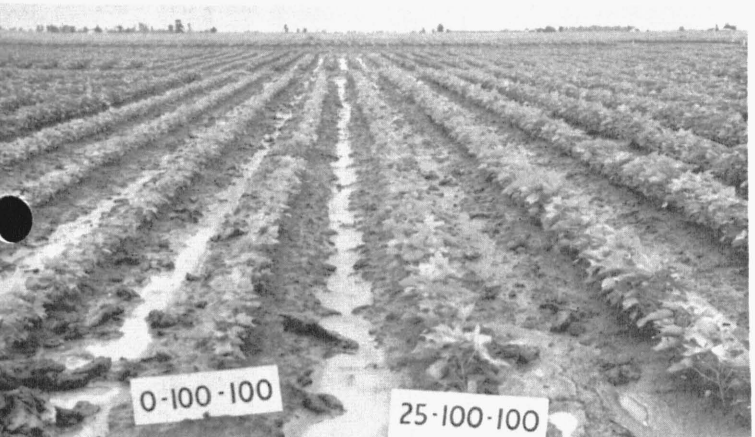
	Malden Experiment Field				Bragg City Experiment Field		Bell City Experiment Field	
	No Water		Irrigated		No Water		No Water	
	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint	1st Pick	Total Lint
No Fertilizer	103	189	80	146	32	71	0	97
0 + 100 + 100	148	289	175	279	44	83	0	63
100 + 100 + 100 (Anhydrous)	245	451	267	449	44	130	0	79
100 + 100 + 100 (Urea)	254	553	184	489	215	366	44	431
100 + 100 + 100 (Ammonium Nitrate)	218	535	214	525	216	268	75	411
100 + 100 + 100 (Sodium Nitrate)	218	585	288	602	160	261	32	312
100 + 100 + 100 (Ammonium Sulphate)	278	577	277	590	249	406	92	458

The source of nitrogen used seems to be of considerable importance, but the erratic response with seasons makes it difficult to determine the best source of nitrogen for consistently good yield response.

Ammonium nitrate and ammonium sulfate have consistently produced favorable yield and maturity results for the past three years on the sandy soil at the Malden field. During this same period on the Malden field, Urea has produced relatively low yields and late maturing cotton, whereas anhydrous ammonia and sodium nitrate have produced inconsistent results.

Similar experiments have been conducted for two years on heavy clay soils at the Bell City and Bragg City fields. Ammonium nitrate and ammonium sulfate have produced early maturing and relatively high yields during both a wet and dry season. Urea has been an acceptable source of nitrogen on these clay soils during 1956 and 1958, but has produced slightly less total yield and later maturing cotton during both a dry and wet season. Sodium nitrate has produced relatively less total yield and anhydrous ammonia has produced erratic results on these gumbo soils. (Project 267)

The use of phosphate and potash without supplemental nitrogen was not adequate on gumbo soils during the wet year of 1958.



The use of 25 pounds of nitrogen in the starter fertilizer hastened maturity and increased the lint yield 96 pounds. However, 100 pounds of nitrogen was necessary for maximum production, and produced a total lint yield of 503 pounds at the Bragg City Experimental Field.

Methods of Fertilizer Application

SUMMARY OF METHODS OF APPLICATION OF FERTILIZER ON SANDY AND CLAY SOILS

Soil Treatment*				Bell City Experimental Field		Bragg City Experimental Field		Malden Experimental Field			
								No Water		Irrigated	
Plow Down	Starter	Side Dress	Comments	1st Pick	Lbs. Lint per Acre	1st Pick	Lbs. Lint per Acre	1st Pick	Lbs. Lint per Acre	1st Pick	Lbs. Lint per Acre
(Bedded Ground on Gumbo & Plowed Ground on Malden Sand)											
1) No Fertilizer				40	371	72	128	118	205	143	302
2) 400			Broadcast before Plow Down	115	535	153	229	335	543	328	569
3) 400			Banded under bed	61	376	307	421				
4) 300	100			152	580	236	326	303	461	331	616
5)	400			78	504	220	381	313	572	313	634
6)	100	300		75	566	195	392	328	577	297	608
7)	400	40# N	June next to cotton row	40	633	298	554	200	436	224	554
8)	400	40# N 40# N	June July next to cotton row			296	574	219	470	241	534
9)	400	40# N	June center of cotton middle	34	514	307	529	214	457	229	515
10)	400	40# N	July			380	567				
11) 400	400	400		169	757	276	578	228	444	208	521
12) 0 + 48 + 0	48 + 0 + 48		Phosphate Plow Down	75	602	262	441	309	532	308	593
13) 0 + 0 + 48	48 + 48 + 0		Potash Plow Down	102	646	267	441	170	372	189	497
14)	400		Made with potassium sulfate	23	473	286	435	362	520	277	561
15) 48 + 48 + 48 (50% water Sol - P_2O_5)			Broadcast before planting	17	213	140	211	379	516	313	578
16) 48 + 48 + 48 (5% water Sol - P_2O_5)			Broadcast before planting	30	309	238	350				
17) 48 + 48 + 48 (95% water Sol - P_2O_5)			Broadcast before planting	38	388	173	286				
18) 48 + 48 + 48 (Liquid)			Broadcast before planting	32	285	139	243				
19) 96 + 96 + 96			1/2 broadcast before bedding & 1/2 broadcast before planting	81	436	198	307	294	574	241	569
Flat Planted											
20)			No Treatment			57	112				
21)	400					193	352				
22)	100	300				196	381				
23) 300	100					150	227				
24) 400						99	162				

* Expressed in 100 pounds of 12-12-12

The placement and method of applying fertilizer can be just as important as the amount and kind of fertilizer used. Proper methods of application are vital in obtaining efficient utilization of fertilizer.

The method of planting cotton will influence the method of applying fertilizer. Since most farmers plant cotton on bedded ground in heavy clay soils, the fertilizer may be applied in the bedding operation or as a starter. The data above and previous year's data indicate that cotton planted on beds produces higher yields than that planted on flat prepared seedbeds.

Some of the higher yields are associated with banded fertilizer. The data indicate that fertilizer must be applied in concentrated areas such as band application on both sandy and clay soils for maximum utilization.

The highest yields produced in the methods experiment on gumbo soils were plots that received 400 pounds of 12-12-12 starter plus additional nitrogen as a side dress. The highest yields obtained on the sandy soil at the Malden field have been from applications of 400 pounds of 12-12-12 without additional nitrogen. The nitrogen contained in this starter fertilizer is probably sufficient on this sandy soil.

The practice of broadcasting fertilizer and disking it or plowing it into the soil has produced relatively poor yields on sandy soils. The banded starter application seems to give superior results on sandy soils.

Banded applications seems to be a must on gumbo soils. The results on the Bell City and Bragg City fields indicate that no method of broadcast application is adequate. The 1956 data indicated that band application of fertilizer placed under the cotton bed produced higher yields than banded starter applications on gumbo soils. (Project 267)

INDIVIDUAL COTTON FERTILITY STUDIES

Subsoiling Experiments

(Malden Experimental Field)

Soil Treatment		Lint 1st Pick	Pounds Lint per A.	Increase Over Check
Preplant	Starter			
No Treatment		118	205	
None	400	313	572	367
Subsoiled (1)	None	227	320	115
Subsoiled (1)	400	291	517	312
Subsoiled (2) plus fertilizer deep.	400	355	594	389
Subsoiled (3) plus fertilizer deep.	400	415	618	413
Subsoiled (4)	400	258	464	259
*No Treatment		143	302	---
*None	400	313	634	332
*Subsoiled (1)	None	177	285	-17
*Subsoiled (1)	400	292	592	290
*Subsoiled (2) plus fertilizer deep.	400	333	625	323
*Subsoiled (3) plus fertilizer deep.	400	319	595	293
*Subsoiled (4)	400	212	495	193

Starter fertilizer 12-12-12

(1) Subsoiled with D4 Caterpillar 1957
(2) Subsoiled with D4 Caterpillar 1957 with 600# of liquid 8-8-8 applied deep.
(3) Subsoiled with D4 Caterpillar 1957 with 1200# of liquid 8-8-8 applied deep.
(4) Subsoiled with farm tractor.

* Irrigated with two, two inch, applications July 4th and Aug. 28th.
Auburn cotton replanted May 13th.

Sandy and sandy loam soils compact easily and form "pans" under intensive cultivation. The possibilities of increasing yields by breaking this "pan" through subsoiling have been considered. The results of the subsoiling experiment under non-irrigated conditions indicates that subsoiling increased the yield where no fertilizers were used, but decreased the yield where a starter fertilizer was used. Subsoiling may have decreased the yield under irrigated conditions and caused the amount of fertilizer necessary for optimum yields to be increased. Since only two supplemental irrigations were required during 1958, the effectiveness of subsoiling upon water requirements is difficult to determine, but a comparison of the irrigated and non-irrigated results suggest that less irrigation would have been necessary where the soil has been subsoiled. (Project 267)

Time of Fertilizer Application

(Malden Experimental Field)

	Soil Treatment			Lint 1st Pick	Pounds Lint per A.
Starter	Sidedressed July 3	Sidedressed July 16	Sidedressed Aug. 4		
100 + 100 + 100				378	638
75 + 100 + 100	25# N			291	578
50 + 100 + 100	25# N	25# N		326	592
25 + 100 + 100	25# N	25# N	25# N	300	565
0 + 100 + 100	100# N			363	610
0 + 100 + 100		100# N		391	601
0 + 100 + 100			100# N	380	624
25 + 25 + 25	25 + 25 + 25	25 + 25 + 25	25 + 25 + 25	337	570
50 + 50 + 50	25 + 25 + 25	25 + 25 + 25		285	508
25 + 25 + 25	25 + 25 + 25	50 + 50 + 50		327	555
	25 + 25 + 25	75 + 75 + 75		261	487
25 + 25 + 25	0	25 + 25 + 25	50 + 50 + 50	350	562
200 + 100 + 100			0 + 200 + 0	265	531
200 + 100 + 100				249	548
200 + 100 + 100			0 + 200 + 0 (Aug. 24)	253	535

Starter fertilizer applied close to row in band after planting June 11th.
Irrigated July 2nd and August 28th with 2 inches at each application.
Replanted Auburn 56 Cotton May 15 and irrigated to stand May 31st.

Leaching of plant nutrients on sandy soils seems to be excessive during periods of heavy rainfall. Applying a portion of the fertilizer at planting time and the remainder at fruiting time would avoid a portion of the leaching problem on sandy soils. The application of readily available nutrients at fruiting time might also be beneficial to cotton fruiting.

The time of nitrogen application didn't seem to be critical, but delaying application of the complete fertilizer depressed yields. Further study needs to be conducted on this experiment for more conclusive data. (Project 267)

Cover Crops

(Malden Experimental Field)

*Soil Treatment			Rye & Vetch		**No Cover Crop	
Topdressed December	Topdress Cover Crop March	Fertilizer Applied to Cotton	1st Pick	Total Lint	1st Pick	Total Lint
		100# N (50# N at planting; 50# N Sidedressed)	366	433	185	342
25# Nitrogen		75# N (25# N at planting; 50# N Sidedressed)	424	490	225	361
50# Nitrogen		50# N Sidedressed	445	488	214	344
100# Nitrogen		No Nitrogen	438	466	110	173
	25# Nitrogen	75# N (25# N at planting; 50# N Sidedressed)	337	391	183	308
	50# Nitrogen	50# N Sidedressed	252	325	149	250
	100# Nitrogen	No Nitrogen	296	356	133	184
50# Nitrogen	50# Nitrogen	50# N Sidedressed	343	421	96	177
		100# N (Urea) (50# N at planting; 50# N Sidedressed)	388	468	171	275
50# N (Urea)		50# N (Urea) Sidedressed	366	423	53	118
No Cover Crop		200# 6-24-24 at planting; 100# N (50# N at planting; 50# N Sidedressed)	273	352	175	340

Planted Auburn Cotton May 12th.

* 200# 6-24-24 applied to cover crop at seeding except plot on which no cover crop was planted.
** Ryegrass was winter killed whereas a heavy crop of ryed vetch was plowed under. Irrigated July 4th and Aug. 28th with 2" at each application.

Cover crops are important on sandy soils to add organic matter and prevent leaching during periods of high rainfall in winter and spring months.

Yields averaged approximately 100 to 200 pounds more lint per acre where a rye and vetch cover crop was turned under previous to cotton planting. The highest yields were obtained where one-fourth to one-half of the nitrogen was applied on the cover crop in December and the remainder applied directly to the cotton crop. The data show that a good cover crop definitely reduces leaching of nitrates during winter months.

Good soil management practices also produce desirable effects on gumbo soils. Even though leaching may not be a problem on gumbo soils, cover crops aid in aeration, and the crop residue and roots help produce better soil structure.

A rotation experiment at the Bell City experimental field has shown that adequate nitrogen will triple forage yields of Sudan grass during a wet summer on gumbo soils. When the Sudan forage was removed and the soil plowed, many more roots were noticed in the soil of the fertilized Sudan. The soil of the fertilized Sudan was cracked and well aerated and plowed much easier than an adjacent field of gumbo that had not produced a forage crop. Gumbo that was plowed deep during June 1958, and planted to soybeans was much easier to bed during December 1958, than an adjacent field that was bedded and produced a cotton crop.

Much of the natural soil organic matter that was in the gumbo soils at time of clearing has been removed by the intensive farming practices followed in the Delta area. If better soil management practices are not followed, this soil will probably become more hazardous and difficult to farm. (Project 231)

Effects of Gibberellin on Boll Retention.

Gibberellin, a growth-stimulating plant hormone, was studied at the Sikeston Station during 1958. Past experience with cotton has shown that only 30 to 50 percent of the flowers or blooms are set and harvested as a mature boll. Yet, agricultural scientists in other states have shown that treating young cotton blooms and bolls with gibberellin solutions could result in 90 percent of the blooms being set and harvested. The increase in fruit set by treating with gibberellin indicated a possible potential yield increase of from 200 to 300 percent.

Various concentrations and methods of applying gibberellin to cotton were used. The yield and fruiting results obtained from the various combinations of treatments are presented below.

	No Treatment	Young Boll Application			Flower Application		
		10 ppm	100 ppm	2000 ppm	100 ppm	500 ppm	200 ppm
% of flowers that dropped	43.6	12.8	9.1	11.7	14.6	11.7	16.9
Average days from bloom to drop	11.8	12.6	13.8	16.0	16.0	17.4	16.4
% of flowers that matured	56.4	87.2	90.9	88.3	85.4	88.3	83.1
Average days from bloom to harvest	69.1	67.5	67.3	69.5	68.2	70.8	69.3
Bolls per pound	74	110	112	128	133	132	146
Pounds seed cotton/acre*	2810	1781	1828	1719	1511	1555	1435

* Calculated yield

Approximately 90 percent of the young bolls treated with gibberellin "set" and matured, whereas only 56 percent of the non-treated bolls "set" and matured. This decrease in shedding of fruit indicated that the yield might have increased 150 percent. However, the yield per boll was inferior on the treated plants as indicated by the "bolls per pound" data and the general appearance of the treated bolls in the picture. The calculated yield of seed cotton indicates that the treated plants yielded less cotton, and this lower yield is probably accounted for by the small, poor quality bolls. (Project 267)

Nutrition and Water Requirements

Fundamental studies of cotton fertility and water requirements were conducted in 20 gallon pots at the Southeast Missouri Research Center. The effects of fertility and moisture levels on cotton yield and fruiting habits are presented in the table below.

Soil Treatment	Av. Days from Bloom to Fruit Drop			Percent Fruit Set			Av. Days from Bloom to Maturity			Yield in Gms. Seed Cotton/Pot		
	50%	100%	100%	50%	100%	100%	50%	100%	100%	50%	100%	100%
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
No Fertilizer + Lime	4.8	4.8	6.8	28	34	32	48	60	57	24	18	25
50 + 50 + 50 + Lime	2.6	4.5	3.3	61	50	70	51	57	58	72	99	87
100 + 100 + 100 + Lime	4.3	4.7	3.5	42	53	43	51	56	56	56	91	118
100 + 100 + 100 + Lime + Trace Mineral Mix	4.5	3.9	3.1	40	50	55	77	56	56	64	127	125

(1) 50% available moisture maintained.
(2) 100% moisture with leachate discarded.
(3) 100% moisture with leachate returned to pot.

Cotton was grown in 20 gallon pots containing soil from the Malden field. This study was established to determine why high yields produced from supplemental irrigation or wet weather one year tend to suppress yields the following year on the same field. This study will need to be continued for possibly two to three years before an observation of the suppressed yields from the preceding year's weather can be determined.

The data received from the experiment this first year show that approximately five additional days are required for boll maturity under high moisture conditions. Greater response from fertilizer was received under high moisture conditions on this sandy soil. A yield response to trace elements was indicated under each of the three moisture conditions.

Light Sandy Loam

Soil Treatment	1st Pick	Total Lint	Lint Increase
None	382	453	---
100 + 100 + 0	738	898	445
100 + 100 + 25	752	943	490
100 + 100 + 50	762	933	480
100 + 100 + 100	634	863	410
100 + 100 + 150	722	903	450

Purpose of this experiment at the Diehlstadt field was to determine the response of fertilizer on a light sandy soil. This soil is heavily infested with the fusarium wilt-nematode complex which is very detrimental to cotton production. The addition of various rates of potassium fertilizer was used to determine the influence of the soil potassium level on cotton yield on a wilt infested soil. The soil type was Bertrand sand.

High rates of nitrogen and phosphorus approximately doubled the cotton yield, but the addition of 25 pounds of potassium per acre seemed to be adequate. However, this soil tested high in potassium, so better response might be expected on a lower potassium level soil. This experiment indicated that no benefit from excessively high rates of potassium fertilizer would be obtained on wilt infested soils, where a fusarium wilt resistant variety of cotton was grown. Further study is needed. (Project 267)

Application of Fertilizer to Cotton in Irrigation Water

The purpose of this experiment on the Charles Gardner Farm, 4 miles southeast of Matthews, was to determine the effects of applying readily available fertilizer to cotton at time of fruiting. Soil type on the plot site was Dexter sandy loam. Nitrogen solution, mixed fertilizer solution, and liquid phosphoric acid were applied through furrow irrigation water at different times. The highest yield was obtained from the plot that received 100 pounds of nitrogen in the irrigation water on July 8, and a combination of 800 pounds of P_2O_5 on August 11 and 29 as phosphoric acid in furrow irrigation water. The heavy rate of phosphoric acid was applied to stimulate early maturity, but no beneficial effects were observed.

Soil Treatment*	Lint - 1st Picking	Pounds Lint/Acre	Increase Over Check
None	682	944	---
(1) 25 + 0 + 0	725	1107	163
(1) 50 + 0 + 0	741	1068	124
(1) 100 + 0 + 0	736	1129	185
(1) (2) 100 + 800 + 0	780	1151	207
(3) 25 + 25 + 25	784	1068	124
(3) 50 + 50 + 50	818	1102	158

* Vetch plowed down and 16 + 48 + 16 starter used; Variety Fox planted May 10, 1958.

(1) 28% N solution was applied in furrow irrigation on July 8.
(2) Phosphorus applied as liquid phosphoric acid in furrow irrigation on August 11 and 29.
(3) Solution 8-8-8 applied in furrow irrigation on July 8.

(Project 267)

SOYBEAN FERTILITY EXPERIMENTS

Soybean fertility experiments were conducted at four locations during 1958. One fertility experiment indicated that the addition of balanced plant food according to soil test would increase the yield approximately 10 bushels on a soil that was initially low in fertility. The other experiments were designed to test the response of soybeans to treatment with organic materials in addition to inorganic elements and some response was indicated.

The two experiments included treatment with organic and inorganic materials on a sandy and heavy clay soil. The treatment with organic materials was speculative to determine if some amino acid or unknown factor within the material would produce a yield response. Heavy rainfall and late planting caused the yields to be erratic. However, soybeans treated with dried skim milk and soybean meal on the sandy soils produced yield increases that probably are significant. The apparent response to dried skim milk could be seen during the two months previous to harvest, so indicates that the 5.6 bushel increase is significant. Even though these organic materials would not be economical to use, they offer a means of learning more about the fertility requirements of soybeans. It appears that hydrated lime banded beside the soybean row may have given a small yield increase at both experimental locations.

	Bragg City Field		Diehlstadt Field	
Soil Treatment	Average Bu./Acre	Increase Over no Treatment	Average Bu./Acre	Increase Over no Treatment
Dried skim milk, 200 lbs./A	23.4	0	35.4	5.6
Tankage, 200 lbs./acre	26.0	2.6	31.7	1.9
Soybean meal, 200 lbs./acre	25.6	2.2	32.9	3.1
Cottonseed meal, 200 lbs./acre	25.7	2.3	30.5	.7
Alfalfa meal, 400 lbs./acre	26.9	3.5	28.8	-1.0
No treatment	23.4	--	29.8	--
25 + 75 + 75	---	--	31.0	1.2
Hydrated lime, 400 lbs./acre	25.3	1.9	33.1	3.3
Hydrated lime, 800 lbs./acre	26.5	3.1	---	--
Rock phosphate, 400 lbs./acre	26.3	2.9	31.7	1.9
Rock phosphate, 800 lbs./acre	26.9	3.5	---	--
Gypsum, 400 lbs./acre	26.9	3.5	32.1	2.3
Gypsum, 800 lbs./acre	26.9	3.5	$MgSO_4$ used on stand instead of dolomite	
Dolomite, 400 lbs./acre	25.5	2.1		
Dolomite, 800 lbs./acre	23.9	0.5	31.2	1.4
Iron sulfate, 25 lbs./acre	23.8	0.4	29.5	-0.3
Copper sulfate, 25 lbs./acre	25.6	2.2	31.0	1.2
Zinc sulfate, 25 lbs./acre	25.4	2.0	29.2	-0.6
Manganese sulfate, 25 lbs./acre	23.1	-0.3	31.1	-1.3
Borax, 40 lbs./acre	22.7	-0.7	25.7	-4.1
Trace element mixture, 50 lbs./acre	22.7	-0.7	30.4	0.6

SMALL GRAIN FERTILITY EXPERIMENTS

The application of fertilizer to small grain has resulted in higher yields and increased interest in small grain production. Starter fertilizer with a relatively low nitrogen (6-24-24) content plus additional nitrogen topdressed in the spring, produced profitable yields of wheat on the sand and gumbo soils of Southeast Missouri.

A summary of the data from the past three years shows a complete starter fertilizer is essential in small grain production. On the sandy soils the bulk of the nitrogen should be topdressed in the spring, whereas on the heavier or clay soils, earlier applications are satisfactory. A total fertilizer application of 75+36+36 proved to be profitable on most of the different soil types.

The application of a 9+36+36 starter fertilizer at seeding has been sufficient for maximum utilization of additional nitrogen. A 132 pound application of nitrogen produced the highest yield on this sandy soil, but a 66 pound application has appeared to be the most economical during the past three years.

SMALL GRAIN FERTILITY EXPERIMENT - WHEAT 1958
EFFECT OF STARTER FERTILIZERS

Plot	Soil Treatment Fertilizer at Seeding	*Top Dressed	Bu./Acre
1	No Fertilizer		12.5
2	300# 12-12-12		16.5
5	300# 3-12-12		14.5
6	33# N Ammo Nitrate		14.0
7	300# 3-12-12 + 33# N		16.0
12	66# N		16.5
13	300# 3-12-12 + 66# N		20.0
14	300# 3-12-12 + 100# N		27.0
15	300# 3-12-12	33# N December	24.0
22	300# 3-12-12	33# N Spring	29.0
23	300# 3-12-12	66# N Spring	32.0
24	300# 3-12-12	100# N Spring	34.0
25	300# 3-12-12	132# N Spring	34.0

* Ammonium nitrate used as a source of nitrogen.

The yields were probably limited in this experiment because of low nitrogen supply. The comparison of three 1-1-1 ratio fertilizers indicates that there is little difference on sandy soils.

COMPARISON OF 1-1-1 RATIO STARTER FERTILIZERS

Plot	Soil Treatment Fertilizer at Seeding	Bu/Acre
1	No Fertilizer	12.5
5	300# 3-12-12	14.5
2	300# 12-12-12*	16.5
3	300# 12-12-12**	16.5
4	300# 12-12-12***	16.4

* 50% water soluble phosphate
** 5% water soluble phosphate
*** 95% water soluble phosphate

A 132 pound nitrogen application produced the highest yield when adequate starter fertilizer was used. However, the past three years' data indicate that a 66 pound application of nitrogen applied in the spring produced the most economical yields where sufficient starter was applied at seeding.

RATE OF NITROGEN APPLICATION

Fertilizer at Seeding	Time of Nitrogen Application: At Seeding Bu./Acre	Time of Nitrogen Application: Spring Bu./Acre
No fertilizer	12.5	12.5
300 lbs. 3-12-12	14.5	14.5
300 lbs. 3-12-12 + 33 lbs. N	16.0	29.0
300 lbs. 3-12-12 + 66 lbs. N	20.0	32.0
300 lbs. 3-12-12 + 100 lbs. N	27.0	34.0
300 lbs. 3-12-12 + 132 lbs. N	---	34.0

The time of applying nitrogen in Southeast Missouri has appeared to definitely be in favor of topdressing in spring on sandy and clay soils. However, the difference in yields has not been as great on clay soils as sandy soils. During the past three years there has been little difference in yield caused by the source of nitrogen used when topdressed in the spring.

EFFECT OF TIME OF NITROGEN APPLICATION

Fertilizer at Seeding	Source of Nitrogen	Applied at Seeding Bu./Acre	Applied in December Bu./Acre	Applied in March Bu./Acre
No fertilizer		12.5	12.5	12.5
300 lbs. 3-12-12		14.5	14.5	14.5
300 lbs. 3-12-12	33 lbs. (Ammon. nitrate)	16.0	24.0	29.0
300 lbs. 3-12-12	33 lbs. (Ammon. sulfate)	16.0	24.0	21.0
300 lbs. 3-12-12	33 lbs. (Urea)	15.0	26.0	25.0
300 lbs. 3-12-12	33 lbs. (Sodium nitrate)	13.0	18.0	26.0

A starter fertilizer is necessary for efficient utilization of high rates of nitrogen on a sandy soil. The data indicate that there is no advantage in applying over 33 pounds of nitrogen where a starter fertilizer is not used.

EFFECT OF NITROGEN WITHOUT STARTER ON WHEAT

Plot	Soil Treatment Fertilizer at Seeding	Top Dressed	Bu/Acre
1	No Fertilizer		12.5
5	300# 3-12-12		14.5
7	300# 3-12-12 plus 33# N		16.0
6	33# N		14.0
13	300# 3-12-12 plus 66# N		20.0
12	66# N		16.5
22	300# 3-12-12	33# N Spring	29.0
8		33# N Spring	25.0
23	300# 3-12-12	66# N Spring	32.0
16		66# N Spring	26.0
24	300# 3-12-12	100# N Spring	34.0
26		100# N Spring	29.0

CORN FERTILITY EXPERIMENTS

Corn fertility experiments were conducted at the Malden and Bragg City fields in 1958. These experiments are a part of a regional project of the North Central States on the response of corn to time and rate of application of different sources of nitrogen. The extremely wet conditions at the Bragg City field caused the corn to yield very poorly. However, the yields at the Malden field point out how critical the leaching of nitrogen is on a sandy soil during winter months. The data indicate that nitrate nitrogen leaches more freely than ammonia nitrogen.

Nitrogen*	Malden Field				Bragg City Field			
	Grain		Stover		Grain		Stover	
	Bu./A	% N	Lbs./A	% N	Bu./A	% N	Lbs./A	% N
None	26.4	.95	2640	.60	11.1	1.23	1534	.64
Fall, nitrate 40 lbs. N/A	28.6	.99	2530	.58	13.3	1.25	1367	.70
Fall, ammonia 40 lbs. N/A	53.9	.99	3700	.50	18.3	1.23	1368	.57
Spring, nitrate 40 lbs. N/A	50.9	1.01	3600	.49	16.5	1.16	1853	.59
Spring, ammonia 40 lbs. N/A	71.9	1.06	4300	.58	13.8	1.16	1430	.60
Fall, nitrate 80 lbs. N/A	31.6	1.02	2900	.44	12.8	1.22	1102	.49
Fall, ammonia 80 lbs. N/A	61.3	1.20	3870	.79	17.5	1.15	1113	.64
Spring, nitrate 80 lbs. N/A	75.8	1.21	4800	.58	14.1	1.21	1084	.52
Spring, ammonia 80 lbs. N/A	77.8	1.40	5000	.77	13.3	1.23	956	.61

* Ammonia source was ammonium sulfate
Nitrate source was calcium nitrate