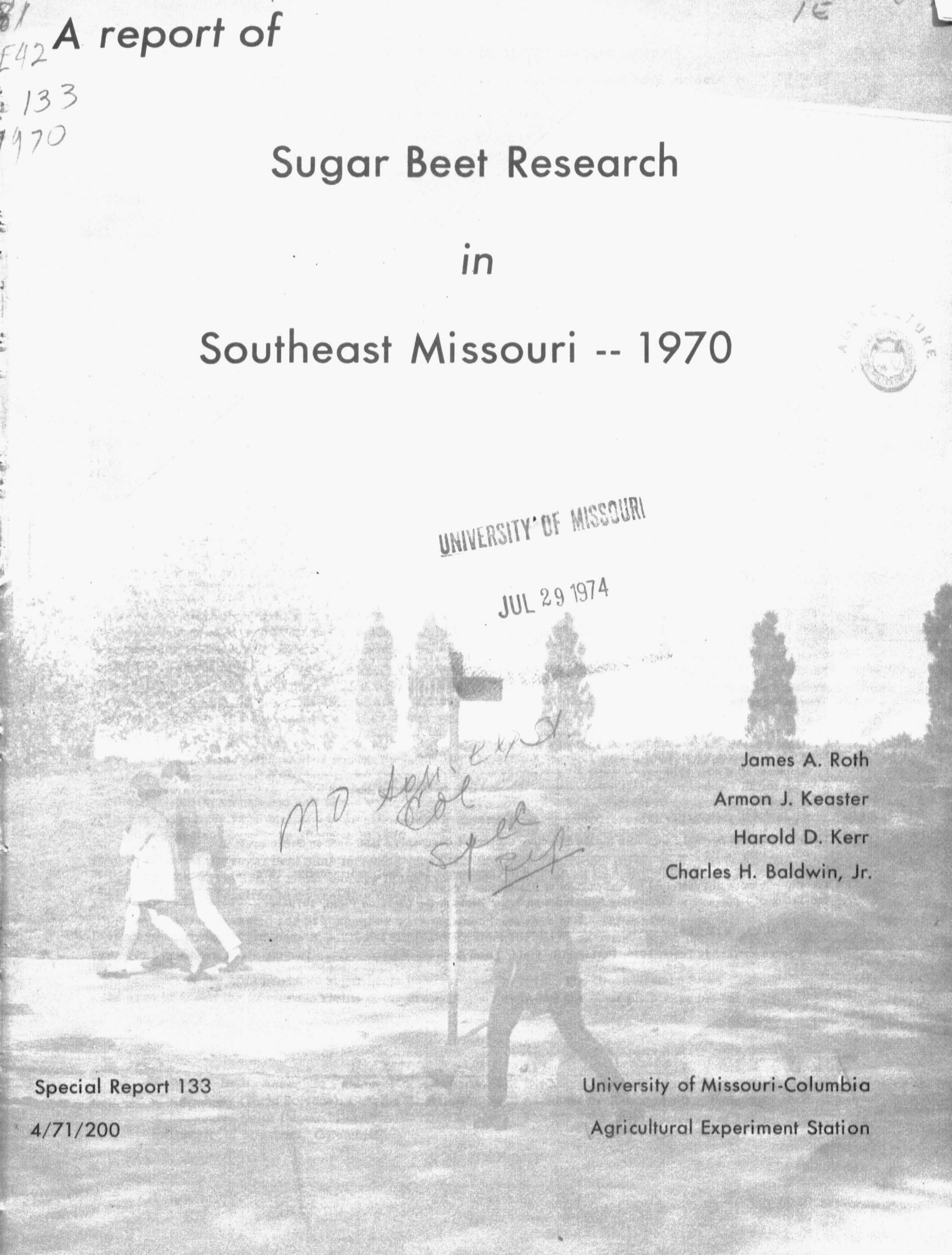
A report of

Sugar Beet Research

in

Southeast Missouri -- 1970



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SUGAR BEET RESEARCH IN SOUTHEAST MISSOURI 1970

James A. Roth, Harold D. Kerr, Armon J. Keaster and Charles H. Baldwin, Jr.

SUMMARY

Sugar beet research was conducted by the University of Missouri Agricultural Experiment Station at the Delta Center near Portageville in 1970. Experiments included varieties, chemical weed control, soil fertility, row spacing, plant population, fumigants, fungicides for control of Cercospora leaf spot, and Rhizoctonia root rot.

Yields of beets varied from 8.4 to 36.1 tons in the experimental plots. The highest yields were obtained on the clay soil. Herbicides effectively controlled weeds when applied preemergence and postemergence. Variety tolerance and foliar fungicide sprays were very effective in control of Cercospora leaf spot. Deep cultivation after emergence of sugar beets improved penetration of the supplemental irrigation water.

Six farmers in the area grew sugar beets on a commercial scale. The beets were shipped to Colorado for processing. Yields from these crops were disappointing as compared to the yields obtained at the Delta Center.

INTRODUCTION

The research involving sugar beets in 1970 included three different soils of the Delta Center experiment fields. The Portageville Field has two soils, one of which was a Tiptonville silt loam or clay loam with a sandy loam overwash phase and is referred to in this report as the "Loam" soil. The other soil on the Portageville Field was of the Sharkey clay type and is referred to as the "Clay" soil in this report. Experiments at the Clarkton Field were on a Beulah fine sandy loam soil which has a low water holding capacity requiring frequent irrigations.

The clay soil on the Portageville Field has produced continuously the higher yields of beets relatively free of Cercospora leaf spot. This soil has a high water holding capacity and the need for irrigation was only a fraction of the requirements of the loam soil at the Portageville Field or sandy soil of the Clarkton Field. The clay soil is very difficult to till and preparation of the seedbed the previous fall or winter has been essential for early planting on this soil.

The loam soil on the Portageville Field consists of a texture that is desirable to till but compacts easily during a rain which renders the soil practically impervious to supplementary irrigations. Deep cultivations, using chisel plow shanks, following thinning improved water penetration in 1970 and reduced number of irrigations. Cercospora leaf spot has been a serious problem on the loam soil, but resistant varieties combined with fungicide sprays have eliminated the damage caused by the disease.

The sandy soil of the Clarkton Field has not been as desirable as the other two locations for production of sugar beets. This soil is infested with root knot nematodes (Meloidogyne spp.) and has required fumigation which adds considerably to the production costs. Selections were made from sugar beets grown on this soil for resistance to the nematode, but after additional screening in the greenhouse none was found resistant to the nematode. In 1970 a fumigation study was conducted and only the plots fumigated with DD survived an attack of foliar anthracnose. The production of sugar beets on the sandy soils would be very desirable in the operation of a sugar mill to insure a steady supply of beets during harvest. Beets on the sandy soil may be harvested soon after a rain while the other soils may be too wet for harvesting equipment to operate.

Irrigation was available and required at all locations in 1970. The row method was used on the graded land of the Portageville Field and sprinklers were used at the Clarkton Field. The 1970 growing season was dry and several irrigations were applied at each location.

All experiments, except one half of the variety tests, were sprayed with a fungicide to control Cercospora leaf spot disease. Various fungicides were included in an experiment to determine their effectiveness in the control of leaf spot disease. Duter and Benlate were very effective in 1970.

Surveillance of the sugar beet plots indicated very little damage from insects during 1970. Feeding by blister beetles (Epicauta spp.) resulted in minor damage in the experimental plots on the Portageville Field. Three sprayings with an insecticide were required to control this insect.

The beets were harvested and pulp samples were obtained from each plot. These samples were frozen and shipped to The Great Western Sugar Company Experiment Station laboratory for purity analysis. Sugar determinations were made in the station laboratory at Portageville.

Six farmers of the area produced sugar beets commercially in 1970. The Great Western Sugar Company had a field man in the area to assist the growers. Yields of the growers plots were low and other plots were not harvested completely because

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of extremely wet weather.

1970 completes ten years of research in sugar beets at the Delta Center. With this much research in the background it is the consensus of the authors that sugar beets can be economically produced in southeast Missouri. The most evident problem of major importance has been the damage caused by the various root rots that have reduced the stand of beets. Additional research in the use of fungicides, development of varieties, and improved cultural practices needs to be conducted. This does not mean that all other problems have been solved but considerable progress has been made in the selection of varieties, fertilizing, mechanical thinning, and cultural practices in adapting the crop to Missouri.

Harvesting techniques need to be improved as the beets grown in southeast Missouri have protruded above the ground level more than they do in other areas. Machinery used in the western states has not been acceptable as many beets are pushed to the side and do not enter the harvester. Actually these beets required considerably less power to harvest than beets growing in the soil to the depth of the crown.

ACKNOWLEDGEMENT

The authors wish to acknowledge consultation, supply of materials and financial assistance provided by The Great Western Sugar Company, Cities Service Foundation, Shell Development Corporation, Mobil Chemical Company, PPG Industries, Chemagro Corporation, and E.E. Dupont de Nemours.

These experiments were conducted and reported under Missouri AES Project 7033-3720 "Sugar Beets", Agronomy Department, Roger L. Mitchell, Chairman.

SUGAR BEET VARIETY EXPERIMENTS IN SOUTHEAST MISSOURI 1970

James A. Roth and Thomas E. Fisher[1/]

Sugar beet variety tests in 1970 included two tests on each of the "Loam" soil (Tiptonville series) and the "Clay" soil (Sharkey series) of the Portageville Field of the Delta Center. One test was sprayed periodically with a fungicide to control Cercospora leaf spot whereas the second test at each location was not sprayed so as to determine natural resistance of each variety. All tests were on soil which had been graded so drainage and row irrigation was feasible.

Planting was completed by April 10 which was a later date than was planned. Extremely wet soil prevented plantings in March which would have been most optimum for maximum sugar beet production. The beets were planted in 26-inch rows on the flat, but depressions made by the tractor tires provided ample drainage on these plots. Planting during the past two seasons has been done on the clay soil with no seedbed preparation at time of planting. This year due to the late planting on the clay soil weeds had emerged which were killed by 1/2 lb/A of paraquat applied before the sugar beets had emerged. Seedbed preparation on the clay soil must be done in fall or winter so that the soil has time to be firmed and mellowed by rainfall and alternating temperature prior to planting. Seedbed preparation on the loam soil can usually be accomplished at time of planting but prior preparation is usually more desirable.

Fertilizer (50 N + 100 P_2O_5 + 100 K_2O + 2 Boron) was broadcast over all plots on the clay soil soon after planting with later applications of sidedressed nitrogen. On the loam soil the complete fertilizer was broadcast and disc in before planting with additional nitrogen sidedressed soon after thinning and in July. The total amount of nitrogen (225 pounds) was an excessive amount for the following extremely wet fall season. This resulted in high yields but the sugar content was lower than desired. Tissue tests during the summer indicated a need for the additional nitrogen but proved to be an erroneous indication at time of harvest. The plants turned dark green in color indicating excessive available nitrogen during September and October.

The experimental design of the four experiments was a randomized block with nine varieties and six replications planted in four row plots. Each row of the four row plots was harvested for yield and stand counts. Two of the rows were sampled for sugar and purity determinations.

A preemergence herbicide (Pyramin) was applied on the tests on the clay soil followed by an application of Treflan after thinning. On the silt loam soil the application of Treflan after thinning was the only herbicide used.

Irrigation water was applied two times on the clay soil and six applications on the loam soil which may have been excessive but it was desirable to be assured that water was not limiting production.

Spraying of a fungicide (Benlate) to control leaf spot improved yield and sugar percentage as compared to the plots which were not sprayed. All varieties tested were affected by leaf spot as indicated by the leaf spot rating. Ratings increased as infection increased (1 = 0 infection and 10 = 100% infection or leaves completely infected).

The yields of sugar beets on the loam soil compared similarly with yields on the clay soil. Yields on the clay soil previously have been above yields on the loam. Yield data was adjusted as if all plots were of uniform stand. Plant skips equal to or in excess of three feet were eliminated in measuring length of row harvested whereas skips less than three feet were ignored.

Southern blight (Sclerotium rolfsii) caused considerable damage to the stand of beets on the clay soil. The percent beets that died during the season ranged from 10% to 31%. This disease could be very serious and additional research will be required to determine methods of control or to develop resistant varieties. Varieties did vary in their susceptibility to southern blight and the 68MSH614 variety appeared to be the most resistant of the varieties tested in 1970.

The testing and selection of sugar beet varieties adapted to southeast Missouri is an essential part of the sugar beet research program. Through selection and breeding, improved varieties are possible that will be more adapted to the climatic conditions of the area.

The assistance of Dr. A. W. Erichsen of the Great Western Sugar Company Experiment Station is acknowledged in supplying the variety test seed, experimental design, and computation of the data.

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SUGAR BEET VARIETY TEST ON THE CLAY SOIL AT THE PORTAGEVILLE FIELD - 1970

Variety	% Dead Beets	Beets/100 ft.	% Sugar	% Juice Purity	Leaf Spot Rating[1]	Yield/A (tons)
A402-64R	26.5 a[3]	151 ab	12.8 a-d	90.4 ab	5.7 ab	25.0 ab
702H9	25.3 a	175 a	13.0 ab	91.0 a	3.8 c	30.1 a
68MSH131	23.9 a	173 a	12.1 e	89.2 b	6.5 a	30.9 a
68MSH613	21.9 a	138 b	13.5 a	91.0 a	4.8 b	28.4 ab
68MSH614	14.0 a	135 b	13.1 a	90.2 ab	5.5 ab	26.0 ab
67MSH128	24.0 a	165 a	12.9 abc	90.3 ab	6.3 a	25.5 ab
69MSH141	22.5 a	172 a	12.4 b-e	90.5 ab	6.5 a	25.2 ab
68MSH110	28.4 a	151 ab	12.2 de	90.1 ab	6.2 a	23.8 b
69MSH113	14.2 a	168 a	12.3 cde	89.4 b	5.7 ab	25.9 ab
Mean	22.3	158	12.7	90.2	5.7	26.7
Minimum Least Significant Range(L. S. D.)(.05)	14.6	20.8	0.6	1.35	0.9	5.2
Maximum Least Significant Range	17.0	24.2	0.7		1.0	6.0
Coefficient of Variance	55.9%	11.2%	4.2%	1.3%	13.3%	16.5%
			SPRAYED TEST[2]			
A402-64R	16.7 bc	147 b	13.6 b	90.7 ab	1.2 a	33.9 ab
702H9	30.7 a	176 a	14.0 ab	90.3 ab	1.0 a	36.1 a
68MSH131	23.7 ab	179 a	14.3 a	90.6 ab	1.0 a	29.3 c
68MSH613	16.9 bc	125 c	14.1 ab	91.3 a	1.2 a	33.7 ab
68MSH614	10.8 c	115 c	14.3 a	90.5 ab	1.2 a	30.7 bc
67MSH128	16.3 bc	163 ab	14.0 ab	90.0 ab	1.0 a	32.5 abc
69MSH141	20.5 abc	152 b	13.6 b	89.9 b	1.0 a	32.0 abc
68MSH110	14.0 bc	160 ab	14.0 ab	90.6 ab	1.2 a	30.3 bc
69MSH113	16.6 bc	157 ab	13.6 b	90.0 ab	1.2 a	32.2 abc
Mean	18.4	153	13.9	90.4	1.1	32.3
Minimum Least Significant Range(L. S. D.)(.05)	10.2	22	0.5	1.30	0.3	3.8
Maximum Least Significant Range	11.9	26	0.6		0.4	4.4
Coefficient of Variance	47.4%	12.3%	3.1%	1.2%	28.4%	10.0%

Planted: April 10.
Experimental Design: Randomized Complete Block, six replicates.
Fertilizer: 50 N + 100 P_2O_5 + 100 K_2O + 2 Boron broadcast over all plots. 100 N sidedressed May 27 and 75 N sidedressed June 29.
Row Irrigated: July 9 and 30.
Fungicide: (Spray Test Only) Sprayed June 18; July 9, 30; August 13, 27; September 10 and 24.
Herbicide: Pyramin Paraquat applied preemergence and Treflan applied after thinning and cultivated in.
Harvested: November 3 and 4.

1/ Cercospora leaf spot readings from 1 (low) to 10 (high).
2/ Sprayed with Benlate (3 oz ai) fungicide to control cercospora leaf spot. (Test above was not sprayed).
3/ Duncan's New Multiple Range Test: Results followed by same letters are not significantly different (.05).

OBJECTIVE: To determine the most adapted varieties to southeast Missouri conditions and to assist in the development of improved varieties.

PROCEDURE: Two variety tests were planted on each of the clay soil and the loam soil located at the Portageville Field. One test on each of the soils was sprayed with a fungicide to control leaf spot whereas the second test was not sprayed so that natural resistance could be determined. Fertilizer and irrigation were applied at optimum rates so that these would not limit yields. Beets were planted in 26 inch rows at an excessive rate to assure a stand and then thinned to an approximate eight inches between plants. Herbicides were used preemergence and post emergence to control weeds. Insecticide spray was applied once to control blister beetles during the season. Plans included harvesting mechanically but due to excessive rainfall both tests were harvested by hand. The four rows of each plot were harvested separately so that yield and stand data were obtained on the individual rows. Sugar percent and purity analysis were determined from samples obtained from two center rows of each plot.

RESULTS: Spraying resulted in an increase in sugar percentage and yield as compared to the non-sprayed test. Leaf spot was reduced to a minimum by fungicide sprays during the season. As indicated by percentage dead beets the sprayed test had a lower percentage of beets affected by southern blight or other root rot diseases. The 68MSH614 appeared to be somewhat resistant to southern blight as compared to the other varieties tested.

SUGAR BEET VARIETY TEST ON THE LOAM SOIL AT THE PORTAGEVILLE FIELD - 1970

Variety	Beets/100 ft.	% Sugar	% Juice Purity	Leaf Spot Rating[1]	Yield/A (Tons)
A402-64R	148 ab[3]	11.6 abc	89.2 a	6.0 bc	22.5 bc
702H9	167 a	11.8 ab	87.2 b	4.8 d	25.3 ab
68MSH611	123 bc	11.1 bcd	86.9 b	4.7 e	27.2 a
68MSH613	135 abc	12.2 a	88.6 ab	5.5 cd	23.4 bc
68MSH614	122 bc	11.7 ab	88.0 ab	5.8 bc	23.0 bc
67MSH128	131 bc	11.1 bcd	88.3 ab	6.5 ab	20.6 c
69MSH141	110 c	9.7 e	86.9 b	6.8 a	22.7 bc
68MSH110	142 abc	10.7 d	88.1 ab	6.2 abc	22.3 bc
69MSH113	134 abc	10.8 cd	87.2 b	6.2 abc	22.6 bc
Mean	135	11.2	87.8	5.8	23.2
Minimum Least Significant Range(L.S.D.)(.05)	30	0.7	1.7	0.7	3.3
Maximum Least Significant Range	35	0.8		0.9	3.8
Coefficient of Variance	19.2%	5.6%	1.6%	10.7%	12.1%
			SPRAYED TEST[2]		
A402-64R	177 bc	13.9 a	90.9 a	1.2 a	29.1 c
702H9	209 a	13.3 ab	89.2 b	1.3 a	34.7 a
68MSH611	159 c	13.7 ab	89.7 ab	1.2 a	29.3 c
68MSH613	170 bc	14.1 a	89.8 ab	1.2 a	34.6 a
68MSH614	128 d	13.4 ab	88.9 b	1.0 a	32.7 abc
67MSH128	160 c	13.4 ab	89.3 b	1.2 a	33.7 ab
69MSH141	155 c	13.5 ab	90.1 ab	1.2 a	31.3 abc
68MSH110	186 b	13.4 ab	90.0 ab	1.0 a	30.6 bc
69MSH113	170 bc	12.8 b	88.8 b	1.0 a	33.5 ab
Mean	168.2	13.5	89.6	1.1	32.2
Minimum Least Significant Range(L.S.D.)(.05)	20	0.9	1.4	0.4	3.5
Maximum Least Significant Range	24	1.0		0.5	4.0
Coefficient of Variance	10.4%	5.5%	1.3%	3.3%	9.2%

Planted: April 8.
Experimental Design: Randomized Complete Block, six replicates.
Fertilizer: 50 N + 100 P_2O_5 + 100 K_2O + 2 Boron broadcast before planting. 100 N sidedressed May 27 and 50 N sidedressed July 15.
Row Irrigated: June 30; July 9, 16, 28; August 19 and 28.
Herbicide: Treflan applied and cultivated in June 3.
Fungicide: (Sprayed Test Only) Sprayed with (3 oz ai) Benlate June 18; July 9, 30; August 13, 27; September 10 and 24.
Harvested: November 5.

1/ Cercospora leaf spot readings from 1 (low) to 10 (high).
2/ Sprayed with Benlate (3.0 oz ai) fungicide to control cercospora leaf spot (Test above not sprayed).
3/ Duncan's New Multiple Range Test: Results followed by same letters are not significantly different (.05).

OBJECTIVE: To determine the most adapted varieties to southeast Missouri conditions and to assist in the development of improved varieties.

PROCEDURE: Two variety tests were planted on each of the clay soil and the loam soil located at the Portageville Field. One test on each of the soils was sprayed with a fungicide to control leaf spot whereas the second test was not sprayed so that natural resistance could be determined. Fertilizer and irrigation were applied at optimum rates so that these would not limit yields. Beets were planted in 26 inch rows at an excessive rate to assure a stand and then thinned to an approximate eight inches between plants. A herbicide was incorporated following thinning to control weeds. Plans included harvesting mechanically but due to the excessive rainfall at harvest one of the tests was harvested by hand. The four rows of each plot were harvested separately so that yield and stand data were obtained on the individual rows. Sugar percent and purity analysis were determined from samples obtained from two center rows of each plot.

RESULTS: Spraying resulted in an increase in sugar percentage and yield. Leaf spot was reduced to a minimum by spraying with a fungicide periodically during the season. The A402-64R variety in 1969 rated high in leaf spot resistance but in 1970 this variety was no better than other varieties. Yields on the loam soil in 1970 were the highest as compared to yields of previous years. Increased penetration of the irrigation water may have been the reason for this increase in yield in 1970.

SOIL FERTILITY, SPACING, PLANT POPULATION AND GROWTH REGULATOR EXPERIMENTS WITH SUGAR BEETS 1970

James A. Roth and Thomas E. Fisher[1/]

Soil fertility research experiments on sugar beets were conducted on two soil types on the Portageville Field and one soil type on the Clarkton Field. Experiments also included growth regulators, row widths, plant spacing, and deep cultivation at the Portageville Field.

The soil fertility experiments in 1970 included rates, time, and sources of nitrogen and a check on the phosphorous and potassium requirements. Nitrogen has been the most critical plant food element whereas the need for phosphorous and potassium has not been required on the soils testing high in these two elements. Boron has not been required on sugar beets grown in southeast Missouri on three soils tested but has been included to assure an ample supple.

One hundred and fifty pounds of nitrogen has been optimum when applied at time of planting. Higher rates of nitrogen have increased yields in some instances but has usually resulted in a lower sugar content and lower juice purity. Ammonium nitrate, ammonium sulphate, and sodium nitrate have not been significantly different when applied at the 150 pound rate of application.

The incorporation of fine lime into the clay soil before planting increased the yield of sugar beets 6.2 tons and reduced damage to stand by southern blight by twelve percent. Similar limestone treatment on the loam and sandy soils was not as effective as on the clay soil.

Yields of sugar beets in the fertility test on the loam soil exceeded yields on the clay soil in 1970. Southern blight reduced stand considerably on the clay soil in 1970 but yields were corrected as if a uniform stand remained. Increasing the rate of nitrogen on the clay soil resulted in a reduction of damage caused by southern blight disease by 29.4 percent.

Deep cultivation with chisel plow shanks on the loam soil increased penetration of irrigation water and reduced the frequency of irrigation. Continued deep cultivation during the season reduced yields. Additional research will be required to determine how many times beets may be deep cultivated to obtain maximum production of high quality sugar beets.

The application of experimental growth regulators did not produce favorable results in 1970. There was a small increase in yield and sugar percent with Chemagro 8728 but a decrease in sugar percent and yield was encountered with Chemagro 8601. Other stations have reported favorable results with these compounds so additional research will be required to more thoroughly test growth regulators and their effect on sugar content of sugar beets grown under Missouri conditions.

Row and plant spacing experiments indicated in 1970 that there was no difference in yields between the 22, 26, and 30-inch rows. The 30-inch rows resulted in a reduction in sugar content and purity percent as compared to the 22 and 26-inch rows. The 12 inch spacing of beets within the row produced the highest yield but had the lowest percent sugar and purity as compared to the six and eight inch spacings. Results indicate that row spacing of 22 and 26 inches and a plant spacing of eight to 12 inches within the row produced satisfactory sugar beets in southeast Missouri.

Sugar beet research in 1971 will not be continued by the Agronomy Department due to the uncertainty of the international sugar situation and lack of plans to build a processing plant in the near future. In the event this crop does promise to be a cash crop in Missouri at a future date agronomy research will probably be resumed.

1/ Associate Professor and Technician in Agronomy

THE EFFECT OF SOIL FERTILITY TREATMENTS ON YIELDS AND QUALITY OF SUGAR BEETS - 1970
PORTAGEVILLE FIELD - CLAY SOIL

Soil Test	O.M.	P_2O_5	K	Mg.	Ca	pH	H	C.E.C.	Soil Series
Topsoil	2.8	362	600	1000+	9900	5.9	4.0	33.5	Sharkey
Subsoil	2.7	362	600	1000+	9900	6.0	3.5	33.0	

Soil Treatment[1] Lbs/A: At Planting $N+P_2O_5+K_2O$+Boron	Sidedress Nitrogen	% Dead Beets	Leaf Spot Rating	Beets/100 ft.	% Sugar	Juice Purity %	Yield Tons/A
0+100+100+2B		57.1 a[4]	1.0 a	100 a	13.7 a	91.6 abc	16.3 c
75+100+100+2B		45.8 abc	1.0 a	105 a	14.0 a	91.4 abc	19.3 c
150+100+100+2B		42.0 bcd	1.0 a	116 a	13.8 a	91.6 abc	23.3 abc
75+100+100+2B	75 (June 9)	39.9 bcd	1.0 a	107 a	13.8 a	91.2 abc	22.5 bc
225+100+100+2B		29.7 d	1.0 a	118 a	13.8 a	90.9 bc	27.8 a
75+100+100+2B	75(June 9) 75(August 12)	37.2 cd	1.0 a	110 a	13.6 a	90.8 bc	24.9 ab
150+100+100+2B[2]		34.5 cd	1.0 a	122 a	13.8 a	91.8 ab	24.6 ab
150+100+100+2B[3]		39.1 bcd	1.0 a	108 a	13.7 a	91.9 ab	22.5 bc
75+ 0+100+2B	75(June 9)	41.5 bcd	1.0 a	117 a	13.9 a	91.2 abc	25.0 ab
75+100+ 0+2B	75(June 9)	39.1 bcd	1.0 a	122 a	14.1 a	91.3 abc	24.5 ab
75+100+200+2B	75(June 9)	44.6 abc	1.0 a	128 a	13.8 a	92.0 ab	26.3 ab
75+100+100	75(June 9)	47.0 abc	1.0 a	117 a	13.9 a	91.5 abc	24.9 ab
10+100+100+2B	75(June 9) 75(July 15)	52.1 ab	1.0 a	100 a	13.0 b	92.5 a	24.4 ab
75+ 0+ 0	75(June 9)	46.1 abc	1.0 a	122 a	14.1 a	90.3 c	23.9 abc
Minimum Least Significant Range(L.S.D.)(.05)		12.5	0.0	29	0.5	1.2	4.1
Maximum Least Significant Range		15.0	0.0	34	0.7	1.5	4.9
Coefficient of Variance		25.3%	0.0%	21.7%	3.4%	1.2%	15.1%
8 T Fine Lime incorporated into bed 75+100+100+2B	75(June 9)	26.5 a	1.0 a	160 a	14.2 a	92.6 a	27.7 a
75+100+100+2B	75(June 9)	38.4 a	1.0 a	118 b	14.1 a	93.4 a	21.5 b
Minimum Least Significant Range(L.S.D.)(.05)		19.5	0.0	30	0.7	1.2	5.1
Maximum Least Significant Range		19.5	0.0	30	0.7	1.2	5.1
Coefficient of Variance		26.6%	0.0%	9.7%	2.3%	0.6%	9.3%

Planted: Variety A-290 planted April 9
Row Irrigated: July 9 and 31.
Fungicide: Benlate (3 oz ai) sprayed to control leaf spot June 18; July 9, 30; August 13, 27; September 10 and 24.
Herbicide: Applied Treflan after thinning and incorporated with cultivator.
Insecticide: Sevin used to control blister beetles August 12 and September 14.
Harvested: October 29.

1/Ten pounds nitrogen broadcast over all plots at time of planting.
2/Sodium nitrate used as source of nitrogen.
3/Ammonium sulphate used as source of nitrogen.
4/Duncan's New Multiple Range Test: Results followed by same letters are not significantly different (.05).

OBJECTIVE: To determine rate, source, and time of application of nitrogen for maximum yields of high quality sugar beets.
To determine if all nitrogen can be applied in one operation, either preplant at time of planting, or sidedress at various times during the growing season.
To determine need for calcium, phosphate, potassium, and boron.

PROCEDURE: Limestone was applied preplant and the fertilizers were banded after emergence. Nitrogen was sidedressed at various times as indicated in the above table. Insects and leaf spot diseases were controlled by spraying periodically during the season. At thinning trifluralin was broadcast and incorporated with a cultivator. All plots were irrigated as needed by the row method two times during the season. Sugar beets were harvested, yields determined, sampled obtained from which sugar and purity analysis were made.

RESULTS: The 225-pound rate of nitrogen application produced the highest yield but was not statistically different from the 150-pound rate. There appeared to be no advantage to splitting the nitrogen applications in 1970. Incorporating eight tons fine lime into the soil before planting increased the yield and reduced the damage from southern blight on the clay soil in 1970. Omitting phosphate and potash from the fertilizer did not significantly reduce yields on this soil which tests high in these plant nutrients. These data indicate that boron was not required in the fertilization of sugar beets on this soil.

THE EFFECT OF SOIL FERTILITY TREATMENTS ON YIELDS AND QUALITY OF SUGAR BEETS - 1970
PORTAGEVILLE FIELD - LOAM SOIL

Soil Test	O.M.	P_2O_5	K	Mg.	Ca	pH	H	C.E.C.	Soil Series
Topsoil	2.3	247	520	420	4100	6.5	1.5	14.0	Tiptonville
Subsoil	2.3	243	340	410	4700	6.3	1.5	15.5	

Soil Treatment (Pounds Per Acre) At Planting $N+P_2O_5+K_2O$+Boron	Sidedress Nitrogen	Leaf Spot Rating	Beets/100 ft.	% Sugar	Juice Purity %	Yield Tons/A
0+100+100+2B		1.0 c[3]	125 b	13.6 a	89.3 a	22.5 b
75+100+100+2B		1.0 c	151 ab	13.3 a	89.0 abc	25.7 ab
150+100+100+2B		1.0 c	147 ab	13.3 a	88.9 a-d	24.4 ab
75+100+100+2B	75(June 9)	1.2 ab	138 ab	13.1 abc	88.2 a-e	25.9 ab
225+100+100+2B		1.0 c	158 a	12.5 bcd	87.3 e	27.6 a
75+100+100+2B	75(June 9) 75(August 12)	1.2 ab	144 ab	12.5 bcd	87.7 cde	25.4 ab
150+100+100+2B[1]		1.0 c	164 a	13.1 abc	87.6 de	27.9 a
8 T Fine Lime Preplant 75+100+100+2B	75(June 9)	1.0 c	163 a	13.1 abc	89.1 ab	27.8 a
150+100+100+2B[2]		1.0 c	144 ab	12.4 cd	87.8 b-e	24.7 ab
75+ 0+100+2B	75(June 9)	1.0 c	161 ab	13.0 a-d	88.9 a-d	25.1 ab
75+100+ 0+2B	75(June 9)	1.2 ab	155 ab	12.6 bcd	87.9 a-e	25.4 ab
75+100+200+2B	75(June 9)	1.2 ab	149 ab	12.7 bcd	88.5 a-e	26.6 a
75+100+100	75(June 9)	1.3 a	149 ab	12.5 bcd	88.0 a-e	26.8 a
10+100+100+2B	75(June 9) 75(July 15)	1.0 c	134 ab	12.2 d	87.8 b-e	26.8 a
75+ 0+ 0	75(June 9)	1.0 c	135 ab	13.3	88.9 a-d	25.5 ab
Minimum Least Significant Range(L.S.D.)(.05)		0.3	27	0.7	1.2	3.1
Maximum Least Significant Range		0.3	32	0.9	1.4	3.7
Coefficient of Variance		22.0%	15.8%	5.0%	1.2%	10.5%

Planted:	Variety A-290 planted April 8.
Row Irrigated:	July 1, 9, 17, 29; August 19 and 28.
Fungicide:	Sprayed with Benlate (3 oz ai) to control leaf spot June 18; July 9, 30; August 13, 27; September 10 and 24.
Herbicide:	Incorporated Treflan after thinning June 3.
Insecticide:	Sprayed with Sevin to control blister beetles August 12 and September 14.
Harvested:	November 5.

1/ Sodium nitrate used as source of nitrogen.
2/ Ammonium sulphate used as source of nitrogen.
3/ Duncan's New Multiple Range Test: Results followed by same letters are not significantly different (.05).

OBJECTIVE: To determine rate, source, and time of application of nitrogen for maximum yields of high quality sugar beets.
To determine if all nitrogen can be applied in one operation, either preplant at time of planting, or sidedress at various times during growing season.
To determine the need for calcium, phosphate, potassium, and boron.

PROCEDURE: Limestone was applied preplant and the fertilizers were banded after emergence. Nitrogen was sidedressed at various times as indicated in the above table. Insects and leaf spot diseases were controlled by spraying periodically during the season. At thinning trifluralin was broadcast and incorporated with a cultivator. All plots were irrigated as needed by the row method, six times during the season. Sugar beets were harvested, yields determined, samples obtained from which sugar and purity analysis were made.

RESULTS: As the rate of nitrogen was increased so did the yields increase with the highest rate, 225 pounds of nitrogen, producing 27.9 tons of beets per acre. There was no statistical difference between the various sources or rates of nitrogen applications varying from 25 pounds to 225 pounds per acre. These data indicate that boron was not required on this soil in 1970.

THE EFFECT OF SOIL FERTILITY TREATMENTS ON YIELDS AND QUALITY OF SUGAR BEETS - 1970
CLARKTON FIELD

Soil Test	O.M.	P_2O_5	K	Mg.	Ca	pH	H	C.E.C.	Soil Series
Topsoil	1.0	211	184	200	1100	6.2	1.5	5.5	Beulah
Subsoil	0.8	170	124	180	1700	6.2	2.0	7.0	

Soil Treatment (Pounds Per Acre) At Planting N+P_2O_5+K_2O+Boron	Sidedress Nitrogen	Leaf Spot Rating	Beets/100 ft.	% Sugar	Juice Purity %	Yield Tons/A
0+100+100+2B		4.8 a[3]	86 ab	12.4 ab	95.3 a	8.4 d
75+100+100+2B		4.3 a	86 ab	12.2 ab	96.1 a	9.7 cd
150+100+100+2B		4.5 a	114 a	12.2 ab	95.1 a	17.9 ab
75+100+100+2B	75(June 4)	6.0 a	83 b	11.1 b	94.4 a	9.7 cd
225+100+100+2B		5.0 a	96 ab	12.5 ab	94.8 a	19.0 a
75+100+100+2B	75(June 4) 75(August 12)	4.8 a	89 ab	12.3 ab	95.4 a	13.6 a-d
150+100+100+2B[1]		4.5 a	96 ab	11.9 ab	94.0 a	13.4 a-d
8T Fine Lime Preplant 75+100+100+2B	75(June 4)	5.0 a	98 ab	11.3 ab	96.0 a	12.9 b-d
150+100+100+2B[2]		5.3 a	90 ab	11.5 ab	96.0 a	14.1 a-d
75+ 0+100+2B	75(June 4)	4.5 a	99 ab	12.7 a	95.3 a	15.6 abc
75+100+ 0+2B	75(June 4)	5.5 a	104 ab	11.4 ab	94.5 a	15.3 abc
75+100+200+2B	75(June 4)	5.0 a	92 ab	11.5 ab	95.6 a	13.4 a-d
75+100+100	75(June 4)	4.8 a	105 ab	12.0 ab	94.8 a	14.3 a-d
10+100+100+2B	75(June 4) 75(July 17)	5.5 a	89 ab	11.5 ab	95.3 a	12.5 b-d
75+ 0+ 0	75(June 4)	5.3 a	92 ab	12.0 ab	95.2 a	12.3 b-d
Minimum Least Significant Range(L.S.D.)(.05)		1.7	24	1.3	1.7	5.1
Maximum Least Significant Range		2.0	29	1.5	2.1	6.1
Coefficient of Variance		23.8%	17.8%	7.5%	1.3%	26.7%

Planted: Variety A-290 on April 10.
Sprinkler Irrigated: June 30; July 6, 13, 23; August 18 and 28.
Fungicide: Sprayed with Benlate (3 oz ai) to control leaf spot on June 17; July 8, 29; August 12, 26; September 9 and 23.
Herbicide: Incorporated Treflan after thinning on May 28.
Insecticide: Sprayed with Sevin to control blister beetles, July 27; August 12; and September 14.
Harvested: October 26.

1/ Sodium nitrate used as source of nitrogen.
2/ Ammonium sulphate used as source of nitrogen.
3 Duncan's New Multiple Range Test: Results followed by same letters are not significantly different (.05).

OBJECTIVE: To determine rate, source, and time of application of nitrogen for maximum yields of high quality sugar beets.
To determine if all nitrogen can be applied in one operation, either preplant at time of planting, or sidedress at various times during the growing season.
To determine need for calcium, phosphate, potassium, and boron.

PROCEDURE: Limestone was applied preplant and the fertilizers were banded after emergence. Nitrogen was sidedressed at various times as indicated in the above table. Insects and leaf spot diseases were controlled by spraying periodically during the season. At thinning trifluralin was broadcast and incorporated with a cultivator. All plots were irrigated as needed by the sprinkler method six times during the season. All plots were fumigated with 40 gallons of DD prior to planting to control root knot nematodes.

RESULTS: This experiment was severely affected by a foliar attack of Anthracnose which killed some of the beets during the latter part of the growing season. Two hundred-twenty-five pounds of nitrogen applied preplant produced the highest yield of sugar beets (19.0 tons), but 150 pounds of nitrogen resulted in a yield of 17.9 tons. Leaf spot was more difficult to control at this location as compared to the Portageville Field where excellent control was obtained by use of fungicidal sprays.

This soil is very sandy and with a low water holding capacity frequent irrigations were required. This type of soil would be ideal because in commercial production harvest it would be possible to continue harvesting operations during wet periods. Results have indicated that commercial production on this soil would be more costly because of lower yields, fumigation, and irrigation requirements. Additional research is needed to improve methods in the production of an economical crop on this soil.

DEEP CULTIVATION OF SUGAR BEETS - 1970
PORTAGEVILLE FIELD - LOAM SOIL

	Beets/100 ft.	% Sugar	Juice Purity %	Yield Tons/A
Check	133 a[1/]	12.2 a	88.2 a	28.3 a
Deep Cultivations[2/]	154 a	12.0 a	87.2 a	23.8 b
Minimum Least Significant Range(L.S.D.)(.05)	35	0.5	3.0	3.3
Maximum Least Significant Range	35	0.5	3.0	3.3
Coefficient of Variance	16.4%	2.8%	2.3%	8.4%

Planted:	Variety A-290 planted April 8, 1970.
Row Irrigated:	June 30; July 7, 16, 28; August 20 and 29.
Fungicide:	Sprayed with Benlate (3 oz ai) to control leaf spot June 18; July 9, 30; August 13, 27; September 10 and 24.
Herbicide:	Incorporated Treflan after thinning.
Insecticide:	Sprayed with Sevin to control blister beetles, August 12 and September 14.
Fertilizer:	50+100+100+2B broadcast and bedded, 100 N after thinning and 75 N July 15.
Harvested:	November 13.

1/ Duncan's New Multiple Range Test: Results followed by same letter are not significantly different (.05).
2/ Cultivated with chisel plow approximately ten inches deep before each irrigation or a total of six times. Check was cultivated two times just prior to irrigation.

OBJECTIVE: To increase rate of penetration of irrigation water.

PROCEDURE: Sugar beets were cultivated before each irrigation using a chisel plow in the center of each middle ten inches deep. All other cultural practices were optimum for maximum production.

RESULTS: The deep cultivation increased the rate of water penetration as determined by the time required for the water to completely penetrate the row. The results indicate a significant depression of yield probably due to breaking of the plant roots. Additional research will be required to determine how many times this operation may be done without depressing yield or quality and still obtain maximum water penetration.

THE INFLUENCE OF ROW AND PLANT SPACING ON SUGAR BEET YIELDS AND QUALITY - 1970
PORTAGEVILLE FIELD - LOAM SOIL

Single Row Width (Inches)	Plant Spacing Within Row (Inches)	Beets/100 ft.	% Sugar	Juice Purity %	Yield Tons/A
			Row Width X Plant Spacing		
22	6	161 ab[1/]	13.0 ab	91.1 a	31.0 ab
22	8	133 c	12.9 abc	90.2 ab	31.0 ab
22	12	113 d	12.4 bcd	89.7 bc	32.6 ab
26	6	166 a	13.1 a	89.7 bc	30.2 bc
26	8	147 bc	12.9 abc	89.5 bc	29.5 c
26	12	114 d	12.7 a-d	89.4 bc	33.4 a
30	6	162 ab	12.7 a-d	89.1 bc	30.0 b
30	8	139 c	12.2 d	88.8 c	32.3 ab
30	12	104 d	12.3 cd	88.5 c	31.7 ab
Minimum Least Significant Range(L.S.D.)(.05)		17.3	0.6	1.2	2.7
Maximum Least Significant Range		20.0	0.7	1.4	3.1
Coefficient of Variance		10.7%	4.0%	1.2%	7.6%
			Row Width Means		
22		136 a	12.8 a	90.3 a	31.5 a
26		142 a	12.9 a	89.5 b	31.0 a
30		135 a	12.4 b	88.8 c	31.3 a
Minimum Least Significant Range(L.S.D.)(.05)		13.4	0.30	0.42	2.0
Maximum Least Significant Range		14.0	0.32	0.44	2.1
Coefficient of Variance		13.1%	3.2%	0.6%	8.5%
			Plant Spacing Means		
	6	163 a	12.9 a	89.9 a	30.4 b
	8	140 b	12.7 ab	89.5 a	30.9 b
	12	110 c	12.5 b	89.3 a	32.4 a
Minimum Least Significant Range(L.S.D.)(.05)		10.0	0.35	0.69	1.57
Maximum Least Significant Range		10.5	0.37	0.73	1.65
Coefficient of Variance		10.7%	4.0%	1.2%	7.5%

Planted: Variety A-290 planted April 11.
Fertilizer: 50+100+100+2B broadcast and disc in before planting. Sidedressed 100 pounds nitrogen May 25 and 50 pounds July 15.
Row Irrigated: July 1, 9, 17, 29; August 19 and 28.
Herbicide: Treflan applied and cultivated to incorporate on May 28.
Insecticide: Sprayed with Sevin to control blister beetles August 12 and September 14.
Harvested: November 9.

1/ Duncan's New Multiple Range Test: Results followed by the same letters are not significantly different (.05).

OBJECTIVE: To determine the most desirable sugar beet row and plant spacing for maximum yield and highest quality. However, it was desirable to maintain a row spacing within practibility of present day farm equipment.

PROCEDURE: Preplant fertilizer was broadcast and disc into the soil. Sugar beets were planted on a flat seedbed in rows spaced 22, 26, and 30 inches apart. Plants were thinned to desired spacing within the row. Treflan was broadcast after thinning and incorporated into the soil by use of the cultivator. Irrigation water was applied by the row method as needed for a total of six times during the season. A fungicide was applied periodically during the season to prevent leaf spot infestations. An insecticide was sprayed on the beets two times during the latter part of the season to control blister beetles.

The beets were harvested with a mechanical harvester, washed, yields determined, and samples obtained for determination of sugar percentage and purity analysis.

RESULTS: The 22-inch rows produced the highest percent sugar and the 30-inch rows the lowest. The six inch plant spacing resulted in the higher percent sugar whereas the 12 inch spacing the lower percent. Even though the plants were initially thinned to specified stand the final results indicate the six inch plant spacing considerably below the correct stand. Many of the beets in the six inch spacing were too small for harvesting. Row spacing of 26 and 30 inches have been equal in yield this season and also in the previous 1969 season.

THE INFLUENCE OF GROWTH REGULATORS ON SUGAR BEETS - 1970
PORTAGEVILLE FIELD - CLAY SOIL

Per Acre[2] Spray Treatment	Leaf Spot Rating	Beets/100 ft.	% Sugar	Juice Purity %	Yield Tons/A
0.53 oz (0.5 oz ai) Chemagro 8728	5.5 b[1]	160 a	12.7 a	89.4 ab	30.0 a
2.10 oz (2.0 oz ai) Chemagro 8728	5.3 b	150 a	12.4 ab	90.8 a	28.2 a
5.25 oz (5.0 oz ai) Chemagro 8728	6.3 ab	182 a	12.0 ab	89.3 ab	29.6 a
No Treatment	6.0 ab	157 a	12.2 ab	88.9 b	28.5 a
4.0 oz (2 oz ai) Chemagro 8601	6.8 a	143 a	11.8 b	89.7 ab	28.9 a
32.0 oz (16 oz ai) Chemagro 8601	6.8 a	145 a	11.9 ab	89.9 ab	27.5 a
Minimum Least Significant Range(L.S.D.)(.05)	1.0	43	0.7	1.6	6.7
Maximum Least Significant Range	1.1	48	0.8	1.8	7.5
Coefficient of Variance	10.5%	18.3%	4.0%	1.2%	15.4%

Planted: Variety A-290 planted April 9.
Row Irrigated: July 9 and 31.
Fungicide: Benlate (3 oz ai) sprayed to control leaf spot June 18; July 9, 30; August 13, 27; September 10 and 24.
Herbicide: Applied Treflan after thinning and incorporated with cultivator.
Fertilizer: 50 N + 100 P_2O_5 + 100 K_2O + 2 Boron broadcast over all plots. 100 N sidedressed May 27 and 75 N sidedressed June 29.
Harvested: November 13.

1/ Duncan's New Multiple Range Test: Results followed by same letters are not significantly different (.05).
2/ Sprayed October 1 with 10 gallons of water and 18 psi.

OBJECTIVE: To determine influence of growth regulator chemicals on yield and quality of sugar beets.

PROCEDURE: Sugar beets were grown with optimum fertility and irrigation. The beets were sprayed 45 days prior to harvest with two experimental chemicals at verying rates. At time of harvest pulp samples were obtained for analysis of juice purity and percentage sugar.

RESULTS: The chemical No. 8728 increased the percent sugar but the difference was not statistically significant. The chemical No. 8601 appeared to depress the sugar percentage but was not significant. There was an improvement in the juice purity with both of the chemicals used. These two chemicals should be included in future research as other stations have reported favorable results.

RESULTS OF WEED RESEARCH IN SUGAR BEETS - 1970

Harold D. Kerr

Information gained from prior research led to the choice of a limited number of herbicides for study. Only herbicides which were available commercially or likely to be very soon were used. Cultivation and other mechanical operations were completed to favor optimum performance of the chemicals used to control weeds and leaf disease. The central objective was to produce the maximum yield of sugar beets by using herbicides in a production scheme practicable for farmer acceptance.

Past results indicated need for a herbicide treatment at planting time followed by a treatment after thinning the sugar beets. Timely cultivation was necessary for control of weeds for the remainder of the growing season.

Experiments were conducted on both Tiptonville loam and Sharkey clay soils. Row spacing on the loam soil was 26 inches and on the clay was 30 inches. Preformed beds were flattened with a bed conditioning tool just before planting the A402-64R variety.

SEQUENCE OF OPERATIONS

The operation performed on a given date is listed below for each soil type:

Description of Operation	Tiptonville Loam	Sharkey Clay
Fertilizer applied (100+100+100)	April 8	----------
Preplant herbicides applied	April 10	----------
Final seedbed prepared	April 10	April 13
Planted sugar beets A402-64R	April 11	April 13
Preemergence herbicides applied	April 11	April 16
Fertilizer applied (100+100+100)	----------	April 14
Weeds counted - first	May 13	May 21
Cultivated - first	May 25	May 25
Fertilizer (300 lbs/A (NH_4NO_3)	May 27	----------
Thinned sugar beets	May 28	May 29
Postemergence herbicides	May 28	----------
Cultivated - second	June 9	June 9
Hoed escaped weeds	June 18	June 26
Sprayed fungicide	June 23	June 24
Cultivated - third	June 23	June 29
Fertilizer (300 lbs/A (NH_4NO_3)	----------	June 29
Irrigated - first	June 30	----------
Postemergence herbicides	----------	July 6- 7
Sprayed fungicide	July 13	July 13
Irrigated - second on loam	July 14	July 13
Fertilizer (50 lbs/A (NH_4NO_3)	July 22	----------
Weeds counted - second	July 27	July 27
Irrigated - third on loam	July 28	----------
Sprayed fungicide	August 4	August 4
Irrigated - second on clay	----------	August 4
Hoed escaped weeds	August 13	August 13
Sprayed fungicide	August 19	August 19
Sprayed fungicide	September 2	September 2
Sprayed fungicide	September 16	September 16
Sprayed fungicide	September 30	September 30
Harvested sugar beets	November 12-13	November 10-11

DISCUSSION OF RESULTS

Tiptonville Loam:

Beet Stand:

The beet stand counts as affected by all treatments applied during the season are shown in Table 1. The initial stands which emerged after the herbicide treatments at planting are given in Table 1A. The combination of pyrazon + CP 52223 and CP 52223 alone reduced the stand of beets which emerged in plots with these herbicides applied on the soil surface (Table 1A). When incorporated in the surface two inches of soil, these treatments did not reduce the initial stand established. The ideal stand for producing the proper beet growth is about 150 plants at the time of thinning to the proper stand. At harvest, all plots had somewhat less than ideal stands as is shown in Table 1. The stand of beets was not affected by different treatments applied at thinning, but some loss of stand continued through the growing season on plots treated at planting with CP 52223 and pyrazon + CP 52223.

Weed Control:

Counts are shown in Tables 2 and 3. The site chosen on Tiptonville loam was not heavily infested with weeds. Several dicot weed species were present and crabgrass and goosegrass were the main grass weeds. Redroot pigweed, annual morningglory, smartweed, prickly sida, cocklebur, and yerba were present at varying low densities. Best weed control resulted from the combination treatment with pyrazon + CP 52223 at planting. The control of weeds by CP 52223 tended to be improved by shallow incorporation in the surface soil, but incorporation caused poorer dicot weed control by pyrazon and cycloate than resulted from surface treatment. All treatments reduced the density of dicots compared with no treatment. Density of grasses was too low to permit detection of differences among the treatments for controlling them. At the time of thinning, the hoeing operation to thin the beets to proper stand and remove all weeds that escaped the treatments at planting required about seven man hours per acre.

Beet Yield and Quality:

The average yield overall for the 2.07 acre study on Tiptonville loam was 32.42 tons of sugar beets per acre at 12.81% sugar.

All weeds were removed from the drill row during the thinning operation. This kept weed competition from being a factor in production for the balance of the growing season.

Percent sugar content is shown for each treatment in the study in Table 4. Among herbicides applied at thinning, the granular formulation of CP 52223 tended to reduce the sugar content. Why this happened may be because of the high concentration of the herbicide in spots where the granules came to rest. Uptake at levels which may have caused some growth retardation early may explain the lower content of sugar. However, the difference in content of sugar between the granular and liquid formulation of CP 52223 is not great (12.54 vs 12.84) and has no statistical significance. Herbicide or method of application at planting time did not cause differences in sugar percentages.

The average size of beet as affected by the treatments is shown in Table 5. The beets were too large for best quality of pulp. The stand of beets was too sparse in the row and this caused excess beet size. The CP 52223 treatment and the combination of pyrazon + CP 52223 applied at planting time caused loss of stand during the summer. The beets remaining in plots given these two treatments grew significantly larger than those in plots treated with pyrazon or cycloate at planting time.

No difference was detected among treatments in total yield of sugar beets (Table 6). Stands were not different enough to cause total yield to differ. Larger beets were produced where spacing between beets in the row was more sparse. No effect of the herbicides applied at thinning time was detectable in the size or yield of sugar beets.

Sharkey Clay Soil:

Beet Stand:

The beet stand established after the herbicide treatments were applied at planting time is shown in Table 7. Granular CP 52223 and pyrazon + CP 52223 reduced the stand significantly. However, stands were adequate in all of the plots for testing production after thinning. The beet stands in all treatments at harvest are given in Table 8. No differences were detected among the herbicides applied either at planting or after the thinning operation. Thinning down to proper stand eliminated the differences in beet stand caused by the herbicides put on at planting. Disease and mechanical injury after thinning depleted the stand during the season to an average of 121 plants in 100 feet of row. This resulted in a higher than average size of beet. A proper stand of 150 beets per 100 feet of row would likely have resulted in a smaller and more uniform average size of beet.

Weed Control:

The first count of weeds following herbicide treatments at planting did not show a difference among treatments for control of dicot weeds but control of grasses varied with treatment (Table 9). The emulsifiable formulation of CP 52223 alone or combined with pyrazon controlled grasses better than other treatments. The granular formulation of CP 52223 was less effective than the emulsifiable for control of grasses. Pyrazon alone or pyrazon + CP 52223, EC as banded treatments remained active for control of dicot weeds longer than other treatments.

Beet Yield and Quality:

The average yield for this 1.7 acre study was 24.59 tons per acre at an average of 14.45 percent sugar content.

Percent sugar content data are given in Table 10. Averaging over all plots, those treated with nitralin produced beets at a higher sugar percentage than the liquid CP 52223 treatment. The herbicides applied at planting did not affect the final sugar content and the slight effect from the herbicides at thinning may be statistically apparent but not of significant magnitude economically.

Average size of beet at harvest shown in Table 11, was not correlated with the stand of beets counted May 21 after the planting time treatments. The number of beets in the plots at harvest shown in Table 8 was not related to average beet weight as might be expected. Southern blight disease infections tended to eliminate the normal negative correlation between size of beet and number of sugar beets in the row.

Production on the Sharkey clay in tons of beets per acre is shown in Table 12. No difference in tonnage could be ascribed to the herbicide treatments at planting or at thinning time. Elimination of weed competition at thinning kept the weed factor from influencing yield. Weeds emerged in the plots late in the season but competition was not evident. There was no trend in the effect of the herbicides applied at thinning time on yield of sugar beets. No herbicide injury was detected following application of the chemicals at thinning.

TABLE 1
SUGAR BEET PLANTS IN 100 LINEAR FEET OF 26-INCH SPACED ROWS AT HARVEST (BEVU 01)[1/]

Herbicide at Planting	Lb/A 30 gpa	Herbicide Applied at Thinning Time: Granular CP 52223 2 lb/A	Liquid Trifluralin 1 lb/A	Liquid Nitralin 1 lb/A	Liquid CP 52223 2 lb/A	Mean
Preplant Incorporated						(118 a)
Pyrazon	3	104	143	130	144	130
Cycloate	2.5	123	134	118	100	118
CP 52223, EC	2	103	110	124	101	109
Pyrazon + CP 52223, EC	3+2	131	111	114	96	113
	Mean	115	124	121	110	
Preemergence Broadcast						(110 b)
Pyrazon	3	101	116	139	128	121
Cycloate	2.5	119	134	129	105	122
CP 52223, EC	2	95	99	105	129	107
Pyrazon + CP 52223, EC	3+2	94	79	86	101	90
	Mean	102	107	115	116	
Preemergence - 13" Band						(113 ab)
Pyrazon	3	116	128	130	135	127
Cycloate	2.5	121	136	150	149	139
CP 52223, EC	2	110	116	79	98	100
Pyrazon + CP 52223, EC	3+2	71	60	101	110	86
	Mean	105	110	115	123	
Pyrazon	3	107	129	133	135	126 a
Cycloate	2.5	121	135	132	118	126 a
CP 52223, EC	2	103	108	103	109	106 b
Pyrazon + CP 52223, EC	3+2	99	83	100	103	96 b
	Mean	107 a	114 a	117 a	116 a	(114)

1/ Lower case letters after means show Duncan's 5% error probability.

TABLE 1A
SUGAR BEET PLANTS PER 100 LINEAR FEET IN ROW (BEVU 0170)

Early Treatment	Lb/A 30 gpa	Counted May 13, 1970
Preplant Incorporated		
Untreated	-	274
Pyrazon	3	323
Cycloate	2.5	293
CP 52223	2	299
Pyrazon + CP 52223	3+2	305
Preemergence Surface		
Pyrazon	3	299
Cycloate	2.5	329
CP 52223	2	262
Pyrazon + CP 52223	3+2	213
Preemergence Band		
Pyrazon	3	323
Cycloate	2.5	311
CP 52223	2	238
Pyrazon + CP 52223	3+2	213
$LSD_{05,36}$		65
$_{01,36}$		78

TABLE 2
DICOT WEEDS IN 10 SQUARE METERS (BEVU 0170)

Early Treatment	Lb/A 30 gpa	Counted May 13, 1970	Counted July 27, 1970
Preplant Incorporated			
Untreated	-	300	18
Pyrazon	3	105	10
Cycloate	2.5	175	18
CP 52223	2	25	11
Pyrazon + CP 52223	3+2	3	10
Preemergence Surface			
Pyrazon	3	32	8
Cycloate	2.5	40	22
CP 52223	2	110	2
Pyrazon + CP 52223	3+2	3	12
Preemergence Band			
Pyrazon	3	60	11
Cycloate	2.5	92	14
CP 52223	2	65	9
Pyrazon + CP 52223	3+2	10	10
$LSD_{05,36}$		130	NS
01,36		174	NS

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TABLE 3
MONOCOT WEEDS IN 10 SQUARE METERS (BEVU 0170)

Early Treatment	Lb/A 30 gpa	Counted May 13, 1970	Counted July 27, 1970
Preplant Incorporated			
Untreated	-	14	6
Pyrazon	3	9	10
Cycloate	2.5	10	21
CP 52223	2	2	1
Pyrazon + CP 52223	3+2	1	6
Preemergence Surface			
Pyrazon	3	2	16
Cycloate	2.5	1	6
CP 52223	2	6	19
Pyrazon + CP 52223	3+2	1	6
Preemergence Band			
Pyrazon	3	3	9
Cycloate	2.5	4	4
CP 52223	2	8	11
Pyrazon + CP 52223	3+2	2	2
$LSD_{05,36}$		NS	NS
01,36		NS	NS

TABLE 4
PERCENT SUGAR CONTENT (BEVU 0170)[1/]

Herbicide at Planting	Lb/A 30 gpa	Herbicide Applied at Thinning Time: Granular CP 52223 2 lb/A	Liquid Trifluralin 1 lb/A	Liquid Nitralin 1 lb/A	Liquid CP 52223 2 lb/A	Mean
Preplant Incorporated						(12.75 a)
Pyrazon	3	12.65	13.02	12.85	12.52	12.76
Cycloate	2.5	13.02	12.50	13.17	12.55	12.81
CP 52223, EC	2	12.57	13.00	12.95	12.15	12.66
Pyrazon + CP 52223, EC	3+2	12.40	13.57	12.80	12.80	12.76
	Mean	12.66	13.02	12.81	12.50	
Preemergence Broadcast						(12.90 a)
Pyrazon	3	12.60	13.32	13.42	13.30	13.16
Cycloate	2.5	12.25	13.52	13.27	13.20	13.06
CP 52223, EC	2	12.40	12.22	13.22	12.82	12.66
Pyrazon + CP 52223, EC	3+2	12.55	12.40	13.35	12.67	12.74
	Mean	12.45	12.86	13.31	13.00	
Preemergence - 13" Band						(12.79 a)
Pyrazon	3	12.85	12.80	12.65	13.12	12.85
Cycloate	2.5	12.40	13.12	13.30	13.30	13.03
CP 52223, EC	2	12.57	12.30	12.87	12.70	12.61
Pyrazon + CP 52223, EC	3+2	12.17	12.40	13.30	12.87	12.68
	Mean	12.50	12.65	13.03	13.00	
Pyrazon	3	12.70	13.05	12.97	12.98	12.92 a
Cycloate	2.5	12.55	13.05	13.25	13.01	12.96 a
CP 52223, EC	2	12.51	12.50	13.01	12.55	12.65 a
Pyrazon + CP 52223, EC	3+2	12.37	12.79	12.98	12.78	12.73 a
	Mean	12.54 b	12.85 ab	13.05 a	12.84 ab	(12.81)

1/ Lower case letters after means show Duncan's 5% error probability.

TABLE 5
AVERAGE WEIGHT PER SUGAR BEET IN GRAMS (BEVU 0170)[1/]

Herbicide at Planting	Lb/A 30 gpa	Herbicide Applied at Thinning Time: Granular CP 52223 2 lb/A	Liquid Trifluralin 1 lb/A	Liquid Nitralin 1 lb/A	Liquid CP 52223 2 lb/A	Mean
Preplant Incorporated						(1371 a)
Pyrazon	3	1724	1038	1122	1093	1244
Cycloate	2.5	1233	1346	1355	1569	1376
CP 52223, EC	2	1534	1400	1291	1642	1467
Pyrazon + CP 52223, EC	3+2	1368	1236	1362	1625	1398
	Mean	1465	1255	1282	1482	
Preemergence Broadcast						(1456 a)
Pyrazon	3	1363	1174	1145	1185	1217
Cycloate	2.5	1448	1122	1212	1352	1284
CP 52223, EC	2	1715	1509	1366	1207	1449
Pyrazon + CP 52223, EC	3+2	1640	1971	2066	1828	1876
	Mean	1541	1444	1447	1393	
Preemergence - 13" Band						(1406 a)
Pyrazon	3	1190	1231	1225	1226	1218
Cycloate	2.5	1204	1195	1006	969	1093
CP 52223, EC	2	1393	1397	1853	1475	1529
Pyrazon + CP 52223, EC	3+2	2055	2301	1449	1330	1783
	Mean	1460	1531	1383	1250	
Pyrazon	3	1426	1147	1164	1168	1226 c
Cycloate	2.5	1295	1221	1191	1297	1251 c
CP 52223, EC	2	1547	1435	1503	1441	1482 b
Pyrazon + CP 52223, EC	3+2	1687	1836	1626	1594	1686 a
	Mean	1489 a	1410 a	1371 a	1375 a	

1/ Lower case letters after means show Duncan's 5% error probability.

TABLE 6
TONS OF SUGAR BEETS HARVESTED PER ACRE (BEVU 0170)[1/]

Herbicide at Planting	Lb/A 30 gpa	Herbicide Applied at Thinning Time: Granular CP 52223 2 lb/A	Liquid Trifluralin 1 lb/A	Liquid Nitralin 1 lb/A	Liquid CP 52223 2 lb/A	Mean
Preplant Incorporated						(33.4 a)
Pyrazon	3	34.2	32.5	32.0	34.2	33.2
Cycloate	2.5	32.9	35.8	34.6	34.4	34.4
CP 52223, EC	2	31.4	32.4	36.2	31.2	32.8
Pyrazon + CP 52223, EC	3+2	35.2	30.7	33.3	33.0	33.0
	Mean	33.4	32.8	34.0	33.2	
Preemergence Broadcast						(32.2 a)
Pyrazon	3	28.9	27.7	33.8	33.4	30.9
Cycloate	2.5	33.7	32.2	34.5	27.8	32.0
CP 52223, EC	2	31.7	29.9	30.9	34.0	31.6
Pyrazon + CP 52223, EC	3+2	32.5	29.5	36.7	38.0	34.2
	Mean	31.7	29.8	34.0	33.3	
Preemergence - 13" Band						(31.7 a)
Pyrazon	3	30.4	33.3	34.8	35.2	33.4
Cycloate	2.5	30.2	34.6	32.1	32.0	32.2
CP 52223, EC	2	32.5	35.4	30.4	28.8	31.7
Pyrazon + CP 52223, EC	3+2	31.2	26.4	29.4	31.1	29.5
	Mean	31.1	32.4	31.7	31.7	
Pyrazon	3	21.2	31.1	33.6	34.2	32.5 a
Cycloate	2.5	32.3	34.2	33.7	31.4	32.9 a
CP 52223, EC	2	31.8	32.5	32.5	31.3	32.0 a
Pyrazon + CP 52223, EC	3+2	33.0	28.8	33.2	34.0	32.2 a
	Mean	32.1	31.7	33.2	32.7	(32.4)

1/ Lower case letters after means show Duncan's 5% error probability.

TABLE 7
SUGAR BEET PLANTS PER 100 LINEAR FEET IN ROW (BEVU 01A70)

Early Treatment	Lb/A 30 gpa	Counted May 21, 1970
Untreated	-	273
Pyrazon, broadcast	4	293
Cycloate	3	247
CP 52223, Granule	3	165
Pyrazon + CP 52223, Granule	4+3	274
Pyrazon	4	320
Cycloate	3	319
CP 52223, EC	3	191
Pyrazon + CP 52223, EC	4+3	192
$LSD_{05,24}$		70

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TABLE 8
SUGAR BEET PLANTS PER 100 LINEAR FEET OF 30-INCH SPACED ROWS (BEVU 01A70)

		Herbicide Applied at Thinning Time				
Herbicide at Planting	Lb/A 30 gpa	Liquid Trifluralin 1 lb/A	Granular Trifluralin 1 lb/A	Liquid Nitralin 1 lb/A	Liquid CP 52223 2 lb/A	Mean
Untreated	-	100	129	123	113	116 a
Pyrazon*	4	86	151	121	114	118 a
Cycloate	3	144	129	141	143	139 a
CP 52223, Granule	3	111	109	119	91	108 a
Pyrazon + CP 52223, Granule	4+3	130	99	130	174	133 a
Pyrazon	4	100	106	108	106	105 a
Cycloate	3	129	119	126	119	123 a
CP 52223, EC	3	156	130	104	100	123 a
Pyrazon + CP 52223, EC	4+3	126	109	149	115	125 a
	Mean	120 a	120 a	124 a	119 a	(121)

* Applied broadcast; other herbicides applied on 15-inch band.

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TABLE 9
WEED PLANTS IN 10 SQUARE METERS (BEVU 01A70)

Early Treatment	Lb/A 30 gpa	Dicots Counted May 21	Dicots Counted July 27	Monocots Counted May 21	Monocots Counted July 27
Untreated	-	490	58	270	5
Pyrazon, broadcast	4	560	58	140	5
Cycloate	3	560	49	300	3
CP 52223, Granule	3	410	51	100	5
Pyrazon + CP 52223, Granule	4+3	470	58	180	5
Pyrazon	4	580	22	230	5
Cycloate	3	410	48	170	5
CP 52223, EC	3	390	41	30	10
Pyrazon + CP 52223, EC	4+3	510	31	80	5
$LSD_{05,24}$		NS	18	20	NS
$LSD_{01,24}$		NS	24	27	NS

TABLE 10
PERCENT SUGAR CONTENT AT HARVEST (BEVU 01A70)

Herbicide at Planting	Lb/A 30 gpa	Herbicide Applied at Thinning Time: Liquid Trifluralin 1 lb/A	Granular Trifluralin 1 lb/A	Liquid Nitralin 1 lb/A	Liquid CP 52223 2 lb/A	Mean
Untreated	-	13.95	14.60	14.85	14.12	14.38 a
Pyrazon*	4	14.42	14.40	14.67	14.32	14.45 a
Cycloate	3	14.55	14.52	14.70	14.57	14.58 a
CP 52223, Granule	3	14.17	14.32	14.67	13.95	14.28 a
Pyrazon + CP 52223, Granule	4+3	14.42	14.57	14.52	14.77	14.57 a
Pyrazon	4	14.45	14.47	14.72	13.90	14.38 a
Cycloate	3	14.37	14.15	14.45	14.00	14.24 a
CP 52223, EC	3	14.90	14.67	14.27	14.60	14.61 a
Pyrazon + CP 52223, EC	4+3	14.82	14.27	14.77	14.30	14.54 a
	Mean	14.45 ab	14.44 ab	14.62 a	14.28 b	(14.45)

* Applied broadcast; other herbicides applied on 15-inch band.

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TABLE 11
AVERAGE WEIGHT PER BEET PLANT IN GRAMS (BEVU 01A70)

Herbicide at Planting	Lb/A 30 gpa	Herbicide Applied at Thinning Time: Liquid Trifluralin 1 lb/A	Granular Trifluralin 1 lb/A	Liquid Nitralin 1 lb/A	Liquid CP 52223 2 lb/A	Mean
Untreated	-	1143	1122	1030	1040	1083 b
Pyrazon*	4	927	959	924	1368	1045 b
Cycloate	3	957	851	1452	1218	1119 b
CP 52223, Granule	3	1440	1510	1313	1278	1385 ab
Pyrazon + CP 52223, Granule	4+3	946	1432	825	765	992 b
Pyrazon	4	1000	1012	1129	898	1010 b
Cycloate	3	1016	1130	851	950	987 b
CP 52223, EC	3	2022	1231	1848	1792	1723 a
Pyrazon + CP 52223, EC	4+3	1523	1399	1193	1192	1327 ab
	Mean	1219	1183	1174	1167	(1186)

* Applied broadcast; other herbicides applied on 15-inch band.

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TABLE 12
TONS OF SUGAR BEETS HARVESTED PER ACRE (BEVU 01A70)

Herbicide at Planting	Lb/A 30 gpa	Herbicide Applied at Thinning Time: Liquid Trifluralin 1 lb/A	Granular Trifluralin 1 lb/A	Liquid Nitralin 1 lb/A	Liquid CP 52223 2 lb/A	Mean
Untreated	-	22.50	24.97	25.22	23.67	24.09
Pyrazon*	4	23.30	26.97	26.80	28.75	26.45
Cycloate	3	25.30	22.72	27.17	25.25	25.11
CP 52223, Granule	3	24.27	25.45	21.12	22.02	23.21
Pyrazon + CP 52223, Granule	4+3	25.52	19.05	25.80	22.97	23.33
Pyrazon	4	25.55	24.05	24.50	23.05	24.28
Cycloate	3	26.40	23.72	20.62	22.42	23.29
CP 52223, EC	3	27.60	24.32	24.87	24.95	25.43
Pyrazon + CP 52223, EC	4+3	26.30	26.10	25.22	26.57	26.05
	Mean	25.19	24.59	24.40	24.15	(24.59)

* Applied broadcast; other herbicides applied on 15-inch band.

INSECT PESTS OF SUGAR BEETS 1970

E. C. Houser and A. J. Keaster

Five sugar beet fields in three southeastern Missouri counties were surveyed for insects during the 1970 growing season.

The objective of this survey was to collect and identify insects associated with sugar beets in southeastern Missouri; and to study population trends and the economic significance of the various insect populations in sugar beets.

Insects were collected by two methods: 1) Twenty-five leaves were collected randomly from each of three locations within each field. Two medium sized leaves per plant were taken from near the crown of each plant sampled. The leaves were taken to the laboratory and examined for the presence of various insects, and for insect feeding damage. 2) Insect specimens were vacuumed from approximately 33 row feet of sugar beets at each of three locations within each field. This represents approximately 100 row feet per field. Samples were taken with a D-VAC insect sampler and preserved in 70% ethyl alcohol. Specimens were separated to species as nearly as is practical and were shipped to the Entomology Department, University of Missouri-Columbia for identification.

Data from leaf samples are presented in the tables below. Insect specimens taken with the D-VAC machine are being identified. To date, more than 110 insect species have been identified from the 1969 samples.

The Ted Brogden field was not sampled on July 7 and the Sam Hunter, Jr. field was not sampled on August 17 and September 10.

Insect populations in sugar beets in southeastern Missouri during 1970 were quite similar to those of years past. The three insects of major importance here were present again in 1970 but were not considered of significant economic importance. These were the garden fleahopper, the garden webworm and the blister beetle complex. Webworms and blister beetles were responsible for isolated spots of heavy leaf feeding during September in the Julian Boyd field and the Gideon-Anderson field, but control measures were not necessary.

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SUMMARY OF INSECTS PRESENT AND DAMAGE TO FRESH SUGAR BEET PLANT SAMPLES TAKEN ON FOUR SAMPLING DATES IN SOUTHEAST MISSOURI 1970

Observation	Field					
	Boyd	Pierce	Holifield-Purvis	Brogden	Gideon-Anderson	Hunter
			July 7, 1970			
Thrips/leaf	0.01	0.00	0.00	-	0.01	0.00
Aphids/leaf	.00	.00	.00	-	.00	.00
Garden fleahoppers/leaf	.00	.00	.00	-	.00	.00
% Leaves damaged	12.00	29.33	46.67	-	36.00	17.33
# Feeding holes/leaf	.27	.52	.89	-	.68	.37
			July 27, 1970			
Thrips/leaf	.00	.00	.04	.07	.00	.00
Aphids/leaf	.00	.00	.03	.00	.01	.04
Garden fleahoppers/leaf	.00	.00	.00	.00	.00	.00
% Leaves damaged	64.00	38.67	50.67	42.67	37.33	30.67
# Feeding holes/leaf	1.63	.85	1.19	.91	.71	.59
			August 17, 1970			
Thrips/leaf	.04	.00	.01	.00	.00	-
Aphids/leaf	.00	.00	.00	.00	.00	-
Garden fleahoppers/leaf	.64	.48	.15	.41	.35	-
% Leaves damaged	30.67	21.33	24.00	14.67	17.33	-
# Feeding holes/leaf	.40	.25	.43	.23	.27	-
			September 10, 1970			
Thrips/leaf	.00	.03	.04	.00	.00	-
Aphids/leaf	.00	.00	.00	.00	.00	-
Garden fleahoppers/leaf	.19	.07	.53	.21	.59	-
% Leaves damaged	65.33	44.00	40.00	40.00	62.67	-
# Feeding holes/leaf	1.89	.85	.69	.83	2.00	-

AVERAGE FOR ALL FIELDS

Observation	July 7	July 27	August 17	September 10
Thrips/leaf	0.01	0.02	0.01	0.01
Aphids/leaf	0.00	0.01	0.00	0.00
Garden fleahoppers/leaf	0.00	0.00	.41	.32
% Leaves damaged	28.27	44.00	21.60	50.40
# Feeding holes/leaf	.55	.98	.32	1.25

SUGAR BEET DISEASE CONTROL - 1970

Charles H. Baldwin, Jr.

The objective of this years research was to further our knowledge in the area of techniques and chemical control of Cercospora leaf spot, Rhizoctonia crown rot and root knot nematode diseases of sugar beets.

CERCOSPORA LEAF SPOT

The results of the Cercospora fungicide trials are given in Tables I and II. These particular fungicides, rate of application, and intervals between application were selected following an evaluation of the previous research conducted at the Delta Center. The major research emphasis was placed on the time interval between fungicide applications.

The data obtained from the Cercospora resistant variety (Table I) trials showed that there were no significant differences in yield between the check and the treatments at the 0.05 or 0.01 level. However, the percent sugar obtained for the unsprayed check beets was significantly lower than that reported for all of the chemical treatments at the 0.01 level. It should also be noted that TBZ at 3 oz of ai/A was the least effective treatment in the test. The three best fungicidal treatments in the Cercospora resistant variety trials were Du-Ter 3 oz + 4.8 oz ai/A, Du-Ter 3 oz ai/A, and the combination of Du-Ter 3 oz ai/A and Benlate 3 oz ai/A + surfactant (Table I). These results again stress the importance of proper and timely fungicidal applications for the control of Cercospora leaf spot on Cercospora resistant varieties.

The data from the fungicide trials on the Cercospora susceptible variety showed that there were significant differences between the check and the treatments in yield, percent sugar, and disease index at the 0.01 level. The three most effective fungicide applications on the Cercospora susceptible variety were Du-Ter 3 oz ai/A, the combination of Du-Ter 3 oz ai/A and Benlate 3 oz ai/A + surfactant, and Benlate 3 oz ai/A + surfactant (Table I).

Tests were conducted with two new formulations of Benlate (Table II) for Cercospora control. However, the results of these tests indicate that there was no significant increase in the control of Cercospora with these two new formulations (Benlate S or N). Although there were no significant differences between the check and the treatments in so far as yield or percent sugar were concerned, there was a significant difference between the check and the treatments in their disease indexes. Both formulations (Benlate S or N) were very effective in controlling Cercospora beticola.

RHIZOCTONIA CROWN ROT

Tests were conducted again this year at the Delta Center with the objective of discovering an effective means of chemically controlling Rhizoctonia solani or crown rot of sugar beets. The results of this year's tests were analogous to those of previous years, ie no effective chemical disease control was demonstrated. There were no significant differences in stand, disease index, percent sugar, purity or yield between the checks and the treatments (Table III). However, one of the most disturbing discoveries was the fact that the major root rot problem on sugar beets in the Bootheel was not due to Rhizoctonia as had been previously reported, but was instead due to "southern blight" or Sclerotium rolfsii. Thus, the inoculum level of Rhizoctonia in the test plots, which was considered to be high, was extremely low and resulted in very little crown rot development. Furthermore, there was a very high root knot nematode population in these plots which also contributed to stand and yield reduction.

It is the opinion of this researcher that "southern blight" produced by the fungus Sclerotium rolfsii is the most significant disease problem on sugar beets in Missouri. The importance of this disease can not be over emphasized, if we contemplate growing extensive acreages of sugar beets in the bootheel in the near future. Our current agricultural practices will continue to cause an increase in the (inoculum potential) amount and distribution of Sclerotium rolfsii in our soils.

ROOT KNOT NEMATICIDE TESTS

The results of this year's nematicide test from the Clarkton Field are given in Table IV. It has been exceedingly difficult to get a good stand of beets on the sandy loam soil at Clarkton. However, this year we did make some definite progress. The Shell DD treatments were the only plots harvested as all of the other beets had been killed by a fungal disease commonly known as "anthracnose" with the causal agent being a Colletotrichum sp. In spite of these difficulties we were able to produce, on a per A basis, from 18.9 to 23.2 tons of sugar beets. This is a three to four fold increase in production over the 1969 crop.

The severe epidemic of "anthracnose" which developed on the beets at Clarkton was augmented by the use of sprinkler irrigation at this site. When this type of irrigation is used the leaves are covered with a film of water for long periods of time. This water film provides the necessary environment for the distribution and germination of the Colletotrichum spores. When anticipated this disease can adequately be controlled by fungicidal applications. Furthermore, it would appear that the Shell DD provided some systemic fungicidal action as the leaves of the plants in these plots resisted Colletotrichum infection.

There is one other problem relating to nematode infection of sugar beets, and this was the appearance of severe ecto-parasitic nematode damage on one of the cooperative grower fields. The nematodes which were involved in this complex were the stubby root nematode Trichodorus, the spiral nematode Heloicotylenchus and the dagger nematode Xiphenema. It is this researchers opinion that we can expect to find similar situations appearing more frequently in the future, not only on sugar beets, but on our other crops (soybeans) as well.

SUMMARY

We have collected enough data to clearly show that we can adequately control Cercospora leaf spot with the chemicals presently cleared for use on sugar beets. Therefore, this disease should not constitute a major concern as far as a limiting factor in sugar beet production.

The diseases which will be limiting factors to economic sugar beet production are the root rot diseases such as southern blight-Sclerotium rolfsii and possibly Rhizoctonia crown rot-Rhizoctonia solani combined with the root-knot nematode, ecto-parasitic nematode-root rot complex. Thus, considerable research effort must be channelled into this area before control of these diseases will be realized.

TABLE I

THE EVALUATION OF SEVERAL FUNGICIDES FOR THE EFFECTIVE CONTROL OF CERCOSPORA LEAF SPOT ON SUGAR BEETS AT PORTAGEVILLE IN 1970

Treatment			Rate ai/A	Disease Index[3] 1	Disease Index[3] 2	% Sugar	% Juice Purity	Yield Tons/A
RESISTANT VARIETY[1]								
Check				3.3	5.2	9.8	84.5	23.2
Duter		(7 day interval)	3.0 oz	1.1	1.5**	12.1**	87.0	27.4
Duter		(14 day interval)	4.8 oz	1.0	2.1**	11.8**	87.6	26.2
Duter[4]		(14 day interval)	3 & 4.8 oz	1.0	2.0**	12.2**	87.6	27.5
Benlate	+ Surfactant	(14 day interval)	3.0 oz	1.0	1.6**	12.2**	86.7	24.8
Benlate	+ Oil	(14 day interval)	3.0 oz	1.0	1.2**	12.0**	87.1	27.5
Benlate	+ Surfactant	(28 day interval)	3.0 oz	1.1	1.5**	11.7**	85.8	25.1
TBZ	+ Surfactant	(14 day interval)	3.0 oz	1.5	3.0**	11.5**	86.3	24.0
TBZ	+ Surfactant	(14 day interval)	6.0 oz	1.1	2.2**	11.8**	86.1	24.6
Duter[4] + Benlate		(7 day interval (14 day interval)	3.0 oz 3.0 oz	1.0	1.2**	12.1**	86.9	28.6
Duter[4] + TBZ		(7 day interval) (14 day interval)	3.0 oz 6.0 oz	1.1	1.8**	12.0**	87.3	25.0
Manzate D	+ Surfactant	(14 day interval)	2.4 lb	1.2	2.7**	11.7**	86.6	26.0
Duter[4] + Manzate D		(7 day interval) (14 day interval)	3.0 oz 2.4 lb	1.0	1.9**	12.4**	87.2	22.7
L.S.D. at 0.05% Level					.87	.705	-	15.52
L.S.D. at 0.01% Level					1.14	.782	-	17.83
SUSCEPTIBLE VARIETY[2]								
Check				7.1	7.2	7.8	81.7	18.9
Duter		(7 day interval)	3.0 oz	2.2	4.4**	11.7**	86.2	32.6**
Duter		(14 day interval)	4.8 oz	3.2	6.7	10.1**	84.6	29.3**
Duter[4]		(14 day interval)	3 & 4.8 oz	2.4	6.9	9.7**	83.7	29.5**
Benlate	+ Surfactant	(14 day interval)	3.0 oz	1.6	3.0**	11.5**	84.2	32.4**
Benlate	+ Oil	(14 day interval)	3.0 oz	2.8	4.5**	10.8**	83.6	31.1**
Benlate	+ Surfactant	(28 day interval)	3.0 oz	1.8	5.4**	9.8**	86.8	29.0**
TBZ	+ Surfactant	(14 day interval)	3.0 oz	5.6	6.0**	9.0**	82.1	25.6**
TBZ	+ Surfactant	(14 day interval)	6.0 oz	4.3	6.3*	9.3**	83.7	28.3**
Duter[4] + Benlate		(7 day interval) (14 day interval)	3.0 oz 3.0 oz	2.0	2.9**	11.4**	84.3	32.6**
Duter[4] + TBZ		(7 day interval) (14 day interval)	3.0 oz 6.0 oz	2.5	6.4*	10.5**	83.7	33.3**
Manzate D	+ Surfactant	(14 day interval)	2.4 lb	6.1	6.6	9.2**	84.8	25.5**
Duter[4] + Manzate D		(7 day interval) (14 day interval)	3.0 oz 2.4 lb.	2.0	6.4*	10.6**	82.6	33.9**
L.S.D. at 0.05% Level					.83	.375	-	7.5
L.S.D. at 0.01% Level					1.08	.494	-	9.9

Planted: April 8 on beds spaced 28 inches apart and in 30 ft. rows and thinned May 27.

Fertilizer: Broadcast and bedded 50+100+100+2B on or at time of planting and then applied 75 lb. of N on and chisel plowed 10 inches deep on July 15.

Plowing: The row middles were chisel plowed 10-12 inches deep on June 24 and July 15.

Herbicide: Applied Planavin on June 3.

Row Irrigation: The beets were irrigated on June 30; July 7, 16, 28; August 19 and 28.

Harvested: November 12.

Fungicide Application: All treatments were applied with a sprayer equipped with three (1.5 cone) nozzles per row. The material was applied in 40 gallons of water/A at 40 psi. The last application was made October 5 for the Duter (3 oz ai/A) and September 14 for the rest of the treatments.

1/ The resistant variety used was A-290.

2/ The Cercospora susceptible variety was GW-869-68R.

3/ The disease index used was as follows: 1-clean leaves with no lesions to 10-100% of the leaves completely infected. Any grade above 5 (50% of each leaf on each plant infected) was recorded as ineffective control. Disease readings (1) were taken on August 24, while (2) were made on September 25.

4/ In these treatments Duter (3 oz ai/A) was applied at weekly intervals for eight weeks and then the second fungicide was applied bi-weekly for eight weeks.

* L.S.D. at 0.05% Level

** L.S.D. at 0.01% Level

TABLE II
EVALUATION OF BENLATE-N AND BENLATE-S FOR THE CONTROL OF CERCOSPORA LEAF SPOT, PORTAGEVILLE-1970

Treatment	Rate ai/A	Disease Index*	% Sugar	% Juice Purity	Yield Tons/A
Check		5.2	11.8		16.5
Benlate N + Surfactant (14 day interval)	3.0 oz	1.5	13.1		25.4
Check		5.6	10.6	87.6	24.2
Benlate S + Surfactant (14 day interval)	3.0 oz	1.8	12.4	88.8	29.0

Planted: April 8 with variety A-290.
Fertilizer: Broadcast and bedded 50+100+100+2 Boron at time of planting and then applied 75 lb N and chisel plow 10 " deep July 15.
Plowing: The row middles were chisel plowed 10-12 inches deep June 24 and July 15.
Herbicide: Applied Planavin June 3.
Row Irrigation: The beets were irrigated June 30; July 7, 16, 28; August 19 and 28.
Fungicide Application: All treatments were applied with a sprayer equipped with three (1.5 cone) nozzles per row. The material was applied in 40 gal of water/A at 40 psi. The last application was made October 5 for the Duter (3 oz ai/A) and September 14 for the rest of the treatments.
Harvested: November 12.

* The disease index used was as follows: 1-clean leaves with no lesions to 10-100% of the leaves completely infected. Any grade above 5 (50% of each leaf on each plant infected) was recorded as ineffective control.

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TABLE III
THE EFFECTIVENESS OF FUNGICIDES FOR THE CONTROL OF RHIZOCTONIA CROWN ROT-1970

Treatment[1/]	Rate ai/A	Disease Index[2/] % of Stand	% Sugar	% Juice Purity	Yield Tons/A
Check		36.3	11.9	89.2	27.5
Chemagro 6795	2 lb	45.6	11.4	89.8	30.0
Chemagro 8359	2 lb	38.1	11.9	89.7	27.3
Terraclor	20 lb	38.8	12.2	88.6	28.8
Terraclor Super X	10 lb	43.1	10.9	89.9	25.9
Terraclor Super X	16 lb	44.4	10.6	86.4	23.9
Terraclor Super X (twice applied)[3/]	16 lb	43.1	11.7	89.5	25.6
Bay 78175 (liquid)	10 lb	37.5	12.6	89.0	29.4
Bay 78175 (WP)	10 lb	43.1	12.0	89.0	29.0
Resistant Variety 701		8.1	11.8	84.5	31.3
Resistant Variety 702		18.1	11.1	86.3	25.9

Planted: April 8 with variety A-290 and thinned May 28.
Fertilizer: 50+100+100+2B was broadcast and bedded prior to planting. 100# N applied after thinning May 28 and 75+0+0 sidedressed July 15.
Chisel Plowing: Middles plowed 10-12 inches deep June 24 and July 15.
Row Irrigated: June 30; July 7, 16, 28; August 20 and 29.
Herbicide: Applied Planavin June 3.
Insecticide: Sprayed Sevin 1-1/4 lb/A August 12 and September 14.
Fungicide: Duter (4.8 oz ai/A) sprayed June 18; July 9 and 30. Benlate (3 oz ai/A) sprayed August 13, 27; September 10 and 24 for Cercospora control.
Harvested: November 13.

1/All of the fungicide treatments were broadcast on the planting bed and then incorporated prior to planting. No chemicals were applied to the plots which were planted with the two resistant varieties.
2/These readings werettaken prior to thinning.
3/This treatment consisted of a pre-plant broadcast application and a second treatment (16#/A) sidedressed on July 15.

TABLE IV

THE EFFECT OF FUMIGANTS IN CONTROLLING NEMATODES ON SUGAR BEETS AT THE CLARKTON FIELD-1970

Treatment	Rate ai/A	Disease Index[1] 1	Disease Index[1] 2	Nematode Index[2]	Beets/100 ft.	% Sugar	Yield Tons/A
No Treatment		2.9	-	4.9	-	-	-
20 gallons D. D.		1.2	3.2	2.2	107	12.3	18.9
40 gallons D. D.		1.5	2.5	2.1	127	12.5	23.2
Bay 68138	4 oz	1.8	-	1.6	-	-	-
Mocap	6 lb	2.7	-	1.9	-	-	-
Furadan	5 lb	3.0	-	2.4	-	-	-
Furadan	4 lb	3.4	-	2.1	-	-	-
Potassium Azide[3]	10 lb	3.9	- [4]	1.5	-	-	-
Ins 1410[3]	6 lb	3.1	-	1.3	-	-	-

Planted:	April 10 with variety A-290.
Fertilizer:	50+100+100+2 Boron banded prior to bedding.
Sprinkler Irrigated:	June 30; July 6, 13, 23; August 18 and 28.
Fungicide:	All plots were sprayed with Benlate (3 oz ai/A) for the control of Cercospora leaf spot.
Herbicide:	Incorporated Treflan after thinning May 28.
Insecticide:	Sprayed Sevin 1-1/4 lb/A for blister beetles on July 27; August 12 and September 14.
Nematicides:	Treatments were applied and incorporated into the beds with a rotor-tiller.
Harvested:	October 26.

1/Disease index based on a scale of 1 to 6 with 1 = healthy beets (no root knot lesions) to 6 = roots completely covered with root knot lesions and grossly distorted. Readings "1" were made on July 28 and "2" on October 27.

2/Average nematode count of five fields at 10 x magnification.

3/These treatments were applied five days prior to planting.

4/These plots were not harvested as the beets had died and deteriorated. The foliar portion of the plants were killed by anthracnose.

SWEET SORGHUM VARIETY TESTS

James A. Roth and Thomas E. Fisher

Sweet sorghum may offer the possibility of another source of sugar products in the event a mill is constructed in southeast Missouri for sugar beet processing. Sweet sorghum could be harvested prior to the sugar beet crop which would extend the operating season of the plant.

The results in 1970 and previous years have indicated that sorghum can be adapted to Missouri conditions in the production of sugar products. In 1970, 6,285 pounds of sugar was produced per acre from a yield of 25.8 tons of green sorghum with a 12.2% sugar content.

Dr. J. W. Widner of Great Western Sugar Company, Agricultural Experiment Station assisted in obtaining the seed, designing the experiment, analyzing the samples, and calculating the data.

SWEET SORGHUM VARIETY TESTS - 1970
PORTAGEVILLE FIELD - LOAM SOIL

Variety	Days to Mid-Bloom	Plant Height at Harvest inches	Percent Sugar Fresh Wt	Percent Sugar Dry Wt	Purity %	Yield Green Wt tons	Total Sugar/A pounds	Tons/A	% Dry Matter	Dry Matter/A tons
Brandes	93	108	12.19*[2]	45.48[2]	89.9[2]	25.8 a[1]	6285[2]	25.77[1]	26.8[2]	6.91*[2]
Dale	78	117	12.04*	42.44*	89.2	23.4 ab	5644*	23.41*	28.4*	6.65*
FS-26	78	113	12.72	39.73	90.6	22.8 ab	5626*	22.06	32.1	7.08
Rio	68	123	11.32	44.04*	89.9	22.1 b	5153	22.76	25.7	5.85
FS-4	33	86	11.26	44.96*	90.4	17.9 c	3624	16.11	25.0	4.03
Brawley	34	83	11.55	42.84*	89.6	16.1 cd	3487	15.06	27.0	4.07
NB 305 F	34	89	11.47	44.91*	93.4	15.1 cd	3449	15.01	25.6	3.84
RS	31	84	11.29	42.39*	88.4	15.0 cd	3255	14.39	26.7	3.84
CR-1	32	89	8.68	37.29*	90.7	14.6 cd	3117	17.87	23.4	4.18
Sumax	31	86	9.64	39.69	90.1	14.4 d	2826	14.61	24.4	3.56
Minimum LSR(LSD)(.05)			0.83	3.47	NS	3.0	796	3.00	1.7	0.93
Maximum LSR						3.5				
Coefficient of Variance			4.67%	5.20%	3.25%	10.0%	12.96%	11.06%	4.0%	12.85%

Planted: May 7.
Irrigated: July 1, 9, 17, 29 and August 28.
Fertilizer: Preplant broadcast 50 N + 100 P_2O_5 + 100 K_2O. Sidedress 100 N June 9.
Herbicide: None
Insecticide: None
Harvested: August 20 — Brawley, FS-4, CR-1, RS; August 24 — NB 305 F, Sumax; September 11 — Dale, Rio, FS-26; September 18 — Brandes

1/ Duncan's New Multiple Range Test: Results followed by same letters are not significantly different (.05).
2/ Line drawn under highest figure for each variable.
* Statistically equal to highest at 5% level of significance.

OBJECTIVE: To determine if sweet sorghum can produce satisfactory yields of sugar products on southeast Missouri soils.

PROCEDURE: A variety test was planted on the silt loam soil at the Portageville Field. Optimum rates of fertilizer were applied broadcast preplant and supplemental water was applied as needed. Varieties were harvested approximately six weeks after blooming, weighed for yield determination, and samples obtained for purity and sugar analysis. Samples were frozen and shipped to Longmont, Colorado for analysis.

RESULTS: Sugar production per acre compared favorably with that of sugar beets produced on the same soil. The highest percent sugar was 12.7% with 22.1 tons of green material per acre. The highest yielding sugar was obtained from the Brandes variety which produced 6,285 pounds of sugar per acre.

Brandes, Dale, and Rio varieties were statistically equal in production.

Additional research will be required to improve cultural practices in growing sweet sorghum which have not been included this past season. Mechanical means must be developed to remove leaves from the stalks or a chemical process devised to remove impurities if leaves are processed with the stalks.