A report of

Sugar Beet Research

in

Southeast Missouri--1968

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SUGAR BEET RESEARCH IN SOUTHEAST MISSOURI 1968

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SUMMARY

Sugar beet research was expanded by the University of Missouri Agricultural Experiment Station at the Delta Center near Portageville in 1968. Experiments included varieties, weed control, soil fertility, fungicides for control of cercospora leaf spot, row spacing, water infiltration, irrigation, fumigants, insecticides, and rhizoctonia control. Selection in breeding stock was made for resistance to cercospora leaf spot and root knot nematode. Sugar beet experiments were conducted on three of the major soil types of southeast Missouri.

The results of the variety tests varied from 36.5 to 19.8 tons per acre with an average yield of 31.9 tons of sugar beets (8166 pounds of sugar) per acre on the clay soil as compared to 21.1 tons of sugar beets (4518 pounds of sugar) per acre on the silt loam soil. Herbicide chemicals effectively controlled weeds when applied preemergence and post emergence thus reducing hand labor to a minimum. Variety tolerance and foliar fungicidal sprays were very effective in the control of cercospora leaf spot. Irrigation proved to be an essential practice. Sprinkler irrigation increased leaf spot disease but was more effective in wetting the soil as compared to furrow irrigation.

In addition to sugar beets grown on the experimental fields in 1968, three farmers, as selected by the Pemiscot-Dunklin-New Madrid Sugar Beet Association, grew from three to five acres of a total of thirteen acres. These plots were visited weekly by research or extension personnel from the experiment station and recommendations were made to the growers throughout the season. The yields of these plots were 16, 20 and 22 tons of sugar beets per acre. The low yield was due to a later planting which provided valuable information as to the potentials of late planting due to adverse weather.

The staff of The Great Western Sugar Company of Denver, Colorado provided valuable assistance in the research conducted in southeast Missouri during 1968.

INTRODUCTION

The research involving sugar beets was expanded in 1968 to include 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.

The clay soil on the Portageville Field has produced 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.

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. An experiment in 1968 included various materials incorporated into the soil and deep tillage to improve the rate of water infiltration. Cercospora leaf spot has been a serious problem on the loam soil but resistant varieties have reduced the damage caused by the disease considerably.

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 sp.) 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. Seed will be increased from these selections, planted and additional selections made. 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.

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Irrigation was available and required at all locations in 1968. The row method was used on the graded land of the Portageville Field and sprinklers were used at the Clarkton Field. The 1968 growing season was dry and several irrigations were applied at each location.

All experiments except the variety tests were sprayed with a fungicide to control cercospora leaf spot disease. Various fungicides were included in an experiment to determine the effectiveness of these compounds. Du-Ter and Dupont 1991 were both effective in the control of leaf spot.

Surveillance of the sugar beet plots indicated very little damage from insects during 1968. Feeding by Blister beetles Epicauta sp. resulted in minor damage in an experimental plot on the Portageville Field.

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 sugar and purity analyses.

Three farmers of the area produced a total of thirteen acres during 1968. Experiment Station personnel assisted growers in the production of this acreage. Plant managers from the Great Western Sugar Company visited and noted progress of the beets several times during the growing season.

Research in 1969 will be a continuation of the 1968 experiments and in addition rotations including sugar beets with other crops will be initiated. Rows on beds spaced 26 inches apart will be used instead of the 2 rows on beds spaced 44 inches apart.

SUGAR BEET VARIETY EXPERIMENTS IN SOUTHEAST MISSOURI 1968

J. A. Roth

Two sugar beet variety tests were grown on two soils in southeast Missouri during the 1968 growing season. The soils included the "Loam" soil (Tiptonville series) and the "Clay" soil (Sharkey series) located on the Portageville Field of the Delta Center. The soil at each location was graded and irrigation water applied by the row method as needed.

Planting of both tests was completed on March 29 on beds spaced 44 inches apart with two rows of beets spaced 16 inches apart on each bed. Fertilizer ($100N+100P_2O_5+100K_2O+2B$) was incorporated into the bed prior to planting and additional nitrogen sidedressed in May and July.

The experimental design of the two experimental trials was a randomized complete block with ten replicates of nine varieties. No attempt was made to control disease in the tests during the season so as to measure natural resistance to diseases of the area. Varieties varied considerably in their resistance or susceptibility to cercospora leaf spot.

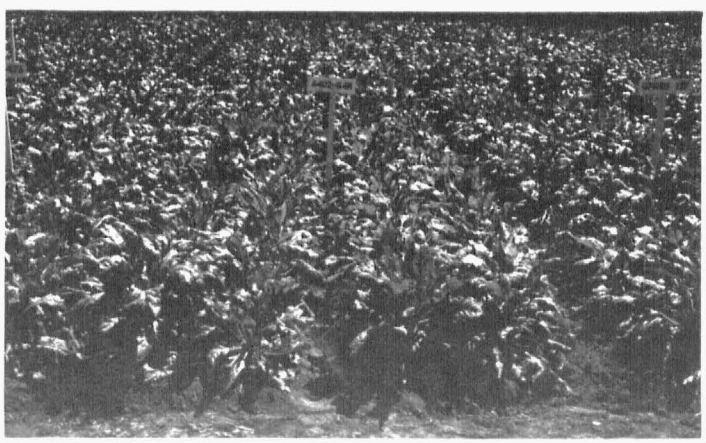
The experiments were harvested October 28. Pulp samples were obtained and shipped to The Great Western Experiment Station at Longmont, Colorado for sugar and purity analyses.

The clay soil produced the highest yield of 36.48 tons per acre with the 67MSH416 variety. Previous tests on the clay soil exceeded yields on the loam soil at the Portageville Field. The 67MSH127 variety was the high yielder on the loam soil in 1968.

Varieties varied considerably in their sugar content as grown under southeast Missouri conditions. On the clay soil the percent sugar varied from 12.24 to 15.80 whereas on the loam soil percent varied from 11.04 to 13.46. Variety A436 (Klein "E") with a low sugar content was severely affected by leaf spot disease which caused complete desiccation of the leaves. The loss of leaves generally reduces the sugar content of the beets as new leaves replace the dead leaves.

The testing and selection of sugar beet varieties adapted to southeast Missouri is an essential part of the sugar beet research program in southeast Missouri. Progress has been made over the years in trials that have been conducted in determining suitable varieties.

In addition to variety testing, selection of beets for cercospora leaf spot resistance has been conducted. Selection on the Clarkton Field for root knot nematode resistance has been in progress for two years.



Variety test on the clay soil at the Portageville Field

SUGAR BEET VARIETY TEST ON THE CLAY SOIL AT THE PORTAGEVILLE FIELD - 1968

Variety	Yield Tons/Acre	% Sugar Content	Juice Purity %	Pounds Recoverable Sugar/Acre[(a)]
67MSH416	36.48	14.87	95.10*	9724
67MSH461	33.84*	15.80	95.17	9604*
67MSH105	32.26	14.53	94.80*	8346
A402-64R (SP6 322-0)	30.90	15.08	94.78*	8272
67MSH144	29.90	15.27	94.82*	8122
GWH16-67A	31.41	14.14	94.23	7799
67MSH127	31.10	14.27	93.55	7688
GWH1-67A	28.67	14.32	94.04	7180
A436 (Klein "E")	32.48	12.24	92.87	6757
General Mean	31.90	14.50	94.37	8166
Coefficient of Variance	9.33%	3.34%	0.51%	9.42%
Least Significant Range (.05)	2.73	0.44	0.44	705

Line drawn under highest figure for each character.

* Statistically equal to highest figure at the 5% level of significance

(a) Calculated by computer; based on formula used since 1954.

Experimental Design: Randomized complete block. 10 replicates
Planted: March 29
Harvested: October 28
Fertilizer: 100+100+100+2 Boron broadcast and rotortilled into the bed before planting. Sidedress with 50 pounds nitrogen May 28 and 100 pounds of nitrogen July 16.
Row Irrigated: June 22, July 22, August 21 and September 11.

SUGAR BEET VARIETY TEST ON THE SILT LOAM SOIL AT THE PORTAGEVILLE FIELD - 1968

Variety	Yield Tons/Acre	% Sugar Content	Juice Purity %	Pounds Recoverable Sugar/Acre[(a)]
67MSH461	21.49*	13.46	94.72	5134
67MSH416	22.40*	12.70	94.49*	5036*
67MSH127	23.01	12.22	93.46	4841*
A402-64R (SP6-322-0)	19.75	13.19*	94.49*	4604
67MSH144	20.10	12.84*	94.12*	4518
67MSH105	20.58	12.27	93.52	4347
GWH16-67A	20.32	11.67	94.33*	4165
A436 (Klein "E")	22.48*	11.04	91.65	4116
GWH1-67A	19.92	11.46	93.26	3907
General Mean	21.13	12.32	93.78	4518
Coefficient of Variance	9.24%	5.59%	0.96%	12.21%
Least Significant Range (.05)	1.79	0.63	0.83	506

Line drawn under highest figure for each character.

* Statistically equal to highest figure at the 5% level of significance.

(a) Calculated by computer; based on formula used since 1954.

Experimental Design: Randomized complete block. 10 replicates.
Planted: March 29
Harvested: October 28
Fertilizer: 100+100+100+2 Boron broadcast and rotortilled into the bed before planting. Sidedress with 50 pounds nitrogen May 29 and 100 pounds nitrogen July 16.
Row Irrigated: June 10, 22, July 9, 17, 23, 30, August 8, 22, September 4 and 11.

SOIL FERTILITY, IRRIGATION AND ROW SPACING EXPERIMENTS WITH SUGAR BEETS

James A. Roth

Soil fertility research involving sugar beets was expanded in 1968 to include the loam and clay soils of the Portageville Field and the sandy soil at the Clarkton Field. Experiments also include methods of irrigation, various row spacings and soil treatments to improve rate of water penetration.

The loam soil at the Portageville Field has produced satisfactory yields and quality of sugar beets since research was initiated in 1961. One difficult problem encountered in this soil has been the slow penetration of irrigation water applied by flooding the middles. The method of planting, two rows on one bed, has contributed to this problem. Experiments have indicated that an expanded mica material incorporated into the soil has aided considerably by increasing water penetration and has been reflected by a yield increase. Other materials incorporated into the soil did not increase yields.

The clay soil at the Portageville Field has resulted in the highest yields of sugar beets of all soils used in the experimental trials in 1968 and previous years. Leaf spot on this soil has not been a serious problem as compared to the loam soil or sandy soil. Irrigation has been required on this soil but not as frequent as either the loam or sandy soils. Harvesting on the clay soil would be extremely difficult in wet seasons so early harvest has been essential.

The soil on the Clarkton Field is sandy and heavily infested with root knot nematode. This nematode is present on a large portion of the sandy soils of the area and will require fumigation if sugar beets are to be grown. The production of beets on this soil will enable continued harvesting in the fall during periods of rainfall when the loam and clay soils would be too wet. The production of sugar beets on this sandy soil in 1968 was unsatisfactory thus additional research is needed to determine how to improve production and quality on this soil.

Nitrogen applications have been very essential in increasing yields of sugar beets but an excessive amount has been detrimental to the quality of the crop. Quality of sugar beets was measured by the percent sugar and purity percentage of the juice. One hundred fifty (150) pounds of nitrogen has produced maximum yields without reducing quality materially. On the sandy soil best results have been obtained by a split application of nitrogen as compared to one preplant application.

The various row spacings of the sugar beets affected the yield and quality of the crop in 1968. Increasing the distance between rows has resulted in a decline in yields and a reduction in quality by reducing percent sugar and juice purity. Results have indicated that 22 inch rows are most favorable for the beet crop but it is somewhat difficult to perform tillage operations with tractors of the area which have large tires.

Preparing seed bed and planting sugar beets on a clay soil in southeast Missouri in 1968

THE EFFECT OF SOIL FERTILITY TREATMENTS ON YIELDS AND QUALITY OF SUGAR BEETS - 1968
PORTAGEVILLE FIELD-CLAY SOIL

Soil Test (1968)	O.M.	P_2O_5	K	Mg.	Ca	pH	H	C.E.C.	Soil Series
Topsoil	2.7	448+	500	920	5600	5.5	5.0	23.5	Sharkey
Subsoil	2.3	221	430	960	5700	5.9	3.5	22.5	

Soil Treatment[1/]		Beets Harvested Per 100 Feet			Percent Sugar		
Pounds of Nitrogen							
Sidedress April 25	Sidedress	Oct. 24	Nov. 21	Mean	Oct. 24	Nov. 21	Mean
0		155 a	132 b	144 ab	15.5 ab	15.9 a	15.7 a
75		138 ab	141 ab	139 ab	15.5 ab	15.7 ab	15.6 a
150		144 ab	141 ab	143 ab	15.3 ab	15.5 ab	15.4 ab
75	75(June 21)	135 b	138 ab	137 ab	15.0 ab	15.4 ab	15.2 ab
225		133 b	131 b	132 b	14.8 ab	15.5 ab	15.1 ab
75	75(June 21)-75(July 30)	135 b	131 b	133 ab	14.7 b	15.0 ab	14.8 b
150[2/]		134 b	138 ab	136 ab	15.4 ab	15.4 ab	15.4 ab
75 - 8 Ton Fine Lime	75(June 21)	149 ab	142 ab	145 a	15.1 ab	15.3 ab	15.2 ab
Mean		140	137	139	15.2	15.4	15.3
Minimum Least Significant Range(L.S.D.)(.05)		16.9		11.9	0.9		0.7
Maximum Least Significant Range		20.2		13.7	1.1		0.8
Coefficient of Variance			8.5%			4.2%	

		Juice Purity Percent			Yield Tons Per Acre		
		Oct. 24	Nov. 21	Mean	Oct. 24	Nov. 21	Mean
0		97.1 a	96.8 ab	96.9 a	11.5 gh	9.7 h	10.5 e
75		96.3 a-d	96.4 a-d	96.3 ab	14.1 fg	12.1 gh	13.1 e
150		96.5 abc	96.1 a-d	96.3 ab	19.1 de	17.7 ef	18.4 cd
75	75(June 21)	95.8 bcd	95.5 cd	95.7 bc	21.8 a-d	19.4 cde	20.6 bc
225		96.1 a-d	95.8 bcd	95.9 bc	23.1 a-d	23.3 abc	23.2 ab
75	75(June 21)-75(July 30)	95.6 cd	95.3 d	95.5 c	24.5 a	23.6 ab	24.0 a
150[2/]		95.8 bcd	95.9 bcd	95.9 bc	20.2 b-e	19.9 b-e	20.0 c
75 - 8 Ton Fine Lime	75(June 21)	96.6 abc	96.2 a-d	96.4 ab	16.3 ef	16.1 ef	16.2 d
Mean		96.2	96.0	96.1	18.8	17.7	18.3
Minimum Least Significant Range(L.S.D.)(.05)		1.0		0.7	3.6		2.5
Maximum Least Significant Range		1.2		0.8	4.3		2.9
Coefficient of Variance			0.7%			13.8%	

Planted: A 402-64R March 29.
Row irrigated: June 22, July 22, August 21 and September 11
Sprayed with fungicide (TBZ) for leaf spot control July 9, August 9 and September 3.
Herbicide: One pound trifluralin and cultivated into soil May 24.
Harvest: First harvest October 24 and second harvest November 21.

1/ Fertilizer applied preplant 0+100+100+2B ($N+P_2O_5+K_2O$+Boron) broadcast and incorporated into bed with rotor-tiller and bed shaper.
2/ Sodium nitrate used as nitrogen source. Ammonium nitrate used as source of nitrogen on all plots.
3/ Duncan's New Multiple Range Test: Results followed by same letters are not significantly different (.05).

OBJECTIVE: To determine rate of nitrogen required for high yields of high quality sugar beets. To determine if all nitrogen can be applied in one operation, either preplant or at time of planting or is it desirable to apply part of the nitrogen later in the season.

PROCEDURE: Limestone, phosphate, potash and boron were applied broadcast and disc into the soil. Land was shaped into beds by use of rotor-tiller equipped with bed shaper. Beds were permitted to settle approximately thirty days after which beets were planted on top of the beds. Beets were fertilized after emergence according to treatments as listed above. At thinning trifluralin was applied and incorporated into the soil with the cultivator. Leaf spot was controlled by periodic spraying of a fungicide. Irrigation water was applied as needed by the row method of application. Sugar beets were harvested, yields determined, samples obtained from which sugar and purity analysis were made. A later harvest was made to determine change in yield and quality of the beets due to a delayed or an early harvest.

RESULTS: Yields in excess of 20 tons per acre were obtained on this clay soil in 1968. One entry in the variety test yielded 36 tons per acre which was the highest yield obtained at any time at the Delta Center.

As the rate of nitrogen was increased the quality of the sugar beets declined. Just the opposite occurred in regard to yields which increased as the nitrogen was increased. On this clay soil the split applications of nitrogen outyielded the same total nitrogen applied in one application.

The eight ton application of fine lime reduced the yield of sugar beets even though the soil pH was 5.5. The rate of application was probably too high or was not mixed as thoroughly in the soil as it should have been.

THE EFFECT OF SOIL FERTILITY TREATMENTS ON YIELDS AND QUALITY OF SUGAR BEETS - 1968
PORTAGEVILLE FIELD-LOAM SOIL

Soil Test (1968)	O.M.	P_2O_5	K	Mg.	Ca	pH	H	C.E.C.	Soil Series
Topsoil	2.3	320	410	260	3400	5.5	2.5	12.5	Tiptonville
Subsoil	2.1	160	220	340	4000	5.3	4.0	15.5	

Soil Treatment[1]		Beets Harvested Per 100 Feet			Percent Sugar		
Pounds of Nitrogen							
Sidedress April 25	Sidedress	Oct. 28	Nov. 26	Mean	Oct. 28	Nov. 26	Mean
0		141 abc[3]	118 c[3]	130 ab[3]	14.6 ab[3]	15.4 bc[3]	14.9 a[3]
75		128 abc	133 abc	130 ab	14.6 cde	15.6 b	15.1 a
150		131 abc	145 ab	138 ab	14.1 e	16.6 a	15.3 a
75	75(June 21)	136 abc	136 abc	136 ab	13.9 e	16.2 a	15.1 a
225		126 bc	124 bc	125 b	13.0 f	14.5 de	13.7 b
75	75(June 21)-75(July 30)	136 abc	144 ab	140 ab	13.1 f	15.1 bcd	14.1 b
150[2]		149 a	134 abc	142 ab	14.2 de	16.3 a	15.2 a
75 - 8 Ton Fine Lime	75(June 21)	138 abc	138 abc	138 ab	14.5 de	15.4 bc	15.0 a
Mean		135	134	135	14.0	15.6	14.8
Minimum Least Significant Range(L.S.D.)(.05)		19.1		13.5	0.8		0.6
Maximum Least Significant Range		23.0		15.6	1.0		0.7
Coefficient of Variance			9.9%			3.8%	

		Juice Purity Percent			Yield Tons Per Acre		
		Oct. 28	Nov. 26	Mean	Oct. 28	Nov. 26	Mean
0		96.3 abc[3]	97.0 a[3]	96.6 a[3]	11.6 ef[3]	9.7 f[3]	10.6 c[3]
75		96.1 abc	95.4 abc	95.7 abc	14.3 cde	17.0 abc	15.6 ab
150		94.5 bcd	96.1 abc	95.3 a-d	12.8 def	13.8 cde	13.3 b
75	75(June 21)	95.7 abc	96.4 ab	96.0 ab	13.7 cde	14.6 cde	14.2 b
225		94.2 cd	94.9 a-d	94.5 cd	13.9 cde	17.2 abc	15.6 ab
75	75(June 21)-75(July 30)	94.5 bcd	93.3 d	93.9 d	15.0 b-e	15.9 a-d	15.4 ab
150[2]		94.7 bcd	95.5 abc	95.1 bcd	17.2 abc	18.2 ab	17.7 a
75 - 8 Ton Fine Lime	75(June 21)	96.5 ab	96.3 abc	96.4 ab	16.5 abc	19.0 a	17.7 a
Mean		95.3	95.6		14.4	15.7	15.0
Minimum Least Significant Range(L.S.D.)(.05)		1.8		1.3	3.1		2.2
Maximim Least Significant Range		2.2		1.5	3.7		2.5
Coefficient of Variance			1.4%			14.2%	

Planted: A 402-64R March 29.
Row irrigated: June 10, 22, July 10, 16, 23, 31, August 21 and September 11.
Sprayed with fungicide (TBZ) for leaf spot control July 9, August 9 and September 3.
Herbicide: One pound trifluralin per acre sprayed and cultivated into soil May 21.
Harvested: First harvest October 28 and second harvest November 26.

1/ Fertilizer applied preplant 0+100+100+2B ($N+P_2O_5+K_2O$+Boron) broadcast and incorporated into bed with rotor-tiller and bed shaper.
2/ Sodium nitrate used as nitrogen source. Ammonium nitrate used as source on all other treatments.
3/ Duncan's New Multiple Range Test: Results followed by same letters are not significantly different (.05).

OBJECTIVE: To determine rate of nitrogen required for high yields of high quality sugar beets. To determine if all nitrogen can be applied in one operation, either preplant or at time of planting or is it desirable to apply part of the nitrogen later in the season.

PROCEDURE: Limestone, phosphate, potash and boron were applied broadcast and disc into the soil. Land was shaped into beds by use of rotor-tiller equipped with bed shaper. Beds were permitted to settle approximately thirty days after which beets were planted on top of the beds. Beets were fertilized after emergence according to treatments as listed above. At thinning trifluralin was applied and incorporated into the soil with the cultivator. Leaf spot was controlled by periodic spraying of a fungicide. Irrigation water was applied as needed by the row method of application. Sugar beets were harvested, yields determined, samples obtained from which sugar and purity analysis were made. A later harvest was made to determine change in yield and quality of the beets due to a delayed or an early harvest.

RESULTS: As the of nitrogen was increased, yields increased but the percent sugar and juice purity declined. The season was extremely hot and dry during July and August which necessitated weekly applications of irrigation water. Poor penetration of water prevented restoration of the soil moisture to the full capacity of the soil. The results indicate that 150 pounds of nitrogen was adequate if applied in the form of sodium nitrate. A split application of 150 pounds of nitrogen (ammonium nitrate) plus eight tons of fine limestone produced a yield equal to the sodium nitrate treatment. Due to the high soil test of phosphorous and potassium this soil in past experiments has not responded to the addition of these nutrients.

THE EFFECT OF SOIL FERTILITY TREATMENTS ON YIELDS AND QUALITY OF SUGAR BEETS - 1968
CLARKTON FIELD

Soil Test (1968)	O.M.	P_2O_5	K	Mg.	Ca	pH	H	C.E.C.	Soil Series
Topsoil	1.3	326	220	220	1300	5.7	2.0	6.5	Beulah
Subsoil	0.8	80	160	280	700	4.8	3.0	6.0	

Soil Treatment[1/]		Beets Harvested Per 100 Feet			Percent Sugar		
Pounds of Nitrogen							
Sidedress April 25	Sidedress	Nov. 4	Nov. 25	Mean	Nov. 4	Nov. 25	Mean
0		136 bcd	133 bcd	135 abc	14.9 bcd	16.1 a	15.5 a
75		128 cde	134 bcd	131 abc	14.7 b-e	15.9 ab	15.3 a
150		129 cde	124 de	126 bc	14.0 def	14.6 c-f	14.3 bc
75	75(June 28)	135 bcd	111 ef	123 bc	13.4 f	14.9 bcd	14.1 bc
225		133 bcd	104 f	119 c	12.3 g	14.2 def	13.2 c
75	75(June 28)-75(Aug. 1)	139 a-d	137 bcd	138 ab	14.1 def	13.5 ef	13.8 c
150[2/]		146 abc	146 abc	146 a	14.7 b-e	15.7 abc	15.2 a
75 - 8 Ton Fine Lime	75(June 28)	158 a	153 a	156 a	14.2 def	15.2 a-d	14.7 ab
Mean		138	130	134	14.0	15.0	14.5
Minimum Least Significant Range(L.S.D.)(.05		16.7		16.7	1.1		0.8
Maximum Least Significant Range		20.1		19.3	1.3		0.9
Coefficient of Variance			12.4%			5.3%	

		Juice Purity Percent			Yield Tons Per Acre		
		Nov. 4	Nov. 25	Mean	Nov. 4	Nov. 25	Mean
0		96.5 abc	96.9 ab	96.7 ab	9.4 abc	8.5 bc	8.9 bc
75		97.1 a	97.2 a	97.2 a	7.6 c	7.4 c	7.5 c
150		96.8 ab	95.4 cde	96.1 a	10.0 abc	9.8 abc	9.9 abc
75	75(June 28)	96.1 abc	95.7 b-e	95.9 bc	11.2 abc	10.9 abc	11.0 ab
225		94.7 de	95.4 cde	95.0 c	11.4 abc	10.9 abc	11.2 ab
75	75(June 28)-75(Aug. 1)	95.7 b-e	94.5 e	95.1 c	11.4 abc	11.0 abc	11.2 ab
150[2/]		96.2 abc	96.0 a-d	96.1 a	12.4 abc	10.8 abc	11.6 ab
75 - 8 Ton Fine Lime	75(June 28)	96.3 abc	96.1 abc	96.2 a	13.3 a	11.0 abc	12.2 a
Mean		96.2	95.9	96.1	10.8	10.0	10.4
Minimum Least Significant Range(L.S.D.)(.05)		1.2		0.9	3.7		2.6
Maximum Least Significant Range		1.5		1.0	4.5		3.0
Coefficient of Variance			0.9%			24.9%	

Fumigated: 25 gallons of Shell D-D soil fumigant per acre placed 9 inches deep under each row, February 23.
Planted: A 402-64R planted March 18 but replanted April 1, and April 10.
Sprinkler irrigated: June 7, 14, July 1, 10, 15, 22, 31, August 6, 23, and September 4.
Sprayed with fungicide (TBZ) for leaf spot control.
Herbicide: 2-1/2 pounds dalapon sprayed over beets May 3 and 1 pound trifluralin May 20 cultivated into soil.
Harvest: First November 4 and second harvest November 25.

1/ Fertilizer applied preplant 0+100+100+2B ($N+P_2O_5+K_2O$+Boron) broadcast and incorporated into bed with rotor-tiller and bed shaper.
2/ Sodium nitrate used as nitrogen source. Ammonium nitrate used as source of nitrogen on all other plots.
3/ Duncan's New Multiple Range Test: Results followed by same letters are not significantly different (.05).

OBJECTIVE: To determine rate of nitrogen required for high yields of high quality sugar beets. To determine if all nitrogen can be applied in one operation, either preplant or at time of planting or is it desirable to apply part of the nitrogen later in the season.

PROCEDURE: Limestone, phosphate, potash and boron were applied broadcast and disc into the soil. Land was shaped into beds by use of rotor-tiller equipped with bed shaper. Beds were permitted to settle approximately thirty days after which beets were planted on top of the beds. Beets were fertilized after emergence according to treatments as listed above. At thinning trifluralin was applied and incorporated into the soil with the cultivator. Leaf spot was controlled by periodic spraying of a fungicide. Irrigation water was applied as needed by the sprinkler method of application. Sugar beets were harvested, yields determined, samples obtained from which sugar and purity analysis were made. A later harvest was made to determine change in yield and quality of the beets due to a delayed or an early harvest.

RESULTS: Sugar beet yields on this sandy soil were below what would be acceptable in commercial production. Root-knot nematode and poor water holding capacity of this soil have contributed to the low yields. The split application totaling 150 pounds of nitrogen with additional limestone produced the maximum yield in 1968. The higher rate of nitrogen (225 pounds) reduced percent sugar and juice purity without improvement in yield.

Future study will aim toward the determination of production methods required to produce satisfactory sugar beet crops on this soil. In the operation of a sugar mill beets may be harvested on this soil at times when wet soil conditions would prevent harvest on the loam or clay soils. Thus it will be desirable that some beets be grown on the sandy soils.

INFLUENCE OF METHOD OF IRRIGATION ON YIELDS AND QUALITY OF SUGAR BEETS - 1968
PORTAGEVILLE-LOAM

	Beets Per 100 Feet Harvest			Percent Sugar Harvest		
	Oct. 28	Nov. 21	Mean	Oct. 28	Nov. 21	Mean
IRRIGATION X HARVEST MEANS						
Row Irrigation	126 a[1/]	111 a	118 a	15.3 a	14.9 a	15.1 a
Sprinkler Irrigation	111 a	119 a	115 a	12.8 b	14.2 a	13.5 b
Minimum Least Significant Range(L.S.D.)(.05)	29		21	1.2		0.9
Maximum Least Significant Range	31		21	1.3		0.9
Coefficient of Variance		14.5%			5.0%	
HARVEST MEANS						
October 28			118 a			14.0 a
November 21			115 a			14.6 a
Minimum Least Significant Range(L.S.D.)(.05)			15			1.4
Maximum Least Significant Range			15			1.4
Coefficient of Variance			8.2%			6.1%

	Juice Purity Percent Harvest			Yield Tons Per Acre Harvest		
	Oct. 28	Nov. 21	Mean	Oct. 28	Nov. 21	Mean
IRRIGATION X HARVEST MEANS						
Row Irrigation	94.6 a	94.6 a	94.6 a	16.6 b	21.0 a	18.8 b
Sprinkler Irrigation	92.3 a	92.9 a	92.6 b	20.5 a	23.5 a	22.0 a
Minimum Least Significant Range(L.S.D.)(.05)	2.8		2.0	3.5		2.5
Maximum Least Significant Range	3.0		2.0	3.7		2.5
Coefficient of Variance		1.8%			9.9%	
HARVEST MEANS						
October 28			93.5 a			18.6 b
November 21			93.8 a			22.3 a
Minimum Least Significant Range(L.S.D.)(.05)			1.4			5.7
Maximum Least Significant Range			1.4			5.7
Coefficient of Variance			0.9%			17.6%

Planted: A 402-64R April 15, Thinned: May 9.
Fertilizer all plots: 100+100+100+2B ($N+P_2O_5+K_2O$+Boron) broadcast and incorporated into bed with rotor-tiller. Fifty pounds nitrogen sidedress May 28 and 100 pounds nitrogen sidedressed July 22.
Herbicide: One pound trifluralin incorporated into soil with rotary hoe May 22 after thinning.
Irrigated: June 10, 22, July 10, 16, 23, 31, August 6, 20, September 4 and 11.
Harvested: First harvest October 28 and second harvest November 21
Fungicide: All plots sprayed with TBZ to control cercospora leaf spot July 8, August 9, 29 and September 21.

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

OBJECTIVE: To determine the influence of the method of applying irrigation water on sugar beet quality and yield.

PROCEDURE: Preplant fertilizer was broadcast and incorporated into the bed. Sugar beets were planted on top of the bed and after thinning trifluralin was incorporated into the soil with a rotary hoe. Irrigation water was applied during the growing season as needed. On portions of the area the row method of irrigation was used while on a similar area the sprinkler system was used. The fungicide TBZ was applied on the beets of both areas. At harvest yields were obtained and samples obtained for sugar and purity analysis. Two harvests were made to measure the differences in yield and quality of the beets between harvests.

RESULTS: Because of poor penetration row irrigation has not been a very effective method of irrigating sugar beets on the loam soil at the Portageville Field.

The sprinkler method improved penetration of the water into the soil but also caused the spread and intensity of cercospora leaf spot. Leaf spot causes the leaves to desicate which necessitates replacement by new leaves. This process of renewing the leaves causes a reduction in the sugar content as indicated by the data in the above table. Fungicide sprays were applied but did not completely control the disease. The row irrigated sugar beets had very little leaf spot on the plant leaves.

The yield of the sugar beets irrigated by sprinkler averaged 3.2 tons more than those row irrigated. Additional studies in the use of fungicides and the development of more resistant varieties may change this unfavorable result of sprinkler irrigation.

THE INFLUENCE OF VARIOUS ROW SPACINGS ON SUGAR BEET YIELDS AND QUALITY - 1968

Row Spacing	Beets Harvested Per 100 Feet			Percent Sugar		
	Oct. 28	Nov. 26	Mean	Oct. 28	Nov. 26	Mean
			PORTAGEVILLE FIELD-CLAY SOIL			
28" and 16"[1]	142 a[2]	143 a	142 b	15.6 a	15.6 a	15.6 a
22"	157 a	155 a	156 ab	15.8 a	15.3 a	15.6 a
26"	143 a	148 a	145 ab	15.0 a	16.8 a	15.9 a
30"	162 a	156 a	159 a	15.8 a	15.6 a	15.7 a
Minimum Least Significant Range(L. S. D.)(. 05)	20.5		14.5	1.8		1.3
Maximum Least Significant Range	23.5		15.6	2.1		1.4
Coefficient of Variance		10.5%			8.9%	
			PORTAGEVILLE FIELD-LOAM SOIL			
28" and 16"	136 ab	143 ab	139 a	14.5 b	16.6 a	15.5 a
22"	133 ab	138 ab	135 a	14.3 b	15.0 b	14.7 b
26"	137 ab	155 a	146 a	14.5 b	15.3 b	14.9 ab
30"	140 ab	125 b	133 a	14.4 b	15.0 b	14.7 b
Minimum Least Significant Range(L. S. D.)(. 05)	22.2		15.7	0.96		0.68
Maximum Least Significant Range	24.8		17.0	1.07		0.73
Coefficient of Variance		9.0%			3.6%	

Row Spacing	Juice Purity Percent			Yield Tons Per Acre		
	Oct. 28	Nov. 26	Mean	Oct. 28	Nov. 26	Mean
			PORTAGEVILLE FIELD-CLAY SOIL			
28" and 16"	96.8 a	95.6 b	96.2 a	10.1 c	11.1 bc	10.6 c
22"	96.0 ab	95.1 b	95.6 a	13.4 a	13.0 ab	13.2 a
26"	95.8 ab	95.6 b	95.7 a	13.2 ab	12.1 abc	12.7 ab
30"	95.6 b	95.3 b	95.4 a	12.0 abc	11.1 bc	11.6 bc
Minimum Least Significant Range(L. S. D.)(. 05)	1.1		0.8	1.9		1.3
Maximum Least Significant Range	1.2		0.8	2.2		1.4
Coefficient of Variance		0.9%			12.0%	
			PORTAGEVILLE FIELD-LOAM SOIL			
28" and 16"	95.2 ab	96.1 a	95.7 a	13.0 b	15.0 ab	14.0 b
22"	94.7 b	95.0 ab	94.9 ab	16.8 a	16.8 a	16.8 a
26"	95.1 ab	95.4 ab	95.3 ab	13.0 b	15.0 ab	14.0 b
30"	94.7 b	94.4 b	94.6 b	13.1 b	13.0 b	13.0 b
Minimum Least Significant Range(L. S. D.)(. 05)	1.09		0.77	3.0		2.1
Maximum Least Significant Range	1.22		0.84	3.4		2.3
Coefficient of Variance		0.7%			11.8%	

Planted: A402-64R April 16.
Fertilizer applied preplant 100+100+100+2 Boron ($N+P_2O_5+K_2O$+Boron) broadcast and incorporated into soil.
Row irrigated: Clay soil-June 22, July 22, August 21 and September 11. Loam soil-June 10, 22, July 10, 16, 23, 31, August 6, 20 and September 4 and 11.
Sprayed with fungicide (TBZ) July 9, and September 3.
Herbicides used were dalapon to control grass postemergence and trifluralin incorporated into soil with cultivator after thinning.
Harvested: First harvest October 28 and second harvest November 26.

1/ Two rows on bed 16 inches apart with 28 inch middles between the double rows.
2/ 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 spacing for maximum yield and highest quality. However it was desired in this experiment to keep the row spacing within practibility of present day equipment.

PROCEDURE: Preplant fertilizer was broadcast and disc into the soil. Sugar beets were planted on the flat in row spacings as listed in the above table. The herbicide trifluralin was applied and incorporated into the soil at time of thinning. Irrigation water was applied as needed. Fungicide (TBZ) was applied three times during the season to prevent leaf spot. The beets were harvested, yields determined, and samples obtained for sugar percentage and purity analysis.

RESULTS: Narrow rows were not practical with the size tires of tractors used in modern agriculture. These data obtained from the two soils above indicate that the 22 inch rows produced the higher yields of the various row widths tested. The 30 inch rows would be the more ideal spacing as far as machinery was concerned but the quality and yield of the beets were reduced on the clay and loam soils. The method of planting two rows of sugar beets on one bed was very difficult to irrigate, cultivate and harvest.

The beets in these two tests were planted late which was the reason for the low yields. Had the sugar beets been planted in March instead of April 16 higher yields would have resulted. Sugar beets in the 1969 experiments will be planted in rows spaced 26 inches apart.

INFLUENCE OF SOIL TREATMENTS ON SUGAR BEET YIELDS AND QUALITY - 1968
PORTAGEVILLE FIELD-LOAM SOIL

Soil Treatment[1/]	Beets Per 100 Feet Harvest			Percent Sugar Harvest		
	Oct. 28	Nov. 26	Mean	Oct. 28	Nov. 26	Mean
TREATMENT X HARVEST MEANS						
None	123 a[2/]	138 a	130 a	13.3 bc	14.5 ab	13.9 a
Deep Tillage 24"	116 a	128 a	122 a	13.7 abc	14.9 a	14.3 a
5 Ton Zonolite	109 a	131 a	120 a	12.9 c	14.9 a	13.9 a
10 Ton Zonolite	118 a	120 a	119 a	13.2 bc	14.9 a	14.0 a
20 Ton Silage	121 a	124 a	123 a	13.6 abc	14.0 abc	13.8 a
250 Ton Clay Soil	121 a	125 a	123 a	12.9 c	14.2 abc	13.5 a
Minimum Least Significant Range(L.S.D.)(.05)	26		19	1.3		0.9
Maximum Least Significant Range	29		20	1.5		1.0
Coefficient of Variance		9.6%			4.3%	
HARVEST MEANS	118 a	128 a		13.3 a	14.5 a	

	Juice Purity Percent Harvest			Yield Tons Per Acre Harvest		
	Oct. 28	Nov. 26	Mean	Oct. 28	Nov. 26	Mean
TREATMENT X HARVEST MEANS						
None	94.7 ab	93.9 ab	94.3 abc	12.6 b	13.7 b	13.2 a
Deep Tillage 24"	95.7 a	94.9 ab	95.3 ab	10.9 b	15.9 ab	13.4 a
5 Ton Zonolite	94.5 ab	94.4 ab	94.4 abc	14.1 b	21.6 a	17.9 a
10 Ton Zonolite	95.5 ab	95.5 ab	95.5 a	15.1 ab	16.9 ab	16.0 a
20 Ton Silage	93.8 b	93.8 b	93.8 c	13.2 b	15.1 ab	14.2 a
250 Ton Clay Soil	94.1 ab	94.4 ab	94.2 bc	13.1 b	14.2 b	13.6 a
Minimum Least Significant Range(L.S.D.)(.05)	1.6		1.2	6.5		4.6
Maximum Least Significant Range	1.8		1.3	7.2		5.1
Coefficient of Variance		0.8%			20.0%	
HARVEST MEANS	94.7 a	94.5 a		13.2 a	16.2 a	

Planted: A 402-64R April 12.
Fertilized all plots with 100+100+100+2B ($N+P_2O_5+K_2O$+Boron) broadcast and incorporated into bed with rotor-tiller.
Irrigated: June 10, 22, July 10, 16, 23, 31, August 6, 20, September 4 and 11.
Harvested: First harvest October 28 and second harvest November 21.
Fungicide: All plots sprayed with TBZ to control cercospora leaf spot; July 8, August 9, 29, and September 12.

1/ Materials were incorporated into top 8 inches of soil
2/ Duncan's New Multiple Range Test: Results followed by same letters are not significantly different (.05)

OBJECTIVE: To determine a soil treatment method that would increase the rate of penetration of irrigation water into the loam soil.

PROCEDURE: Various materials as listed in the above table were incorporated into the soil eight inches deep with a rotor-tiller. In addition one treatment consisted of removing and mixing the soil 24 inches deep. The plots were then shaped into beds and sugar beets planted on top of the beds. Row irrigation was used in applying the water. Trifluralin was incorporated into the soil after thinning to control leaf spot. Two harvests were made so as to determine effects of date of harvest on yields and quality of the beets.

RESULTS: Expanded mica (Zonolite) resulted in the highest yields of this experiment. Observations during the growing season indicated maximum top growth on the plot containing the mixture of clay soil. The yield of beets was not increased by the clay treatment. A practical method of improving the rate of penetration is definitely needed and future work will include experiments on this problem.

RESULTS OF WEED RESEARCH IN SUGAR BEETS

Harold D. Kerr

Field studies were conducted on clay and loam soils on the Delta Center research farm near Portageville and on fine sand on the Clarkton research farm. Weeds were not plentiful on the loam soil but a diverse and dense weed flora was present on the clay soil of the Delta Center research farm. Crabgrass was the main weed on the fine sand of the Clarkton research farm. Five experiments were conducted--two on the fine sand, two on the loam, and one on the clay soil.

FINE SAND AT CLARKTON

The experimental site was fumigated with 25 gpa of Vorlex^{R} six weeks ahead of planting to permit full season growth of sugar beets and collection of complete yield data. However, adverse rain and cold weather prevented establishment from the first planting and a second unfumigated site had to be used because of residues from preemergence applied herbicide treatments. The fumigated site was planted to soybeans after the initial sugar beet planting to bioassay for herbicide residues. Slight stunting of soybeans occurred on BAS 2430 treated plots.

The studies were planted April 10 and preemergence treatments were applied April 12. Plots were sprinkler irrigated April 16 and several times thereafter to maintain soil moisture adequate to sustain sugar beet growth.

Fertilizer at the rate of 100+100+100 lb/a supplemented with 2 lb/a of boron was incorporated into the beds during the shaping operation. An additional 50+50+50 lb/a of $N+P_2O_5+K_2O$ was knifed between the 16-inch spaced rows on May 14.

The first weed counts were taken May 14 before thinning and cultivating on May 15. After thinning several herbicides were applied for controlling weeds for the duration of the season. Weed control and hoeing time data were taken in July. Yield of sugar beets was not taken because of nematode and disease infestation.

DISCUSSION OF RESULTS - CLARKTON FARM

Data are given in Tables 1 and 2. Pyrazon plus dalapon at 2+1.5 lb/a was injurious on sugar beets in the 4 to 6-leaf stage of growth and reduced the stand significantly compared with other postemergence treatments. The dalapon was the injurious component because the same dose of pyrazon was used with other herbicides and no injury occurred. Use of the same mixture of pyrazon and dalapon at earlier growth stages in other experiments did not cause injury. The amount of leaf area intercepting the spray on a per plant basis may be the critical factor which determines the amount of injury. Treatment 8 in Table 1 (BAS 2430) was the most effective as measured by the hoeing time required to thin the sugar beets and weed the plots. Pyrazon and BAS 2430 are chemically quite similar but BAS 2430 was more effective for controlling weeds.

SUGAR BEET 0168 Table 1. Density of Weeds & Height of Sugar Beets May 14 and Hoeing Time May 15[1/]

Treatment	Lb/A 40 gpa	All Dicots	All Grasses	All Weeds	Beet Ht. Cm	Hoeing Time Hr/A
PREEMERGENCE-April 12						
1 CP-52223	1	3	1	4	11	18.1
2 CP-53619	1	15	11	26	11	18.0
3 Propachlor	1.5	6	0	6	9	19.0
4 BAS 2572	2	2	1	3	10	15.8
5 Cycloate	1.5	15	53	68	10	21.1
6 Pyrazon	2	5	1	6	11	18.5
7 Pyrazon + TCA	2+5	3	119	122	11	26.7
8 BAS 2430	2	1	1	2	8	13.1

1/ Weed counts and sugarbeet heights were recorded before thinning the sugar beets and removing weeds by hoeing. Chemical plots were 2 beds forty-five feet long. Plants in 24 sq-ft samples.

SUGAR BEET 0168 Table 2. Density of Weeds in 24 sq-ft on June 10 and Time Hoeing July 12

Treatment	Lb/A 40 gpa	Crabgrass	Dicots	Weeds	Hoeing Time Man Hr/A
POSTEMERGENCE-May 16					
1 Pyrazon + Propachlor	2+1.5	4	4	8	33.6
2 Pyrazon + Trifluralin	2+ .5	32	0	32	29.6
3 Pyrazon + Benefin	2+ .5	4	4	8	24.2
4 Pyrazon + Nitralin	2+ .5	0	0	0	3.1
5 Pyrazon + Dalapon	2+1.5	16	0	16	8.7
6 Trifluralin granules	.75	4	1	5	36.8
7 Cultivated May 15	-	16	0	16	47.2

The combination of pyrazon plus nitralin applied at thinning time was the most effective treatment for sustained control of crabgrass.

Among combinations of preemergence plus postemergence herbicides, pyrazon at 2 lb/a plus nitralin at 1/2 lb/a was most effective for controlling crabgrass on the sandy soil. A rotary hoe implement operated along the row shoulder was used to incorporate the nitralin.

LOAM SOIL AT PORTAGEVILLE

Only postemergence treatments were used on this soil. No supplemental treatments after thinning were evaluated. Treatments were applied on one experiment when the stage of sugar beet growth varied from cotyledon to the 2-leaf stage (no more than 1 square inch of foliar surface per plant). The sugar beets were planted April 12 and treated April 23. A second experiment involved treatments applied when the sugar beets had developed 2 to 4 square inches of leaf surface and other treatments when 4 to 6 square inches were apparent. The sugar beets were planted March 29 and treated April 24 and April 30.

DISCUSSION OF RESULTS - LOAM SOIL

Summary data are shown in Tables 3 and 4. The experimental compound, CP-52223, controlled weed grasses well and resulted in the least amount of hoeing time to thin and free the plots of weeds (Table 3). The combination of pyrazon and siduron was very effective for weed control and resulted in the highest yield of sugar beets. Variability in weed control among treatments was great which caused a high coefficient of variability in sugar beet yields. Leaf growth was very much retarded by BAS 2572. Timely cultivation caused more weeds to germinate and compete with sugar beets after thinning and layby.

SUGAR BEET 0368 Table 3. Hoeing Time, Yield, and Sugar Beet Quality

Treatment-April 23	Lb/A 40 gpa	Man Hr/A[a/]	Yield Ton/A	Mean Wt. g/beet	Percentage Sugar	Percentage Purity
1 CP-52223	2	16.9	14.45	348	13.8	95.9
2 CP-53619	2	35.1	11.24	267	12.6	95.2
3 Propachlor	3	37.5	15.92	443	13.2	93.2
4 BAS 2572	3	40.2	10.32	618	12.7	94.7
5 Cycloate	2	64.2	12.06	341	13.5	94.4
6 Pyrazon	3	67.1	11.00	325	13.4	95.3
7 Pyrazon + Siduron	3+5	18.6	16.24	513	13.7	95.0
8 Cultivate Timely	-	104.9	10.45	335	13.9	95.3
9 Delayed Cultivation	-	80.0	11.11	335	12.8	94.9
c.v.		63%	32%	38%	24%	1.8%
$LSD_{.05,24df}$		47.7	NS	211	NS	NS

a/Hoeing times taken May 20.

Weeds were not abundant in the experiment summarized in Table 4. The broken line through the table separates earlier (upper portion) from later postemergence treatments applied April 24 and April 30, respectively. Foliage growth was retarded 3 to 4 weeks by the CP-53619 treatment number 2. This resulted in a lower tonnage of beets. Cycloate (Ro-Neet®) also tended to reduce yield. In both cases, the reductions may have resulted from the solvent components in the formulated herbicides.

SUGAR BEET 0468 Table 4. Hoeing Time, Yield, and Sugar Beet Quality

Treatment	Lb/A 40 gpa	Man Hr/A	Beet Yield Ton/A	Beet Yield MT/Ha[a/]	Mean Wt. g/beet	Percentage Sugar	Percentage Purity
1 CP-52223	2	11.9	18.56	41.57	630	13.0	93.9
2 CP-53619	2	16.6	11.48	25.72	361	12.2	94.0
3 propachlor	3	19.2	18.91	42.36	655	12.6	94.7
4 BAS 2572	3	18.2	17.94	40.19	561	12.2	93.2
5 cycloate	2	19.7	14.72	32.97	437	13.4	93.2
6 pyrazon	3	20.5	18.65	41.78	601	12.6	94.8
7 pyrazon + siduron	3+5	7.1	17.33	38.82	507	12.7	93.9
8 vorlex fumigant	-	27.0	20.08	44.98	750	13.1	94.4
9 vorlex + cult. April 26	-	25.1	19.51	43.70	663	13.6	95.3
10 vorlex + trifluralin gr.	1	20.8	17.54	39.28	585	12.2	94.1
11 vorlex + nitralin	1	9.2	16.99	38.06	474	12.7	94.6
12 vorlex + bensulide gr.	5	9.8	20.75	46.48	658	12.5	95.6
13 vorlex + bensulide EC	2	15.5	19.65	44.02	611	13.3	94.6
14 trifluralin gr.	1	11.6	17.90	40.10	565	13.1	94.3
15 trifluralin EC	1	7.5	17.06	38.21	558	12.8	94.8
16 bensulide gr.	5	12.9	16.50	36.96	437	12.8	95.0
17 bensulide EC	5	11.4	15.88	35.57	532	13.0	94.2
18 vernolate gr.	3	27.8	20.37	45.63	615	13.4	95.1
19 nitralin	1	6.4	18.93	42.40	621	13.1	94.4
20 cultivated April 26	-	21.5	19.38	43.41	691	13.0	94.5
c.v.		37%	17%	-	22%	44%	1.2%
$LSD_{.05,60df}$		8.5	4.12	9.24	179	NS	NS

a/ Metric tons per hectare. Treatments 1 to 9 applied April 24, and 10 to 20 applied April 30. Vorlex® was injected March 1.

Nitralin, trifluralin, and pyrazon + siduron were very effective for sustained grass control and much less hoeing time was required to thin the sugar beets and weed the plots on July 17.

SHARKEY CLAY AT PORTAGEVILLE

During bed shaping 100+100+100 lb/a of N-P-K were incorporated into the 24-inch beds spaced on 44-inch centers. Sugar beets were planted two rows per bed 16 inches apart on the bed. The one-bed plots were 35 feet long. Additional nitrogen as ammonium nitrate was applied between the two beet rows in the center of the bed behind a double coultered opener. Fifty pounds of nitrogen were applied May 28 and 100 lb/a more were applied July 16. Ten irrigations maintained optimum moisture during the season.

Sugar beets were planted March 29. Treatments for controlling weeds were applied April 27 and 30. Amounts applied per acre are shown in Table 5.

DISCUSSION OF RESULTS - SHARKEY CLAY

Treatments were applied too late for effective early control of weeds. Two Polygonum species, smartweed and knotweed, along with spiny sida were present in the plots at much greater density than other weeds. Smartweed and knotweed were not retarded by the treatments shown in Table 5. After thinning and weeding for which the hoeing times in Table 5 are shown, trifluralin, nitralin, and bensulide applied as emulsifiable concentrates or sprays effectively controlled weeds for the rest of the season when combined with cultivation.

SUGAR BEET 0568 Table 5. Hoeing Time, Yield, and Sugar Beet Quality[a/]

Treatment	Lb/A 40 gpa	Man Hr/A	Yield Ton/A	Mean Wt. g/beet	Percentage Sugar	Percentage Purity
2-4 leaves on April 27						
1 BAS 2430 + vorlex	3	77.5	18.1	513	14.8	95.4
2 BAS 2430	3	85.8	21.8	553	15.2	96.5
3 BAS 2430 + dalapon	3+3	69.9	16.2	467	15.0	95.5
4 pyrazon	3	86.7	21.9	651	14.9	94.4
5 pyrazon + siduron	3+5	95.6	19.5	481	14.9	95.2
6 pyrazon + TCA	3+5	73.6	20.2	491	15.1	94.8
7 pyrazon + TCA	3+7	85.8	17.9	532	15.1	96.2
8 pyrazon + dalapon	3+3	78.6	21.7	493	14.9	95.9
9 vorlex fumigant	-	94.3	18.2	550	15.3	95.5
10 vorlex + cult. April 26	-	70.9	20.0	474	15.5	95.4
3-5 leaves on April 30						
11 vorlex + trifluralin gr.	1	81.9	19.3	576	15.8	95.1
12 vorlex + nitralin	1	95.0	21.9	549	15.1	95.4
13 vorlex + bensulide	5	73.3	19.1	468	15.5	95.2
14 trifluralin gr.	1	72.7	19.8	438	14.7	95.9
15 trifluralin EC	1	84.0	23.6	595	15.1	95.1
16 bensulide gr.	5	90.6	20.1	464	15.2	95.5
17 bensulide EC	5	58.3	18.8	509	15.0	95.5
18 bernolate gr.	3	72.7	21.4	486	14.7	95.7
19 nitralin	1	76.0	22.7	572	14.5	93.8
20 cultivated April 26	-	81.2	23.3	568	15.2	95.7
c.v.		11%	19%	25%	5%	1.0%
$LSD_{.05,60df}$		13.1	NS	NS	NS	NS

a/ Hoeing time includes thinning and weeding on May 20.

FURTHER RESEARCH NEEDED

1. Both preemergence and early postemergence treatments must be developed for controlling weeds until thinning time.
2. After thinning treatments will be necessary for maintaining control of weeds for the remainder of the season. Herbicides such as nitralin, trifluralin, bensulide, siduron, DCPA, and substituted anilides should be evaluated for this use.
3. Liquid nitrogen solutions should be studied as a carrier for postemergence herbicides.

SUMMARY WEED RESEARCH FINDINGS

1. Pyramin and its bromine analogue, BAS 2430, must be used in combination with an effective grass controlling herbicide such as TCA, dalapon, siduron, or CP-52223 for controlling all weeds up to the time of thinning.
2. Nitralin, trifluralin, and bensulide controlled grasses for the duration of the season when applied after thinning and incorporated by cultivation.

SUGAR BEET INSECT AND NEMATODE PROBLEMS - 1968

Armon J. Keaster and John W. Miller

Although no major insect problems arose in the sugar beet field plots during 1968 two fields were sprayed for insects. One field, Harris farm, received an application of Trichlorfon (Dylox) at 1.0 per acre during early May for the control of Varigated cutworm, Peridroma saucia (Hubner), and later another application for garden webworm, Loxestege sp. Another field, Sam Hunter Farm, was also treated with Trichlorfon for the control of garden fleahopper, Halticus bracteatus (Say). In addition some research plots located on the Delta Center farm were treated once for garden webworm.

The insecticide used gave effective control of the insect pests and in neither case were the infestations considered of great importance.

Entomological problems so far encountered have been of minor consequence although several indigious species have been observed in research plots. However, it is possible that any of the insect species so far encountered may reach economic proportions and require periodic or routine insecticidal control measures in the event that large acreages of sugar beets are grown in the Missouri Delta.

A research plot was located at Clarkton, Missouri in an attempt to evaluate treatments for control of soil insects and nematodes.

Results of stand counts (see data) made June 10 indicated little or no severe stand reduction resulting from the application of the various chemicals. Temik plots had fewer plants than other treatments however, which indicates a possible phytotoxic reaction.

Further comparisons were not possible because all plots other than those receiving DD soil fumigant died during the hot summer months.

SUGAR BEET STAND COUNTS
CLARKTON FIELD
NEMATODE-SOIL INSECT INJURY TEST
1968

Treatment	Dosage & Formulation in actual (lbs or gal/acre)		Plants on two beds June 10, 1968[2/]				
			Rep 1	Rep 2	Rep 3	Rep 4	Average
Furadan	1.0	10 G	70	161	145	175	138
Furadan	2.0	10 G	155	77	127	172	133
Furadan	1.0	10 G	141	140	157	152	148
Furadan	2.0	10 G	121	172	146	113	138
Furadan[1/]	1.0	50 Flowable	166	117	106	147	134
Furadan[1/]	2.0	50 Flowable	94	114	141	136	121
Heptachlor	1.5	5 G	99	123	184	125	133
DD	25 gal		118	109	147	161	134
Check	-		163	94	154	137	137
Dasanit	2.0	10 G	147	120	140	157	141
Temik	2.0	10 G	86	91	118	71	92

1/ Rate shown applied at three dates.

2/ Counts made after normal thinning.

SUGAR BEET PATHOLOGY TRIALS, 1968

John W. Miller

CERCOSPORA LEAF SPOT FUNGICIDE CONTROL

Sugar beet varieties A 436, susceptible to Cercospora leaf spot and GW 880, resistant to leaf spot, were planted April 13-15 in 2-bed (4-row) plots 25 feet long, with six replications of each variety. The beds had been prepared with a bed-shaper and pre-plant fertilized with 100-100-100. The first three replications of variety A 436 were replanted April 29 due to a poor stand. One lb/acre Trifluralin was applied and incorporated May 22 for weed control.

Three fungicides were used in the test. Du-Ter at 0.4 and 0.6 lbs/acre was sprayed on every 7-10 days (or as close to this schedule as possible) throughout the season for a total of 13 applications. Benlate (Dupont 1991) and TBZ were each applied at 3 and 6 oz/A; each of these rates at three and four applications. Four applications of TBZ at 12 oz/acre was also used for one treatment. Checks for each of the two varieties were left unsprayed.

The plots were sidedressed with 50 lbs N May 28 and 100 lbs N July 22. All plots were row-irrigated 10 times during the season. Leaf spot readings were made September 19 on a scale of 1 = good control up to 5 = no control. Harvest was made October 30. The ratings, % sugar, % purity, yield in tons/acre and beets/100 ft were measurements that were each analyzed in complete randomized block design and duncan's multiple range test at the 5% level for each variety.

For the leaf spot resistant variety 880, only Dupont 1991 at 3 oz with three applications and 6 oz with four applications reduced leaf spot below the check. There were no significant differences for % sugar, % purity, yield in tons/acre or beets/100 ft row between the fungicide treatments and the check.

For the leaf spot susceptible variety A 436, all Dupont 1991 and Du-Ter treatments significantly reduced the disease incidence below that of the check, while TBZ did not. In addition, both Du-Ter treatments and both 1991 rates sprayed on in four applications significantly reduced the leaf spot below that of both 1991 rates sprayed on in three applications.

All 1991 and Du-Ter treatments significantly increased percent sugar for A 436 over the check, while none of the TBZ treatments did so. However, only 1991, 3 oz/acre with four applications significantly increased the percent purity over that of the check. Surprisingly, there were no significant yield differences in tons/acre produced by any fungicide treatment over the check. However the increase in % sugar would, of course, bring about an increase in sugar obtained. Also, no differences were found for number of beets/100 ft of row.

In summary, Dupont 1991 and Du-Ter were superior to TBZ in leaf spot control on the susceptible variety A 436. TBZ was not different from the check. Du-Ter and 1991 sprayed plots also yielded a higher % sugar than TBZ and check plots. No differences were shown for the other three measured factors. For the resistant GW 880, the only significant differences were in leaf spot control, with better control obtained with four applications of 1991 at 6 oz and three applications at 3 oz.

It would appear from this one test that 1991 has superior durability to TBZ in the sugar beet plant. 1991 would apparently be superior economically to Du-Ter, depending on price, due to the far less number of applications needed to secure the same level of leaf spot control and increase in sugar percent in the susceptible A 436.

RHIZOCTONIA CROWN ROT FUNGICIDE CONTROL

Six fungicides were evaluated for their efficiency in Rhizoctonia crown rot control in sugar beets. 100-100-100 fertilizer was worked in prior to planting and beds were made with a bed-shaper on March 11. Five of the fungicides were applied to the soil as pre-plant treatments March 27. Chemagro 4497 at 7.5 oz WP/1000 ft row on a 24" band was sprayed on. PCNB at 1.1 lb/acre active, Terraclor Super-X at .55 lb PCNB + .137 lb Terrazole/acre active, Daconil 2787 at 11 lb/acre active and Vitavax at 3/4 lb/acre were all applied as granules on a 24" band and worked into the beds, along with the 4497, 3" deep with the sidewinder, a power-driven rotary hoe. The susceptible variety A 402 was mechanically planted March 29. The sixth fungicide, TBZ, was applied in four applications at 12 oz/acre on June 7, July 12, August 16 and September 20. Six replications were used for each control treatment and the control check.

The beets were sidedressed with 50 lbs nitrogen May 28 and 100 lbs nitrogen July 22, and rows irrigated 10 times during the season. One lb/acre Trifluralin was applied and incorporated for weed control. The number of live and dead beets were counted June 10. Four more counts of live beets only were made July 12, August 14, September 13 and October 21 and percent live beets were calculated, based on the June 10 counts. Analysis was made on the October 21 count. All fungicide treatments gave significant increases at the 5% level in percentage live beets over the check, but were not different from each other. No yield data were obtained.

CERCOSPORA RESISTANCE SELECTION

A large Cercospora resistance selection test was planted on the loam April 5-8 after beds had been pre-plant fertilized with 100-100-100 and beds made with the bed-shaper March 7.

Twelve beds 110' long and 60 beds 220' long were planted to each variety GW 880 and GW 842. Six beds 110' long and 25 beds 220' long were planted to XGr 67156. These plantings, made April 5-8, were intermingled with 4-bed plots of Cercospora-resistant A 402 and Cercospora susceptible A 436 at various points to check on severity of leaf spot during the season. One lb/acre Trifluralin was applied and incorporated May 22 for weed control. The beets were row-irrigated 10 times during the season.

Selection of resistant beets were made by Great Western Sugar Co. representatives.

ROOT KNOT RESISTANCE SELECTION

A test for root knot resistance selection was planted April 9 on sandy soil beds pre-plant fertilized with 100-100-100 and shaped with the bed-shaper on May 18. Trifluralin granules at 3/4 lb active/acre were applied and incorporated May 8 for weed control. Irrigation was applied as necessary.

Forty beds each of GW 892 and GW 674 plus 12 beds of C 844 were planted. The resulting stands were poor. Selections for root knot resistance were made by representatives of Great Western Sugar Co.

The Influence of Fungicide Sprays in Control of Cercospora Leaf Spot on Sugar Beets - 1968
Portageville Field - Loam Soil

Treatment	Leaf Spot Reading[12/] Variety 880	Variety 436	Treatment Mean	Beets Per 100 Feet Variety 880	Variety 436	Mean
Du-Ter 6.4 oz/A (7-10 days)[1/]	2.8 cd*	2.7 cd*	2.7 cd*	137 ab*	116 ab*	126 a*
Du-Ter 9.6 oz/A (7-10 days)[2/]	2.7 cd	2.7 cd	2.7 cd	148 ab	130 ab	139 a
Dupont 1991 3 oz/A (3 applications)[3/]	2.5 d	3.4 b	3.0 c	173 ab	111 b	142 a
Dupont 1991 6 oz/A (3 applications)[4/]	3.1 bc	3.5 b	3.3 b	163 ab	139 ab	151 a
Dupont 1991 3 oz/A (4 applications)[5/]	2.7 cd	2.8 cd	2.8 cd	159 ab	146 ab	153 a
Dupont 1991 6 oz/A (4 applications)[6/]	2.4 d	2.5 d	2.5 d	177 a	128 ab	152 a
TBZ 3 oz/A (3 applications)[7/]	3.3 b	4.2 a	3.8 a	131 ab	140 ab	135 a
TBZ 6 oz/A (3 applications)[8/]	3.1 bc	4.3 a	3.7 a	148 ab	114 ab	131 a
TBZ 3 oz/A (4 applications)[9/]	3.2 bc	4.4 a	3.8 a	127 ab	127 ab	127 a
TBZ 6 oz/A (4 applications)[10/]	3.3 b	4.3 a	3.8 a	152 ab	128 ab	140 a
TBZ 12 oz/A (4 applications)[11/]	3.3 b	4.3 a	3.8 a	157 ab	123 ab	140 a
Check	3.2 bc	4.5 a	3.8 a	161 ab	112 b	136 a
Variety Mean	3.0	3.6		153	126	
Minimum L.S.R.(L.S.D.)(.05)	0.4		0.3	52		37
Maximum L.S.R.	0.5		0.4	63		43
Coefficient of Variance	11.3%			22.4%		

Treatment	Percent Sugar Variety 880	Variety 436	Trt. Mean	Juice Purity Percent Variety 880	Variety 436	Trt. Mean	Yield Tons Per Acre Variety 880	Variety 436	Trt. Mean
Du-Ter 6.4 oz/A (7-10 days)	14.4 a-d*	13.2 c-h*	13.8 abc*	94.6 ab*	93.2 a-f*	93.9 a*	9.6 e*	14.0 a-d*	11.8 b*
Du-Ter 9.6 oz/A (7-10 days)	15.1 a	13.2 c-h	14.1 a	94.7 ab	93.0 b-f	93.9 a	9.5 e	16.6 ab	13.0 ab
Dupont 1991 3 oz/A (3 applications)	14.6 ab	13.6 b-e	14.1 a	93.2 a-f	92.9 b-f	93.1 a	15.0 abc	16.7 ab	15.9 a
Dupont 1991 6 oz/A (3 applications)	14.6 ab	13.3 b-g	14.0 ab	94.8 ab	92.5 b-f	93.7 a	13.7 a-e	17.3 a	15.5 a
Dupont 1991 3 oz/A (4 applications)	14.5 abc	13.7 bcd	14.1 a	95.0 ab	93.9 a-d	94.5 a	12.2 cde	15.0 abc	13.6 ab
Dupont 1991 6 oz/A (4 applications)	14.2 a-d	13.9 a-d	14.1 a	95.0 ab	92.4 b-f	93.7 a	13.9 a-d	16.6 ab	15.3 a
TBZ 3 oz/A (3 applications)	14.4 a-d	12.4 f-i	13.4 a-d	94.5 abc	92.2 b-f	93.4 a	14.0 a-d	14.2 abc	14.1 ab
TBZ 6 oz/A (3 applications)	14.3 a-d	12.4 f-i	13.4 a-d	96.0 a	90.6 f	93.3 a	12.3 b-e	13.7 a-e	13.0 ab
TBZ 3 oz/A (4 applications)	13.6 b-f	12.1 hi	12.8 d	93.4 a-e	92.8 b-f	93.1 a	11.7 cde	14.4 abc	13.0 ab
TBZ 6 oz/A (4 applications)	13.8 a-d	12.3 g-i	13.1 cd	93.7 a-d	91.9 c-f	92.8 a	13.1 a-e	15.2 abc	14.1 ab
TBZ 12 oz/A (4 applications)	13.9 a-d	12.5 e-i	13.2 bcd	93.9 a-d	91.4 def	92.7 a	11.8 cde	14.9 abc	13.3 ab
Check	14.1 a-d	11.7 i	12.9 d	94.9 ab	90.9 ef	92.9 a	13.1 a-e	15.5 abc	14.3 ab
Variety Means	14.3	12.9		94.5	92.3		12.5	15.3	
Minimum L.S.R.(L.S.D.)(.05)	1.1		0.8	2.3		1.6	3.7		2.7
Maximum L.S.R.	1.3		0.9	2.8		1.9	4.5		3.1
Coefficient of Variance	4.9%			1.5%			16.3%		

Planted: April 13 and 15.
Fertilizer: Incorporated into bed 100+100+100+2B ($N+P_2O_5+K_2O$+Boron) before planting. 50 pounds nitrogen sidedress May 28 and 100 pounds nitrogen sidedress July 22.
Herbicide: Incorporated one pound trifluralin with rotary hoe May 22.
Row irrigated ten times during growing season.
Leaf Spot readings made September 19 with 1 = good control and 5 = no control.
Harvested: October 30.
Duncan's New Multiple Range Test: Results followed by same letter are not significantly different (.05).

1/ Du-Ter - 6.4 oz. active per acre sprayed June 7, 17, 27; July 8, 12, 26; August 8, 16, 19, 27 and September 3, 10, 17.
2/ Du-Ter - 9.6 oz. per acre sprayed June 7, 17, 27; July 8, 12, 26; August 8, 16, 19, 27 and September 3, 10, 17.
3/ Dupont 1991 - 3 oz. per acre sprayed June 7, July 26 and September 13.
4/ Dupont 1991 - 6 oz. per acre sprayed June 7, July 26 and September 13.
5/ Dupont 1991 - 3 oz. per acre sprayed June 7, July 12, August 16 and September 20.
6/ Dupont 1991 - 6 oz. per acre sprayed June 7, July 12, August 16 and September 20
7/ TBZ - 3 oz. per acre June 7, July 26 and September 13.
8/ TBZ - 6 oz. per acre June 7, July 26 and September 13
9/ TBZ - 3 oz. per acre June 7, July 12, August 16 and September 20.
10/ TBZ - 6 oz. per acre June 7, July 12, August 16 and September 20
11/ TBZ - 12 oz. per acre June 7, July 12, August 16 and September 20.

Fungicide Tests to Control Rhizoctonia Crown Rot in Sugar Beets - 1968
Portageville Field - Loam Soil

Treatment[1/]	Percent Live Beets October 21
PCNB - 20 pounds per acre	36.7 a
Terraclor Super-X - 10 pounds per acre	35.3 a
Dac 2787 - 200 pounds per acre	32.2 a
Vitavax - 15 pounds per acre	32.2 a
4497 - 7.5 ounces WP per 1000 ft. row	32.1 a
TBZ - 12 oz. active per acre sprayed 4 applications	30.0 a
No treatment	23.1 b
Minimum Least Significant Range (L.S.D.)(.05)	7.8
Maximum Least Significant Range	8.9
Coefficient of Variance	0.5%

1/ All treatments except TBZ applied and incorporated into soil 3 inches deep.

Planted: A 402 sugar beets March 29

Fertilizer: 100+100+100+2 Boron broadcast and incorporated into bed before planting. 50 pounds nitrogen sidedressed May 28 and 100 pounds sidedressed July 22.

Row irrigated: ten times during growing season.

SUGAR BEET TRIALS ON PRODUCER FARMS

Name of Producer - Location	Acres	Beets Per 100 Feet	Percent Sugar	Juice Purity Percent	Yield Tons Per Acre
Sam Hunter Farms - New Madrid[1/]	5	146	15.0	95.9	19.6
Bolton & Dortch - Bragg City[2/]	5	159	14.3	95.4	16.1
Winston Harris - Senath[3/]	3	156	15.8	95.2	22.1

Planted: A 402-64R
1/ April 11
2/ May 1
3/ March 27
Fertilizer: According to soil Test recommendation all each location.
Herbicide: One pound treflan incorporated into soil after thinning. Pyramin and TCA used at Harris location to kill weeds post emergence.
Row irrigated at all locations.
Fungicide spray (TBZ) applied all locations four times during July, August and September.
Harvested: Yields obtained November 5.

The members of the sugar beet association selected three producers of the area to grow a small acreage of sugar beets. Members of the staff at the Delta Center assisted the producers in this project.

The results above indicate very satisfactory yields. The Bolton and Dortch farms' yield was lowest due to the late planting (May 1). The delay was due to wet soils. Even though the planting was late a reasonable yield was obtained under the conditions that prevailed.

With the interest of The Great Western Sugar Company plans were made to produce 300 acres in 1969 on ten farms of the area.

CONCLUSIONS

Results from eight years of research at the Delta Center show that acceptable crops of sugar beets can be grown in southeast Missouri. Research must be continued to improve varieties, cultural practices, fertilizing techniques and protection from weed, insect and disease infestations.

Following are conclusions and recommendations from the sugar beet research to date:

1. Plant the most adapted and disease resistant variety available.

2. Include sugar beets in a three year rotation. Research is in progress to determine crop rotations most suitable.

3. Fertilize prior to preparing the soil in the fall. Fall or winter seedbed preparation has been essential to early planting especially on the clay soils. Plantings in March have been the most satisfactory.

4. Sugar beets should be planted on graded fields which will provide drainage and irrigation. Irrigation has been essential (preferably by the row method as the sprinkler method has increased leaf spot disease).

5. Some nitrogen should be applied and incorporated into the bed so as to be readily available to the young sugar beet seedlings. Research is in progress to determine feasibility of using nitrogen in solution and sprayed on with the preemergence herbicides. Additional nitrogen should be sidedressed in May or June so that the total amount applied is approximately 150 pounds during the season.

6. Pyramin and TCA applied preemergence or Pyramin and Dalapon post emergence to kill emerged weeds have been effective in control of early season weeds and grasses. At time of thinning the incorporation of nitralin or trifluralin has effectively controlled grasses the balance of the season.

7. Fungicides (not presently approved but expected to be in the future) have been very effective in the control of cercospora leaf spot. Until approval of the new fungicides, copper and oil may be used.

8. Insects have not been a serious problem so far but fields should be scouted regularly to detect damaging insects.