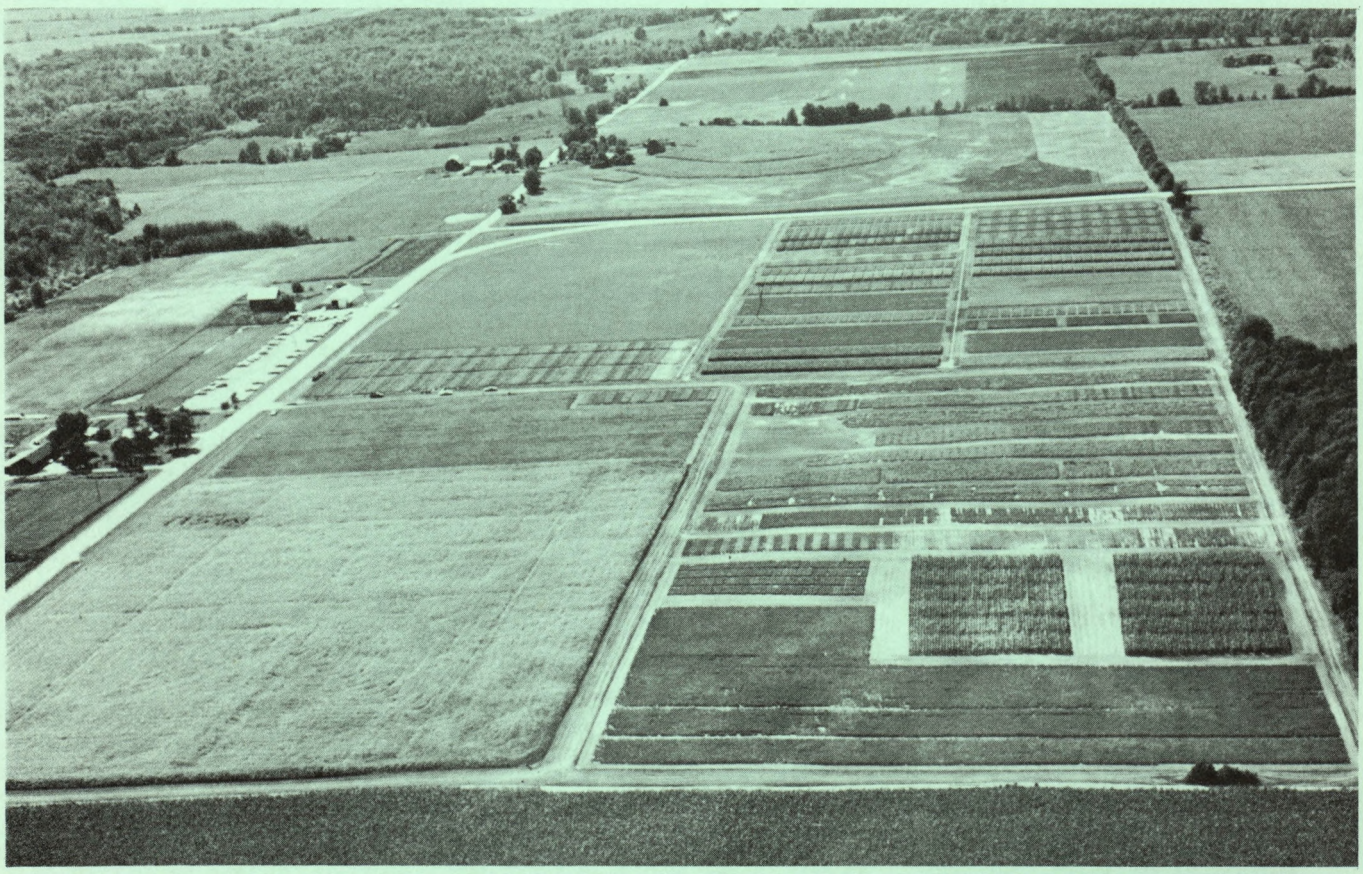
Office File Only

1970 Research Report



MONTCALM EXPERIMENTAL FARM

Michigan State University
Agricultural Experiment Station

ACKNOWLEDGEMENTS

Research personnel working at the Montcalm Experimental Farm have received much assistance in various ways. A special thanks is made to each of these individuals, private companies and government agencies who have made this research possible. Many valuable contributions in the way of fertilizers, chemicals, seeds, equipment, technical assistance and personal services as well as monetary grants were received and are hereby gratefully acknowledged.

Special recognition is given to Mr. Theron Comden for his devoted cooperation and assistance in many of the day-to-day operations and personal services.

TABLE OF CONTENTS

MONTCALM EXPERIMENTAL FARM RESEARCH REPORT

R. W. Chase, Coordinator
Department of Crop and Soil Sciences

INTRODUCTION

The Montcalm Experimental Farm was established in 1966 with the first experiments initiated in 1967 so this report marks the completion of four years of studies. The 80 acre facility is leased from Mr. Theron Comden and is located one mile west of Entrican, Michigan. The farm was established primarily for research on potatoes and is located in the heart of a major potato producing area. Crops commonly used in a potato rotation are also being investigated at the facility.

This report is an attempt to coordinate all of the research data obtained at this facility during 1970. Much of the data herein contained represents ongoing projects so complete results and interpretations may not be final. Results presented here should be treated as a progress report only as data from repeated studies are necessary before any definite conclusions can be made.

Weather

Weather conditions in 1970 are shown graphically in Figure 1. Total rainfall during the April through October period was 28.39 inches which is 5.08 inches more than in 1969. The greatest rainfall occurred in September with a total of 7.18 inches - this is more than double the 30 year average September precipitation recorded at the closest long term weather station at Greenville. This above normal wet condition resulted in lower specific gravity readings in many of the reported studies.

Soil Tests

Soil test results for the general plot area is as follows. For specific areas where more detailed analysis are needed, the results are reported with the individual project.

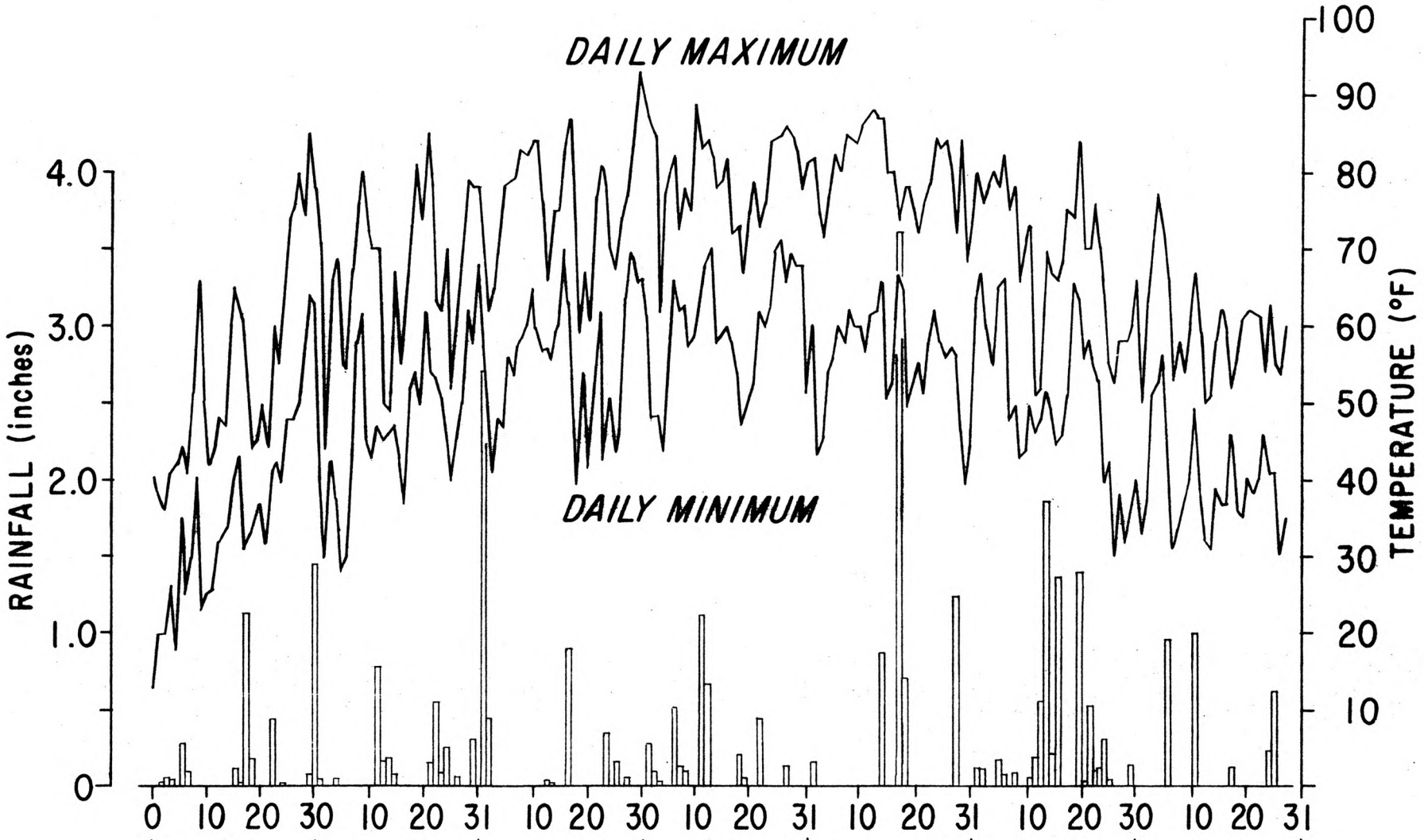
Pounds/Acre				
pH	P	K	Ca	Mg
6.2	330	226	672	102

Irrigation

Irrigation management was maintained to insure a uniform availability of soil moisture. Supplemental irrigation was made to potatoes 9 times during the season for a total application of approximately 8 inches. Irrigation was initiated on June 30 and the final application was August 14.

Disease and Insect Control

A systemic insecticide was applied to most of the potato plots at the time of planting. The general spray program of insecticide and fungicide began on June 27 and continued on a weekly schedule for the remainder of the season. All spray applications were made with an air blast sprayer.



	APRIL	MAY	JUNE	JULY	AUGUST	SEPT.	OCT.
AVERAGE MONTHLY TEMP.	Max. 54°	65°	72°	80°	80°	70°	60°
	Min. 35°	47°	55°	60°	57°	51°	39°
RAINFALL	2.42 inches	4.09 inches	4.62 inches	3.67 inches	6.54 inches	7.18 inches	3.01 inches

Fig 1 CLIMATOLOGY OBSERVATIONS MADE AT THE MONTCALM EXPERIMENTAL FARM IN 1970

CULTURAL AND MANAGEMENT FACTORS AFFECTING POTATO QUALITY

R. W. Chase
Department of Crop and Soil Sciences

Individual studies classified under this project heading are designed to obtain answers of current concern and interest to the Michigan potato industry. The studies reported here are concerned with variety evaluations, plant populations and seed physiology.

1. The effect of different fertility levels on the yields, specific gravity and chipping quality of several chipping varieties.

Procedure

Varieties: Haig, Jewel, Katahdin, Kennebec, Monona, Norchip, MS-709, Superior

Fertility: Plowdown with rye cover 65 lbs/acre N
Planter 800 lbs/acre 14-14-14 + 2% Mg

Planted: May 5, 1970. Spacing: 34" x 8"

Harvested: September 18, 1970

Sidedress treatments: (applied June 5, 1970)

1. Check - no sidedress nitrogen
2. 60 lbs N/acre
3. 120 lbs N/acre
4. 180 lbs N/acre

Results

Table 1 summarizes the yield response to the sidedress treatments. There were no significant differences in terms of cwt/acre to the fertilizer treatments. All varieties, however, except Jewel, did respond to the initial 60 pounds of nitrogen

sidedress with increased yields. The Haig and Monona also showed an additional increase in yield with the 120 pound application. Although the trend does exist, these differences were not significant. Other studies and reports have similarly shown that the Haig variety does have a heavy requirement for adequate nitrogen early in its growth.

Table 2 summarizes the specific gravity, chip quality and size distribution by varieties. There were no significant differences between the sidedress treatments on the yield of B's or tubers in the 1 7/8" - 3 1/4" range or specific gravity. There was, however, a significant response in the yield of tubers over 3 1/4" - Table 3.

Variety Comments

Haig - In 1968 and 1969 the incidence of "speckle leaf" in this variety was severe in some cases. In 1970 the overall occurrence of this condition was very slight. The need for adequate nitrogen early in its growth was apparent in both 1969 and 1970. Its maturity is early.

Jewel - This variety was erratic in response to the use of additional nitrogen. Its yields were well above the average, it does have a high total solids and it produces a very acceptable chip color. The two years of tests with this variety have shown favorable results.

Katahdin - In both 1969 and 1970 this variety has responded only to the initial application of additional nitrogen which was 80 pounds in 1969 and 60 pounds in 1970.

Kennebec - The Kennebec was the highest yielding variety in this study and at this spacing the tubers were very uniform in size and well shaped.

Monona - The tubers of this variety were round and quite uniform. The dry matter content was less than Kennebec, however, it did produce a very acceptable chip color.

Norchip - This variety exhibited a favorable yield potential and a desirable chip color. The spacing of 8 inches used in this study was too close for this variety as it does set heavy and adequate space must be provided for sizing.

MS-709 - In 1969, this was highest yielding variety in this same study, however, in 1970 it was the lowest yielder. This is due in part to the poor quality of seed as the emergence and plant vigor was retarted throughout the entire growing season. Normally, this variety is fully matured by mid-September, however, at the time of harvest this year blossoms were still present.

Superior - As similarly noted with the other varieties the Superior did not respond to additional sidedress applications above the 60 pound level.

Samples taken from each plot have been placed in storage to determine chip quality at varying intervals. One set of samples is being held at 55F to determine the ability to remain in an acceptable chipping condition. A second set of samples were placed in 40F to determine reconditioning potential.

Table 1. The yield of several potato varieties in response to different nitrogen sidedress treatments. Total cwt per acre.

Treatment	Haig	Jewel	Katahdin	Kennebec	Monona	Norchip	MS-709	Superi
Check - no sidedress	414	503	385	534	406	450	390	401
60 lbs N	437	474	432	581	442	488	427	451
120 lbs N	465	482	437	560	460	476	358	452
180 lbs N	431	520	419	571	413	467	337	447
Variety Ave.	437	495	418	561	430	470	378	438

Table 2. The size distribution, specific gravity and chip ratings of several potato varieties. Overall average by variety.

Variety	Percent Size Distribution B's	1 7/8"-3 1/4"	Over 3 1/4"	Specific Gravity	% Dry Matter	Harvest Chip Rating*
Haig	5.8	83.0	11.2	1.063	16.0	4.0
Jewel	3.2	70.9	25.9	1.081	19.9	3.5
Katahdin	5.0	75.9	19.1	1.068	17.1	5.0
Kennebec	3.4	69.1	27.5	1.072	18.0	4.5
Monona	2.8	73.3	23.9	1.065	16.5	3.0
Norchip	5.7	88.5	5.8	1.076	18.8	3.0
MS-709	3.4	71.8	24.8	1.063	16.0	6.0
Superior	2.7	79.6	17.7	1.070	17.5	3.5

*1-10 scale 1 = lightest, 10 = darkest

Table 3. The percentage of tubers over 3 1/4 inch of several potato varieties in response to nitrogen sidedress treatments.

Treatment	Haig	Jewel	Katahdin	Kennebec	Monona	Norchip	MS-709	Superior
Check - no sidedress	8.9	18.0	14.5	21.1	16.0	6.0	19.8	14.5
60 lbs N	11.4	26.1	17.9	24.6	22.9	7.4	25.0	20.4
120 lbs N	10.3	29.9	22.3	28.9	27.5	3.9	31.8	17.5
180 lbs N	14.1	29.4	21.7	35.3	29.1	5.8	22.4	18.3

2. The effect of the fertility level on the yield, quality and grade of whole and cut Russet Burbank seed planted at three spacings.

Procedure

Planted: May 5, 1970 Harvested: October 5, 1970

Fertility: Planter - 800 lbs/A 14-14-14 + 2% Mg
Plowdown with rye cover 65 lbs N/acre
Sidedress Treatments:

1. Low 75 lbs N/A (Applied June 5)
2. Medium 150 lbs N/A (75 lb applied June 5 and June 16)
3. High 300 lbs N/A (75 lb applied June 5; 75 lb June 16; 150 lbs, July 9)

Spacing: 8, 12 and 16 inch. Whole seed and cut seed.

Results

The results of these data and previous observations suggest that nitrogen is not the single limiting factor at least at this location in raising the yield level of Russet Burbanks. The results obtained from this study showed no significant response to the nitrogen levels on the yield of B size, tubers over 10 ounce, off-type tubers or specific gravity. There was a significant difference, however, in the total weight per acre and in the yield of tubers in the 1 7/8 to 10 ounce size at the different spacings.

Table 1 shows the total yield and size distribution of whole seed and cut seed at 3 plant spacings. The highest total yields occurred at the closer plant spacings. In previous years the percentage of B size tubers has been much greater at the closer spacings. It would appear from these data that a spacing somewhere between the 8 and 12 inch interval would be suitable assuming moisture and fertility were not limiting.

Table 2 shows the relationship between plant spacings and fertility levels. In both Tables 1 and 2 nearly all of the tubers in the off-type category could be included in the over-10-ounce category were the off-type characteristics disregarded. In other words, the larger tubers tended to be the ones that had the off-type characteristics. Tables 3 and 4 show the results of planting whole seed versus cut seed and also the overall results for each spacing.

Table 1. The yield and quality of whole and cut seed potatoes of the Russet Burbank variety grown at three plant spacings.

	Plant Spacing	Total cwt/A	Percent Size Distribution: Less than 1 7/8"	1 7/8"-10 oz.	Over 10 oz.	Off type
whole seed	8"	419	7.6	73.3	20.1	9.0
	12"	392	8.9	58.9	18.7	13.5
	16"	356	8.5	59.7	18.1	13.7
cut seed	8"	420	9.0	60.6	19.5	10.9
	12"	366	6.9	57.2	23.2	12.7
	16"	354	5.9	53.7	26.0	14.4

Table 2. The yield, specific gravity and quality of Russet Burbank potatoes grown at three plant spacings and three fertility levels.

Fertility Level	Plant Space	Cwt/ Acre	Percent Size Distribution: Less than 1 7/8"	1 7/8"-10 oz.	Over 10 oz.	Off Type	Specific Gravity
Low	8	426	8.1	67.0	15.3	9.6	1.075
	12	393	7.5	61.5	22.6	8.4	1.076
	16	360	7.1	55.5	22.7	14.7	1.075
Medium	8	410	10.4	61.5	19.8	8.3	1.073
	12	363	7.7	53.6	22.8	15.9	1.072
	16	345	6.9	58.4	23.6	11.1	1.072
High	8	422	6.5	57.2	24.3	12.0	1.073
	12	383	8.8	58.7	17.2	15.3	1.073
	16	361	7.8	56.2	19.9	16.1	1.073

Table 3. The yield and size distribution of Russet Burbank potatoes planted to whole and cut seed.

Seed Type	Cwt/A	Percent Size Distribution: Less than 1 7/8"	1 7/8" to 10 oz.	Over 10 oz.	Off-Type
Whole	389	8.1	60.8	19.1	12.0
Cut	380	7.4	57.3	22.7	12.6

Table 4. The yield and size distribution of Russet Burbank potatoes planted at three spacings.

Spacing	Cwt/A	Percent Size Distribution: Less than 1 7/8"	1 7/8" to 10 oz.	Over 10 oz.	Off-Type
8	419	8.3	61.9	19.8	10.0
12	379	7.9	58.1	20.9	13.1
16	355	7.2	56.7	22.1	14.0

3. The effect of seed age, harvest date and storage on the yield potentials of Onaway and Sebago seed potatoes. (Preliminary Data)

Procedure

Seed of the Onaway and Sebago varieties was harvested at several different harvest dates in 1969, stored and planted at the Montcalm Experimental Farm in 1970.

The 1969 harvest and storage conditions for each variety were as follows:

Onaway

	Topkill	Harvest Date	Storage Condition	Days Growing	Days to Harvest
1.	------	August 5	70 -40F	76	76
2.	------	August 5	40F	76	76
3.	Aug. 8	September 13	40F	76	115
4.	------	August 25	70 - 40F	96	96
5.	------	August 25	40F	96	96
6.	August 25	September 13	40F	96	115
7.	------	September 13	40F	115	115

Sebago

1.	------	August 25	70-40F	96	96
2.	------	August 25	40F	96	96
3.	August 25	October 8	40F	96	140
4.	------	September 13	70-40F	115	115
5.	------	September 13	40F	115	115
6.	Sept. 13	October 8	40F	115	140
7.	------	October 8	40F	140	140

Changes in weight during storage were noted and recorded. Approximately two weeks before planting the seed was removed from storage and warmed to approximately 55F before planting. All seed planted was cut seed. Both varieties were planted on May 5, 1970 at a 10" spacing. Fertilizer applied consisted of 65 lbs N/acre plowdown with rye cover, 800 lb/A 14-14-14 plus 2% Mg in the planter and 60 lbs N sidedressed.

Results

Table 1 shows the Onaway yield results. The differences in emergence were very dramatic and is reflected in the values of plant emergence 30 days after planting. Those with the poorer emergence also resulted in the lower yields. The earliest harvested seed resulted in subsequent higher yields and a more uniformly size crop with a smaller percentage of tubers over 3 1/4". The seed which was topkilled early and allowed to remain in the ground resulted in the lowest yields, delayed emergence and the highest percentage of tubers over 3 1/4".

Table 2 summarizes the data obtained with the Sebago variety. The emergence and early vigor followed the same pattern as noted with the Onaway with the seed topkilled early and left in the ground or the latest harvested seed having the least seed vigor and reduced subsequent yields. With the Sebago variety the later harvested seed yielded a crop with a higher percentage of tubers over 3 1/4". With both varieties there was no significant relationship between the treatment and the specific gravity of the subsequent crop.

Discussion

These data are an initial attempt at studying the relationships between seed age and the yield potential of such seed. The study is being repeated and the Russet Burbank variety is being included. Further data is necessary in order to determine what the economic applications may be.

Table 1. Effect of harvest date on the yield potential of Onaway seed.

No. Days Growing	No. Days to Harvest	Storage Temp.	% Wt. Loss	Cwt/A	Percent 1 7/8-3 1/4	Over 3 1/4	Spec. Grav.	Percent plants emerged 30 days after planting
76	76	70-40	7.0	452	70.4	27.7	1.069	97
76	76	40	7.1	442	74.7	22.6	1.066	98
76	115	40	6.3	398	57.6	40.3	1.068	52
96	96	70-40	5.1	480	75.7	22.2	1.067	93
96	96	40	7.1	450	59.8	38.6	1.064	77
96	115	40	6.7	440	58.8	38.8	1.064	54
115	115	40	7.6	418	61.2	37.9	1.067	52

Table 2. Effect of harvest date on the yield potential of Sebago seed.

96	96	70-40	8.0	452	77.5	21.7	1.068	89
96	96	40	11.7	435	77.0	23.0	1.067	84
96	140	40	6.8	366	70.0	29.3	1.066	53
115	115	70-40	10.1	452	73.6	25.6	1.069	79
115	115	40	10.4	410	73.6	25.9	1.068	67
115	140	40	6.4	398	67.5	32.1	1.067	53
140	140	40	5.6	391	67.1	32.1	1.066	57

SOIL FERTILITY RESEARCH ON POTATOES

M. L. Vitosh
Department of Crop and Soil Sciences

Five soil fertility experiments were conducted on potatoes in 1970. Four of these experiments were initiated in 1967 when the Experimental Farm was first established. One experiment initiated in 1967 on potatoes involving different rates of zinc and zinc materials was abandoned because of a lack of response to this micronutrient. Soil tests also indicated this soil is not deficient in zinc.

A new experiment was established this past year to evaluate several soil fertility factors on speckle leaf in potatoes. Speckle leaf is a disorder of the potato leaves usually showing spots on the oldest leaves first which develop on the underside of the leaves. It was recognized to be of serious economic concern in 1968 and 1969 particularly in Monroe County.

Rotations in the past have consisted of potatoes followed by kidney beans and then sweet corn. A rye cover crop has been established each year after harvest and plowed under just prior to planting. In 1970 potatoes were planted to the same area which grew potatoes in 1967.

The Montcalm Experimental area is composed primarily of two soil types -- Montcalm and McBride sandy loam. The soil on which all of the fertility experiments were conducted has been classified as a McBride sandy loam. Soil test values for each experiment and management practices used are given at the bottom of Tables 1, 4, 7, 9 and 10.

Source, Rate and Time of N Application

A slow release form of nitrogen was also included in this study. This sulfur-coated urea (SCU) material was obtained from the Tennessee Valley Authority, Muscle Shoals, Alabama. The analysis was 36 percent nitrogen, 16 percent sulfur, 3 percent wax, 0.25 percent coal tar (microbicide) and 2 percent conditioner. A water dissolution test showed that 20 percent of the urea dissolved in seven days and it was estimated that the daily dissolution after seven days would be 1 percent per day.

Potato yields (Table 1) were more than doubled with 120 or 180 lb N. The second treatment which involved 60 lb N per acre broadcast SCU and 60 lb N per acre banded urea tended to yield slightly lower than all other nitrogen treatments, however, this yield difference was not significant at the 5 percent probability level.

Nitrogen rates in general were too high to detect major differences between broadcast and sidedress applications. Previous years data, however, have indicated that when total N applications are less than 180 lb N per acre, sidedressing N is far superior to broadcasting and plowing down. A summary of these yields for the past three and four years is presented in Table 3. Banding N is also superior to broadcast and plow down applications. A good suggestion is to apply some N banded at planting time to get the plants off to a good start and to sidedress the remainder at hilling time.

In case of heavy rains, a later application through the irrigation system may also be a very effective means of replacing losses due to leeching. Recommended rates of nitrogen vary considerably with length of growing season. Varieties with a short growing season or varieties which are harvested early require less nitrogen to reach maximum yields. Experimental results here are with long growing season varieties and indicate that near maximum yields can be obtained with 60 lb N per acre banded at planting time and 120 lb N per acre sidedressed at hilling time.

Sulfur-coated urea at the rate used in this experiment produced yields comparable to all other nitrogen treatments.

Specific gravity was not affected by the rates of nitrogen used. It appears that under irrigated conditions up to 300 lb N per acre may be used without any real detrimental effect on specific gravity. Under non-irrigated conditions or with higher rates of nitrogen, reduced specific gravity may occur.

Potato petiole samples were taken from each plot and each variety for this experiment on August 31, 1970. This data is shown in Table 2. Because nutrients in plants vary quite drastically throughout the growing season, any conclusions at any particular point in time are subject to criticism. Some general statements however can be made about the plant analysis data.

Nitrogen increased in plant petioles with increased rates of nitrogen. Petiole samples from the sulfur-coated urea plots contained slightly less nitrogen than all other nitrogen treatments. This may indicate that SCU was not supplying adequate N at the time of sampling.

Phosphorus along with several other elements was slightly higher for the check plot than for all other N treatments. This observation may be found quite often where plant growth is poor. Elements will tend to concentrate in plant tissue with time if plant cells do not elongate properly due to some nutrient deficiency. Phosphorus also tended to increase with increased rates of nitrogen. Sidedress N also appeared to have increased the P content of petioles more than broadcast applications especially the 180 and 240 lb N per acre rates.

Although there is a great deal of variability for potassium this element was not significantly affected by the nitrogen treatments. Calcium content was slightly lower at the higher N levels. Magnesium values varied depending to a great extent on the concentration of K and Ca. The higher the Ca plus K values the lower the Mg content. All values were within the acceptable sufficiency ranges.

Iron, Zn, and B tended to decrease with increased applications of nitrogen. Although Zn values would appear to be on the low side, potatoes at this location have not responded to Zn treatments over a three year period. Iron and B are within the sufficiency ranges.

Manganese values were quite erratic for which no explanation can be given. Sodium, Cu, Al, and Ba were not significantly affected by the N treatments. All values were found to be within the normal or sufficiency range.

K RATE AND TIME OF APPLICATION

This experiment was established in 1967 primarily to evaluate response of potatoes to various rates of potassium and to help correlate soil tests for potassium. Evaluation of broadcast and banded applications of potassium were also part of the initial study.

In 1970, 180 lb K_2O per acre broadcast or banded produced near maximum yields. The four year summary given in Table 7 indicates no yield advantage either to broadcast or banded applications. Both are satisfactory methods of application. The Sebago variety responded slightly better to higher rates of potassium. The 120 lb K_2O per acre rate has normally been sufficient at this location for the Russet Burbanks whereas 180 lb K_2O per acre may have a slight advantage for the Sebago variety.

Specific gravity in 1970 as well as the past three years has shown significant decreases with increased rates of potassium. Although no real advantage with regard to broadcast applications has been seen at this location, it is generally felt that a good practice is to apply only a small amount of the total K to be applied at planting time in order to get the plants off to a rapid start. The additional K required based on soil tests should be broadcast and plowed under prior to planting. Fall applications of K have been shown to be just as good as spring applications and has the advantage of lower salt concentrations in soil solutions during the growing season.

The plant analysis for this experiment are shown in Table 5. Phosphorus content of petioles did not vary significantly with K treatments. Although there was a yield response to K, plant growth was not stunted in the check plot to the extent it was in the N experiment. As a result P content of petioles from the check plot were not greatly different than those of other K treatments as was noted in the N experiment.

Potassium increased directly proportional to the rate of application. This indicates that plants had the ability to take up larger quantities of K than is required to meet the functions of the plant (luxury consumption).

Calcium and Mg content decreased with increasing K content which is a quite normal situation. It is under high rates of K fertilization where Mg may become short in supply. For this reason and because of the effect of K on specific gravity, it is highly important that K applications be based on soil tests and that excess K not be applied.

The only other element which was significantly affected by the K treatments was Fe. The Fe content of petioles decreased with increasing rates of K. All values, however, are well within the normal or sufficiency ranges. Other elements which were determined but found not to be significantly affected by the K treatments were Na, Cu, Zn, Al, B, Mn, and Ba.

K CARRIER STUDY

Many of the literature reports are conflicting concerning the best source of potassium for potatoes. This experiment was established to evaluate yield and specific gravity responses to four sources of potassium.

In 1970 all sources of K resulted in similar results (Table 7). Although potassium sulfate looked very good this past year, the responses are not significantly different at the 5 percent probability level.

The four year summary shown in Table 9 indicates similar increases in yields and decreases in specific gravity with all sources of potassium used.

Petiole analysis (Table 8) did indicate some differences due to potassium sources. Potassium sulfate gave the desired increase in K content while not reducing the Mg content to the extent that other carriers did. Aluminum content of petioles was slightly higher for the potassium sulfate treatment. It is not known why this might have occurred. Further studies are needed to determine the implications of this result.

N CARRIER STUDY

This experiment was established in 1967 to evaluate five sources of N on potato yield and quality. Although the results of the 1970 experiment (Table 10) indicate no significant difference in yields due to these carriers, certain treatments did appear to be superior during the growing season. All N treatments except anhydrous ammonia were topdressed just prior to emergence. Anhydrous ammonia was knifed in at the same time prior to emergence. The topdress N was far superior to the N knifed in because of its closer proximity to the potato root system and as a result gave an early plant response. Once the plants roots reached the N knifed in the center of the row these differences in plant growth disappeared. This illustrates the fact that some nitrogen should be banded at planting time to get the plants off to a rapid start.

Summary data in Table 11 does not indicate any advantage of one carrier over another. There may be some theoretical advantages or disadvantages of these carriers, however, they will not be discussed in this report.

Size and specific gravity have not been significantly affected by these carriers.

Speckle Leaf Study

Speckle leaf in potatoes first became of major concern in 1968 when it was observed to be of serious economic concern in Monroe County. A task force at Michigan State University was asked to address itself to the problem in hopes of determining the cause or causes of this plant disorder. As a result an experiment was established at the Montcalm Experimental Farm to evaluate the effect of several soil fertility factors. The Haig variety which was noted to be more susceptible to the disorder than several other varieties was selected for use in this experiment. The experiment included high rates of nitrogen banded at planting time. Two secondary elements (Ca and Mg) and three micronutrients (Mn, Zn, and Cu) were also included in the experiment. The experimental area had a previous record of potatoes in 1969 with Cu and Zn treatments already established. The results of this experiment are shown in Table 12. A nice response was obtained to N, however, none of the other treatments produced significantly different yields. Only two replications were used in this test and therefore partly explains the reason for the large LSD value which indicates the least significant difference.

Speckle leaf symptoms first appeared in treatment one which received no nitrogen. The symptoms developed about six to eight weeks after planting. Although the speckle leaf symptoms were not initially present in the higher N treatments the symptoms did develop at approximately 14 to 15 weeks. Neither the secondary or micronutrients appeared to correct the disorder. These results are quite different than those obtained in Monroe County where N appeared to totally correct the disorder. More leaching of nitrate may have occurred than was anticipated at this location, however, other experiments indicated that 240 lb N per acre was more than adequate for maximum yields. There may be other factors involved with speckle leaf which are not yet fully understood. Other investigations are attempting to evaluate the causes of this disorder.

Table 1 Effects of rate source and time of nitrogen application on yield, size and specific gravity of irrigated Russet Burbank and Sebago potatoes.

Nitrogen Application (a)				Russet Burbank			Sebago			Average Effects		
Broad-cast	Band-ed	Side-dressed	Total	Yield (Cwt/A)	A Yield (b) (Cwt/A)	Sp. Gr.	Yield (Cwt/A)	A Yield (b) (Cwt/A)	Sp. Gr.	Yield (Cwt/A)	A Yield (b) (Cwt/A)	Sp. Gr.
--------lb N/A----------												
0	0	0	0	136	56	1.081	195	164	1.070	165	110	1.075
60 SCU	60 U	0	120	313	220	1.080	407	363	1.070	360	292	1.075
120 U	60 U	0	180	332	234	1.078	441	393	1.070	387	313	1.074
180 U	60 U	0	240	357	269	1.078	466	426	1.069	411	347	1.074
240 U	60 U	0	300	349	282	1.082	443	408	1.070	396	345	1.076
120 SCU	60 U	0	180	332	240	1.080	434	395	1.070	383	317	1.075
	60 U	120 U	180	360	285	1.078	430	391	1.071	395	338	1.075
0	60 U	180 U	240	375	290	1.079	440	397	1.070	407	344	1.075
0	60 U	240 U	300	344	247	1.078	398	358	1.068	371	302	1.073
180 SCU	60 U	240 U	240	333	245	1.079	449	416	1.073	391	331	1.076
LSD (.05) treatments										37	39	NS
LSD (.05) treatments within varieties				44	50	NS	44	50	NS			
LSD (.05) varieties within treatments				33	44	.004	33	44	.004			

(a)
Broadcast urea (U) and sulfur coated urea (SCU) was applied and plowed down two days prior to planting. Banded urea was applied at planting time 2 inches to side and 2 inches below the seed piece. Sidedress urea was applied to soil surface on June 15 prior to hilling.

(b)
Minimum of 1 7/8 inches. Planted: May 6, 1970 Harvested: October 12, 1970 Harvest Area: 266 sq. ft.
Row Spacing: 32 inches Seed Spacing: Russet Burbank = 14", Sebago = 10"
Basic Fertilizer: 0-150-200 banded at planting time Irrigation: 7.2 inches

Soil Test: pH = 6.6, P = 260, K = 245

Table 2 Effect of rate, source and time of nitrogen application on the elemental composition of potato petioles.
(Russet Burbank and Sebago varieties sampled 7-31-70)

Treatment (a) No.	Elements (b)								
	N	P	K	Ca	Mg	Fe	Zn	B	Mn
	%					ppm			
1	1.6	.40	11.44	1.00	.42	131	41	31	91
2	1.8	.25	9.23	1.06	.56	111	27	29	95
3	2.3	.22	7.99	1.05	.75	77	22	21	58
4	2.7	.29	9.54	.93	.67	75	26	25	132
5	3.2	.25	7.85	.85	.70	57	19	18	120
6	2.6	.22	9.73	1.02	.63	97	25	27	107
7	2.7	.29	8.98	.87	.57	81	25	25	79
8	3.3	.37	10.32	.81	.60	66	25	23	65
9	3.4	.34	9.79	.81	.72	81	27	24	87
10	2.1	.23	8.68	1.00	.63	79	22	25	87
LSD (.05)	.8	.06	NS	.09	.16	37	6	6	38

(a) Treatments are same as in previous table.

(b) The following elements were not significantly affected by the treatments in this experiment: Na, Cu, Al and Ba.

TABLE 3. Summary of yield results for nitrogen rate and time experiment. (1967-1970)

	Russet Burbank		Sebago	
16 N/A	3 year (67-69) Average	4 year (67-70) Average	3 year (67-69) Average	4 year (67-69) Average
	---Average Yield (Cwt/A)---			
Check	176	166	201	199
	---Average Increase (Cwt/A)---			
Banded vs. Plowdown				
120B	+146	---	+148	---
120P	+ 68	---	+ 86	---
Plowdown nitrogen + 60 lbs N/A banded at planting time				
0	+ 64	---	+ 76	---
60P	+103	---	+124	---
120P	+135	+150	+119	+151
180P	+128	+151	+175	+200
Sidedress nitrogen +60 lbs N/A banded at planting time				
0	+ 64	---	+ 76	---
60S	+131	---	+154	---
120S	+144	+164	+167	+184

B = Banded
P = Broadcast and plowed down
S = Sidedressed 5-6 weeks after planting

Table 4 Effects of rate and time of potassium application on yield, size and specific gravity of irrigated Russet Burbank and Sebago potatoes.

Potassium Application lb K_2O/A (a)			Russet Burbank			Sebago			Average Effects		
Broadcast	Banded	Total	Yield (Cwt/A)	A Yield (b) (Cwt/A)	Sp. Gr.	Yield (Cwt/A)	A Yield (b) (Cwt/A)	Sp. Gr.	Yield (Cwt/A)	A Yield (b) (Cwt/A)	Sp. Gr.
0	0	0	314	235	1.082	338	307	1.071	326	271	1.076
0	60	60	337	261	1.081	383	342	1.073	360	301	1.077
0	120	120	346	280	1.082	395	377	1.070	370	328	1.076
0	180	180	366	285	1.078	417	389	1.070	392	337	1.074
0	240	240	362	298	1.080	423	387	1.070	392	343	1.075
360	120	480	351	279	1.075	394	360	1.065	372	319	1.070
60	0	60	318	256	1.084	389	348	1.073	354	302	1.078
120	0	120	343	271	1.081	416	380	1.068	380	325	1.075
240	0	240	340	244	1.078	436	396	1.069	388	320	1.073
180	0	180	349	262	1.081	412	385	1.072	381	323	1.077
LSD (.05) treatment			---	---	-----	---	---	-----	40	NS	.003
LSD (.05) treatments within varieties			48	NS	.004	48	NS	.004	---	---	-----
LSD (.05) varieties within treatments			35	41	.004	35	41	.004	---	---	-----

(a) Applied as KCl either broadcast and plowed down two days before planting or banded at planting time.
(b) Minimum of 1 7/8 inches.
Planted: May 7, 1970 Harvested: October 12, 1970 Harvest area: 266 sq. ft.
Row spacing: 32 inches Seed spacing: Russet Burbank=14", Sebago=10"
Basic Fertilizer: 60-150-0, 180 lb N/A sidedressed June 16, 1970, 30 lb N/A sprinkler irrigation August 11, 1970.
Irrigation: 7.2 inches Soil test: pH=6.9, P=204 K range=127-186

Table 5 Effect of rate and time of potassium application on elemental composition of potato petioles. (Russet Burbank and Sebago varieties sampled 7-18-70)

Treatment No.(a)	Elements (b)					
	N	P	K	Ca	Mg	Fe
	- - - - - - - - - - - - - % - - - - - - - - - - - -					
1	---Not Determined---	.33	4.58	1.10	1.33	102
2		.37	6.80	.94	1.02	78
3		.39	7.92	.87	.72	53
4		.37	9.42	.80	.60	62
5		.34	9.44	.74	.45	63
6		.36	10.84	.66	.39	48
7		.34	6.52	1.02	1.02	84
8		.34	7.92	.82	.69	66
9		.36	9.66	.72	.52	52
10		.31	8.60	.90	.73	64
LSD (.05)		NS	.88	.12	.15	27

(a) Treatments are the same as previous table.

(b) The following elements were not significantly affected by the treatments in this experiment: Na, Cu, Zn, Al, B, Mn and Ba.

TABLE 6. Summary of yield and specific gravity for Potassium rate and time experiment. (1967-1970)

lb K_2O/A	Russet Burbank 4 year average		Sebago 4 year average	
	----Averages----			
	Yield	Specific Gravity	Yield	Specific Gravity
	254	1.086	294	1.078
	---Average Increase---			
Banded vs. Plowdown				
60B	+22	- .002	+39	NC
120B	+48	- .001	+64	- .001
180B	+38	- .004	+68	- .002
240B	+38	- .004	51	- .003
60P	+22	NC	+51	+ .001
120P	+39	- .002	+59	- .001
240P	+39	- .004	+76	- .002
360P, 120B	+39	- .007	+48	- .006

NC = no change
B = Banded
P = Broadcast and plowed down

Table 7 Effects of different sources of potassium on yield, size and specific gravity of irrigated Russet Burbank and MS-709 potatoes.

Source of Potassium (a)	Russet Burbank			MS-709			Average Effects		
	Yield (Cwt/A)	A Yield (b) (Cwt/A)	Sp.Gr.	Yield (Cwt/A)	A Yield (b) (Cwt/A)	Sp.Gr.	Yield (Cwt/A)	A Yield (b) (Cwt/A)	Sp.Gr.
None	256	211	1.082	214	199	1.068	235	205	1.075
Potassium Chloride	308	251	1.080	252	218	1.069	280	235	1.074
Potassium Nitrate	322	261	1.080	240	224	1.065	281	243	1.072
Potassium Sulfate	323	269	1.080	287	251	1.069	305	260	1.075
Potassium Carbonate	318	268	1.078	228	204	1.065	273	236	1.071
LSD (.05) treatments	---	---	-----	---	---	-----	30	33	NS
LSD (.05) treatments within varieties	39	38	NS	39	38	NS	---	---	-----
LSD (.05) varieties within treatments	33	28	NS	33	28	NS	---	---	-----

(a) Applied at a rate of 300 lb K_2O per acre broadcast and plowed down prior to planting.

(b) Minimum of 1 7/8 inches.

Planted: May 8, 1970 Harvested: October 12, 1970 Harvest areas= 266 sq. ft.
Row spacing: 32 inches. Seed spacing: 14 inches Irrigation= 7.2 inches
Basic fertilizer: 60-150-0, 180 lb N/A sidedressed June 16, 1970, 20 lb N/A by sprinkler irrigation August 11, 197
Soil test: pH = 6.6, P = 293, K range = 181 to 275

Table 8 Effect of potassium carriers on elemental composition of potato petioles. (Russet Burbank variety sampled 8-3-70)

Treatment No.(a)	Elements(b)					
	N	P	K	Ca	Mg	Al
	- - - - - - - - - - % - - - - - - - - -					
1		.26	5.29	1.06	1.21	169
2		.26	9.87	.82	.68	125
3		.25	9.13	.85	.72	131
4		.26	7.80	.82	.91	150
5		.22	9.67	.81	.71	131
LSD (.05)		NS	1.17	.08	.12	16

(a) Treatments are same as in previous table.

(b) The following elements were not significantly affected by the treatments in this experiment: Na, Cu, Fe, Zn, B, Mn and Ba.

TABLE 9. Summary of yield and specific gravity results for Potassium carrier experiment (1967-1970).

	Russet Burbank 4 year average	
	---Averages---	
	Yield (Cwt/A)	Specific Gravity
No Potassium	238	1.084
	---Average Increases---	
Potassium Chloride	+ 25	- .002
Potassium Nitrate	+ 23	- .002
Potassium Sulfate	+ 25	- .002
Potassium Carbonate	+ 20	- .003

Table 10. Effect of different sources of nitrogen on yield, specific gravity and size of irrigated Russet Burbank and Sebago potatoes.

Source of Nitrogen	Russet Burbank			Sebago			Average Effects		
	Yield (Ctw/A)	A Yield (c) (Ctw/A)	Sp. Gr.	Yield (Ctw/A)	A Yield (c) (Ctw/A)	Sp. Gr.	Yield (Ctw/A)	A Yield (c) (Ctw/A)	Sp. Gr.
Ammonium Sulfate (a)	282	214	1.080	342	316	1.072	312	265	1.076
Ammonium Nitrate (a)	294	223	1.081	362	321	1.073	328	272	1.077
Calcium Nitrate (a)	246	192	1.081	370	342	1.073	308	267	1.077
Urea (a)	294	233	1.080	374	339	1.071	334	286	1.075
Anhydrous Ammonia (b)	257	186	1.079	378	346	1.073	317	266	1.076
LSD (.05) treatments	---	---	-----	---	---	-----	NS	NS	NS
LSD (.05) treatments within varieties	NS	NS	NS	NS	NS	NS	---	---	-----
LSD (.05) varieties within treatments	44	37	.004	44	37	.004	---	---	-----

(a) 200 lb N/A was top dressed May 22, 1970 just prior to emergence
(b) 200 lb N/A was knifed in May 22, 1970 just prior to emergence
(c) Minimum 1 7/8 inches

Planted: May 7, 1970 Harvested: October 12, 1970 Harvest area: 266 sp. ft.
Row spacing: 32 inches Seed spacing: Russet Burbank = 14", Sebago = 10"
Basic fertilizer: 0-150-200, banded 2 inches to side and 2 inches below seed piece
Irrigation: 7.2 inches
Soil test: pH = 6.6, P = 289, K = 223

TABLE 11. Summary of yield results for Nitrogen carrier experiment (1967-1970)

	Russet Burbank	Sebago
	--- 4 Year Average ---	
	Yield (Cwt/A)	Yield(Cwt/A)
Ammonium Sulfate	259	312
Ammonium Nitrate	261	304
Calcium Nitrate	234	303
Urea	253	320
Anhydrous Ammonia	---(a)	---(a)

(a) 4 year average is not available

Table 12. Effect of various fertilizer treatments on yield, size and specific gravity of irrigated Haig potatoes

Treatment No.	Fertilizer Treatments (a) N - P_2O_5 - K_2O	Yield (Ctw/A)	A Yield (Cwt/A)	Sp. Gr.
(1)	---- lb/A ----			
(2)	0 - 100 - 100	72	47	1.068
(3)	150 - 100 - 100	309	268	1.071
(4)	300 - 100 - 100	342	300	1.074
(5)	240 - 100 - 100 + 20 lbs Mn/A($MnSO_4$)	327	280	1.072
(6)	240 - 100 - 100 + 50 lbs Mg/A($MgSO_4$)	326	297	1.072
(7)	240 - 100 - 100 + 100 lbs Ca/A($CaSO_4$)	296	284	1.072
(8)	240 - 100 - 100 + no micronutrients	309	271	1.072
(9)	240 - 100 - 100 + Zn (1969)	324	314	1.071
(10)	240 - 100 - 100 + Zn-Cu (1969)	320	282	1.074
	LSD (.05) Treatments	97	100	.004

(a) All fertilizer was banded 2 inches to side and two inches below the seed piece except 180 lb N/A on treatments 5-10 which were sidedressed June 16, 1970 just prior to hilling.

(b) Minimum 1 7/8 inches

Planted: May 8, 1970 Harvested: Sept. 11, 1970 Harvest Area: 266 sq. ft.
Row Spacing: 32 inches Seed Spacing: 10 inches Irrigation: 6.4 inches
Soil Test: pH = 6.6, P = 208, K = 184

POTATO BREEDING PROGRAM

N. R. Thompson
Department of Crop and Soil Sciences

Seed Production

Approximately 28,000 seeds from 42 crosses involving *S. stoloniferum* hybrids and an early high yielding *S. tuberosum* clone were produced. From 1000 seeds planted in the greenhouse 735 progenies were classified as early or late. The small tubers plus plants from the balance of the seed will be planted in the field in 1971. Sixty-seven selections were retained from the 1970 first year seedlings.

Seedling Increase and Yield Trials

Forty-six advanced seedling clones were planted in replicated trials for yield and quality evaluation. Heavier than normal rainfall promoted vigorous growth. The absence of frost prolonged the growing season and some late maturing cultivars were still blossoming when harvested in October. Yield and quality (Table 1) reflect the growth conditions. Seedlings MS 735-1, MS 711-8, MS 706-34 and Ia 1111-2 have established yield and quality potentials and will be increased for seed and storage trials.

Nutritional Studies

The potato, with the exception of the amino acid methionine, is a well balanced food. In the 1969 studies one cultivar contained sufficient methionine to balance the protein but to screen seedling populations for methionine a rapid test was essential. Bioassay with streptococcus zymogenes, a bacterium with the same amino acid requirement as man, proved practical.

Random samples from a segregating population comprising 834 clones from 12 families were tested for methionine. Differences within and between family lines were great. Selected individuals have been planted for hybridization to produce more cultivars with high methionine and to study the inheritance pattern.

Table 1. Seedling yield trial, 1970.*

Seedling No.	Average Yield Cwt/Acre	Average Specific Gravity
MS 735-1	699	1.086
MS 645-1	638	1.078
MS 613-21	585	1.079
Merr. 58	542	1.072
MS 711-8	507	1.065
MS 613-7	503	1.064
MS 613-18	484	1.080
MS 637	465	1.092
MS 709	473	1.071
MS 706-34	453	1.068
MS 613-30	453	1.066
MS 506-1	446	1.063
MS 503-14	442	1.068
MS 321-55	438	1.094
MS 613-20	438	1.077
MS 463	427	1.083
MS 321-65	415	1.093
Ia 1111-2	414	1.064

*Yields below 400 cwt/acre not included.

WEED CONTROL IN POTATOES

W. F. Meggitt
Department of Crop and Soil Sciences

Treatments applied preplant and preemergence for weed control in potatoes are given in the table. The herbicides in the substituted urea group (Lorox, Patoran, Maloran) were generally the most effective. These materials have considerable contact activity so those weeds emerged at the time of treatment were killed. In addition, sufficient activity was obtained through the soil to provide weed control throughout the growing season. It was not necessary to cultivate for weeds, however, one hilling operation was performed.

Eptam as a preplant incorporated herbicide gave complete control of annual grasses and excellent control of broadleaved weeds. This chemical has been used for several years.

Bay 94337 is the most outstanding new material evaluated for potatoes. At 1 lb/A complete control of annual weeds was obtained with excellent potato tolerance. This chemical certainly warrants further evaluation and development.

Preplant and Preemergence Weed Control Evaluations in Potatoes. Montcalm Co., 1970.

Planted - May 11, 1970
Rated - June 22, 1970
Treated - May 26, 1970
Variety - Russet Burbank

Weeds Present - pigweed, lambsquarter, barnyard grass, smartweed, crabgrass

Trmt No.	Treatment	Rate lb/A	Injury	Weed Control Rating	
				Bd. Lv.	Grass
PREPLANT					
1	EL 179	1	0	7.0	7.0
2	"	1 1/2	0	8.0	7.3
3	"	2	0	9.0	8.0
4	Eptam	4	0	9.0	10.0
PREEMERGENCE					
5	Patoran	2 1/2	0	10.0	10.0
6	"	3	0	10.0	10.0
7	Lorox	1 1/2	1	10.0	9.0
8	"	2	3	10.0	10.0
9	Maloran 50W	2	1	10.0	9.0
10	Maloran 75W	2	1	10.0	9.3
11	HOE 2991	1	0	10.0	8.7
12	Geigy 14254	3	4	10.0	9.3
13	Lorox + Dacthal	3/4 + 6	0	9.3	8.3
14	Bay 94337	1	0	10.0	10.0
15	EL 119 (Ryzelan)	1	0	9.3	9.3
16	EL 119 "	2	0	10.0	9.0
17	2,4-D amine + Lasso	1 + 2	0	10.0	9.3
18	"	1 + 3	0	10.0	9.3
19	Bladex	2	4	10.0	10.0
20	No Treatment	----	---	---	----

0 - no injury and no control; 10 - complete control or kill.

INSECTICIDE EVALUATIONS*

A. L. Wells
Department of Entomology

The research on potato insects and nematodes was composed of three separate studies: an evaluation of systemic insecticides, a continuation of the study on the role of nematodes in cash crop rotations and a preliminary study to determine the varietal response of potatoes to soil systemic insecticides on speckle leaf and tuber quality.

A. Evaluation of Soil Systemic Insecticides

Procedure

Seven insecticides were evaluated for foliar insect control and on yield and quality of the tubers at harvest. Russet Burbank whole seed planted in 14 inch spacing was used in the study. A normal fertilizer program of 800 lb. 14-14-14 banded at planting and 120 lb. additional nitrogen was sidedressed in June. The insecticides were either broadcast and disced in prior to planting or banded in the seed furrow before closing. The plots consisted of three replications of four-fifty foot rows. The treatments were applied and the plots planted on May 8 and Lorox applied preemergence.

Potato flea beetle control was determined by counting the number of feeding holes in 10 leaves of each plot on June 15. Foliar insects were evaluated on August 20 and September 3. The center two rows of each plot was harvested for yield and quality determination on October 8. Specific gravity and a chip color rating were determined later. The insect control, yield and tuber quality data are presented in Table 1.

Results

All of the treatments provided early season control of flea beetles as shown in the feeding hole counts. Most foliar insect populations did not build up extensively during the season. Normally the systemics will provide control of most insects until late July. The untreated and TD-8550 plots matured earlier than any of the other treatments which resulted in a lower yield at harvest. The treatments appeared to have no effect on the tuber size, specific gravity or chip quality.

---

*All nematode samples were analyzed in the Nematology Laboratory directed by Dr. Charles Laughlin.

Table 1. The effects of soil systemic insecticides on insect populations, yield and quality of tubers.

A. Insect Control

Material	Placement	Rate lb/A	Total Insects Collected: Flea Beetle Holes/leaf	Potato leafhopper	Aster leafhopper	Tarnished plant bug	Green peach aphid	Potato aphid	Potato flea beetle	Cabbage looper	Parasites & predators
Disyston 15G	Band	3 lb	0.30	29	0	25	53	1	20	2	14
Bay 68138 15G	Brd.	4 lb	0.60	10	1	12	56	25	21	6	26
Dupont 1410 10G	Brd.	4 lb	0.30	57	0	34	50	34	46	0	15
Furadan 10G	Band	3 lb	0.03	7	0	11	73	45	4	0	13
Temik 10G	Band	3 lb	0.03	11	1	4	8	3	21	6	3
Phorate 15G	Band	3 lb	0.00	21	5	15	76	32	17	4	23
Phorate 6 E.C.	Band	3 lb	0.10	16	4	12	195	41	6	7	24
TD-855010 G	Band	3 lb	0.07	43	1	61	66	56	79	2	19
Untreated	----	---	3.40	49	4	35	61	22	54	3	32

B. Harvest and Quality Data

Material	Placement	Rate lb/A	Yield/A Cwt.	Yield/A Bu.	% Size Distribution: Less than 1 7/8"	1 7/8" and over	Off-type	Specific Gravity	Chip* rating
Disyston 15G	Band	3 lb	383	639	12	82	6	1.075	6.3
Bay 68138 15G	Brd.	4 lb	392	653	14	79	7	1.074	6.3
Dupont 1410 10G	Brd.	4 lb	390	651	16	73	11	1.076	6.0
Furadan 10G	Band	3 lb	386	644	15	78	7	1.075	6.3
Temik 10G	Band	3 lb	390	650	11	81	8	1.076	6.0
Phorate 15G	Band	3 lb	370	616	11	81	8	1.075	6.3
Phorate 6 E.C.	Band	3 lb	354	590	14	78	8	1.072	7.0
TD-8550 10G	Band	3 lb	282	471	12	82	6	1.074	6.0
Untreated	---	---	330	550	16	81	3	1.074	6.4

* Chip color rating: 1 = lightest to 10 = darkest color

B. The Role of Nematode Control in Cash Crop Rotations

Purpose of Study

To determine the effects of nematode control with soil fumigants and granular nematocides on five different three year rotations of cash crops. The study was initiated in April 1968 and completed in 1970. Although a high population of the root lesion nematode, Pratylenchus penetrans, was present during the first two years of the study, sampling in spring of 1970 indicated the population had dropped to a very low level. They did not build up during the growing season as indicated by samples taken at harvest.

Procedure

The soil treatments used in the study consisted of Annual Fumigation (FA) - Fumigated with Vorlex at 10 gallons per acre on October 25, 1969; Fumigation as Needed (FN) - Fumigated with Telone at 20 gallons per acre on April 24, 1968; Granular Nematocide (Bay) - Bay 68138 (Nemacur) granules incorporated on May 7, 1970 prior to planting at rate of 6 lbs active ingredient per acre; and Untreated (Unt) - No soil treatments applied. An adjacent area of alfalfa seeding was plowed in 1969 and fumigated with Vorlex (Vor) at 30 gallons per acre on October 25, 1969 to compare with the other treatments.

These treated areas were crossed with four replications of five different rotations as follows:

Plot 1 - continuous potatoes
Plot 2 - potatoes, potatoes, dry beans
Plot 3 - dry beans, cucumbers, potatoes
Plot 4 - cucumbers, sweet corn, potatoes
Plot 5 - sweet corn, potatoes, dry beans

Normal agronomic practices were followed in all of the plots. These included, recommended fertilization (N and K_2O plowdown) with 800 lb 14-14-14 banded at planting on the potatoes followed by 120 lb Nitrogen sidedressed in June and 250 lb of 5-20-20 + Mn and Zn banded at planting on the beans. Herbicides and systemic insecticides were used on both the beans and potatoes and foliar insecticides and fungicides were applied on a 7-10 day schedule. The planting dates, varieties and data are presented in Tables 2-6.

Table 2. Data from Plot 1 (potatoes 1968, 1969, 1970) - Date planted: May 8; Vines killed: Oct. 1; Harvested: Oct. 12, 1970.

Variety and Treatment	Maturity Rating*	Yield (cwt/A)	Percent Size Distribution: Less than 1 7/8"	1 7/8" to 10 oz.	10 oz. and Over**	Off Type	Specific Gravity	Chip Rating***
Sebago								
FA	7.5	352	8	92			1.059	4.5
FN	8.8	332	9	91			1.061	4.5
Bay	7.0	375	8	92			1.059	4.5
Unt	9.5	359	9	91			1.062	3.8
Vor	3.8	441	8	92			1.058	4.0
Kennebec								
FA	9.3	409	4	96			1.066	4.3
FN	9.8	366	5	95			1.063	3.5
Bay	9.8	376	4	96			1.063	3.5
Unt	10.0	331	5	95			1.063	4.3
Vor	5.8	531	4	96			1.067	4.3
Russet Burbank								
FA	5.8	340	9	55	25	11	1.078	6.3
FN	8.0	328	10	55	27	8	1.073	6.0
Bay	7.0	358	9	51	33	7	1.073	6.5
Unt	9.5	310	10	66	17	7	1.074	6.0
Vor	3.8	428	9	56	27	8	1.075	6.0

*Maturity rating (Sept. 24): 1 - Normal vigorous growth to 10 - completely dead.
**Determined for Burbanks only - ***Chip color rating: 1 lightest to 10 - darkest color.

Table 3. Data from Plot 2 - (Potatoes 1968, 1969; Beans 1970)
Varieties: Seaway (white) and Charlevoix (dark red kidney)
Date planted: June 11; Harvested: Oct. 5 (Seaway only)

Treatment	Yield/A	
	Cwt	Bu
FA	23	38
FN	20	34
Bay	22	36
Unt	19	32
Vor	27	45

Table 4. Data from Plot 3 - (Beans 1968, Cucumbers 1969, Potatoes 1970) Date planted: May 8; Vines killed: Oct. 1; Harvested: Oct. 12.

Variety and Treatment	Maturity Rating*	Yield (cwt/A)	Percent Size Distribution: Less than 1 7/8"	1 7/8" to 10 oz.	10 oz. and over**	Off Type	Specific Gravity	Chip Rating***
Sebago								
FA	3.8	357	7	93			1.060	4.5
FN	7.0	455	7	93			1.061	4.0
Bay	6.0	421	8	92			1.064	4.5
Unt	7.0	456	8	92			1.064	4.5
Vor	3.3	407	8	92			1.059	4.3
Kennebec								
FA	8.0	431	5	95			1.064	4.8
FN	9.8	493	4	96			1.065	4.0
Bay	8.8	484	3	97			1.065	4.0
Unt	9.8	418	4	96			1.068	4.0
Vor	4.8	564	3	97			1.065	4.8
Russet Burbank								
FA	3.8	374	11	62	21	6	1.080	6.0
FN	6.8	380	11	64	22	3	1.073	6.3
Bay	5.5	396	9	57	26	8	1.076	7.0
Unt	7.0	377	11	64	20	5	1.073	6.3
Vor	2.5	398	14	60	23	3	1.076	6.0

*Maturity rating (Sept. 24): 1 - Normal vigorous growth to 10 - completely dead.
**Determined for Burbanks only. ***Chip color rating: 1 - lightest to 10 - darkest color.

Table 5. Data from Plot 4 - (Cucumbers 1968, Sweet corn 1969, Potatoes 1970) Date planted: May 8; Vines killed: Oct 1; Harvested: Oct. 12.

			Percent Size Distribution					
Variety and Treatment	Maturity Rating*	Yield cwt/A	Less than 1 7/8"	1 7/8" to 10 oz.	10 oz. and Over**	Off Type	Specific Gravity	Chip Rating***
Sebago								
FA	4.5	416	6	94			1.064	4.8
FN	7.8	441	6	94			1.062	4.5
Bay	4.8	471	5	95			1.064	4.8
Unt	7.5	459	6	94			1.062	4.5
Vor	3.3	407	8	92			1.061	5.3
Kennebec								
FA	8.0	504	3	97			1.067	4.8
FN	9.8	531	3	97			1.065	4.3
Bay	8.3	536	2	98			1.066	4.5
Unt	10.0	468	5	95			1.066	4.5
Vor	5.0	588	3	97			1.066	3.8
Russet Burbank								
FA	3.8	403	11	57	26	6	1.081	6.0
FN	7.0	449	10	62	22	6	1.076	6.0
Bay	5.3	452	8	62	24	6	1.076	6.0
Unt	7.5	424	9	62	23	6	1.076	6.8
Vor	2.8	462	9	61	24	6	1.079	6.0

*Maturity rating (Sept. 24): 1 - Normal vigorous growth to 10 - completely dead.
**Determined for Burbanks only. ***Chip color rating: 1 - lightest to 10 - darkest color.

Table 6. Data from Plot 5 - (Sweet corn 1968, Potatoes 1969, Beans 1970). Varieties: Seaway (white) and Charlevoix (dark red kidney) - Date planted: June 11; Harvested: Oct. 5 (Seaway only).

Treatment	Yield/A	
	Cwt	Bu
FA	21	35
FN	20	33
Bay	22	37
Unt	20	33
Vor	27	45

Results

The areas fumigated last fall had a marked effect on the maturation of the potatoes in all three plots especially on the Sebagoes and Burbanks. This was noticeable on the Kennebecs only in the high rate of fumigant. The differences in yield from this treatment could be due to the legume crop plowed down prior to fumigation or the interaction of both. Even after killing the vines the tubers from these fumigated plots showed evidence of immaturity at the time of harvest. No differences were noted in quality of the tubers at the time the specific gravities and chip color ratings were made (approximately 5 weeks after harvest).

A difference was also noted in the yields of potatoes from the different rotations. The yields of all varieties on all treatments were consistently higher in the rotations following cucumbers and sweet corn than after continuous potatoes. This is evidently due to agronomic factors other than the soil treatments.

The Charlevoix beans were not harvested for yield determination due to a poor seeding rate and resulting stand. The only differences in the Seaway yields were noted between the high Vorlex fumigation of the alfalfa sod and the other treatments. There were no differences between the two plots due to rotational crops.

Note: A complete analysis of the three year's data from this study is being made and will be available in the near future.

C. Varietal Response to Soil Systemic Insecticides

A preliminary study to compare the response of 17 varieties of potatoes to soil applications of systemic insecticides was initiated at this farm. Of particular interest was to study their reported effect on speckle leaf and tuber quality.

Procedure

The seed of each variety was planted in two-50 foot non-replicated rows. One series of 17 adjacent rows included 16 ft. untreated, 16 ft. treated with Phorate granules at 3 lb. active ingredient per acre banded in the row, and 16 ft. with an additional 3 lb. broadcast and disced prior to planting. Each treatment was separated by a one foot alley. An adjacent 17 row area included 16 ft. untreated, 16 ft. treated with DiSyston granules at 3 lb. active ingredient per acre banded in the row, and 16 ft. with the DiSyston treatment which had been treated with a broadcast application of Dasanit granules at 5 lb. active ingredient per acre. The plots were treated and planted on May 7.

Flea beetle data were obtained on June 15 by counting the adult feeding holes on 5 leaves in each treatment. Speckle leaf symptoms were taken at the same time. Variety yields and size distribution of tubers were taken at harvest. Specific gravities, sprout indexing and chipping quality were taken about 5 weeks after harvest. The data are summarized in Tables 7 and 8.

Results

Control of flea beetles was very obvious in the treated areas of all varieties which indicate that these materials are effective in preventing damage by these insects. The speckle leaf condition appeared to be more noticeable in the treated plots in the varieties that were susceptible. The growing rate of these varieties in the presence of the insecticides apparently brought on the symptoms. Further studies will stress this interrelationship. The treatments had no affect on the sprouting or chipping quality of the tubers. The yield data from all the treated plots were summarized to compare the varieties.

Table 7. Varietal response to soil systemic insecticides as shown in insect control, speckle leaf incidence and tuber quality.

Variety	Flea Beetle Holes/Leaf						Speckle Leaf Incidence*					Sprout Index**					Color Rating of Chip***				
	Untreated	Phorate Band	Phorate Brd. + Band	Disyston Band	Dasanit Brd.	+ Disyston Band	Untreated	Phorate Band	Phorate Brd. + Band	Disyston Band	Dasanit Brd. + Disyston Band	Untreated	Phorate Band	Phorate Brd. + Band	Disyston Band	Dasanit Brd. + Disyston Band	Untreated	Phorate Band	Phorate Brd. + Band	Disyston Band	Dasanit Brd. + Disyston Band
Haig	9.3	0	0	0.4	0		0	0	+	0	0	3.5	3	3	4	3	3	3	3	3	3
Norchip	6.0	0	0.2	0.4	0		0	0	0	0	+	4	4	2	4	3	3	3	3	3	3
Norgold Russet	5.1	0	0.2	0.2	0		0	0	0	0	0	4	5	5	4	5	6	6	6	6	6
Onaway	7.1	0	0	0.2	0		+	+	+	0	+	1.5	2	1	2	2	7	7	7	7	7
Katahdin	7.1	0.2	0	0	0		0	+	0	+	+	1	1	1	1	1	3.5	5	5	5	4
Kennebec	5.7	0.2	0	1.2	0.4		0	0	+	0	+	0	0	0	0	0	4	4	4	4	4
Sebago	9.5	0	0	0.6	0.2		0	+	+	+	+	1.5	3	2	2	2	3	4	4	4	4
Russet Burbank	6.2	0	0	0.4	0		0	+	+	+	+	0	0	0	0	0	5	5	5	5	5
Io Pride	4.4	0.6	1.0	0	0.2		0	+	+	+	+	1.5	2	1	1	1	4	4	4	4	4
Merrimack	10.0	0	0	0.2	0.2		0	+	+	+	+	0	1	0	0	0	4	4	4	4	4
Jewel	7.2	0	0	0.2	0		0	+	+	+	+	1.5	2	1	1	3	4	4	4	4	4
Superior	6.3	0.2	0	0.2	0		0	+	0	0	+	2	1	2	2	1	3	3	3	3	3
Cobbler	4.3	0	0	0.2	0		0	+	+	0	0	1.5	2	2	1	1	5	5	5	5	5
MSU 709	6.7	0	0	0.8	0		0	++	++	+	+	1	0	0	2	0	6	6	6	6	6
Monona	10.9	0	0	0	0		0	0	0	0	+	2	1	2	2	3	3	3	3	3	3
FL 96	9.1	0	0	0.6	0		+	++	++	++	++	3	3	1	2	3	4	4	3	3	5
Bake King	4.9	0.6	0	0	0		0	0	+	0	+	0	1	1	0	1	6	6	6	6	6

*Speckle Leaf Incidence Ratings (June 15): 0 - none apparent, + - Slight, and ++ - Moderate.

**Sprout Index: 0 - no sprout activity to 5 - extensive sprouting.

***Chip Color Rating: 1 - lightest to 10 - darkest color.

Table 8. Yield, size distribution and specific gravity from variety-insecticide treatment study. *

		% Size Distribution				
Variety	Cwt/A	Less than 1 7/8"	1 7/8" to 10 Oz.	10 Oz. and Over	Off Type	Specific Gravity
Haig	401	10	81	9	--	1.062
Norchip	403	8	90	2	--	1.074
Norgold Russet	326	11	87	2	--	1.066
Onaway	453	6	80	14	--	1.066
Katahdin	340	7	74	19	--	1.067
Kennebec	433	4	80	16	--	1.066
Sebago	334	17	75	8	--	1.064
Russet Burbank	336	13	71	--	16	1.073
Io Pride	387	11	83	6	--	1.065
Merrimack	280	5	78	17	--	1.078
Jewel	397	7	76	17	--	1.076
Superior	355	5	80	15	--	1.072
Cobbler	403	8	84	8	--	1.066
MSU 709	367	4	74	22	--	1.066
Monona	361	5	87	8	--	1.065
FL-96	401	9	78	13	--	1.075
Bake King	301	12	82	6	--	1.075

*Data from all treatments are summarized together.

SOIL FERTILITY RESEARCH ON FIELD CORN, SWEET CORN, KIDNEY BEANS, PEA BEANS, AND PEPPERMINT

M. L. Vitosh
Department of Crop and Soil Sciences

In addition to the five potato experiments, seven additional experiments were conducted in 1970. Most of these experiments are in the potato rotation. All experiments were irrigated when soil moisture tensiometers indicated a need for moisture.

The soil in the area has been classified as McBride sandy loam. Soil test values for each experiment and management practices are reported at the bottom of each table.

Source, Rate, and Time of N Application on Field Corn

This experiment involved comparisons of broadcast vs. sidedress applications of nitrogen and urea vs. sulfur-coated urea (SCU), a slow release N material. The analysis and properties of this material were discussed under the potato section of this report.

Two hybrids of corn (Mich 402-2X and Michigan 500-2X) were used in this experiment. Corn was harvested with a one-row picker-sheller. Lodging and grain moisture were measured at harvest time.

Sidedress applications of N, especially at the 120 lb N per acre rate, indicated greater efficiency than N broadcast and plowed down prior to planting. Yields were not significantly increased beyond the 120 lb N per acre rate. Normally it is expected that one pound of N will produce one bushel of corn. Yields in this experiment were considerably better indicating either very efficient utilization of nitrogen or some carry-over N from previous years was present. Although there was no N applied to this experimental area in 1969 and a residual experiment in 1969 with red kidney beans did not indicate any carry-over, this area did receive 120-240 lb N per acre in 1968 on potatoes. The rooting depth of corn is much deeper than kidney beans and as a result corn may have obtained some N from previous fertilization.

Sulfur-coated urea did not appear to have increased the efficiency of nitrogen above that of other comparable treatments. Comparable yields were obtained when equal N rates were used. Field observations indicated that N was released at too slow a rate from SCU during mid-season and resulted in N deficiency symptoms, especially at the lower rates. Although plant analysis data are not available for this experiment, potato petiole analysis in the potato experiment did indicate lower N content in petioles from sulfur-coated urea plots.

Stalk lodging in general was quite bad. A number of factors may account for such high percentage of lodging. Corn borer populations in 1970 were nearly double that of 1969 with an average of 94 borers per 100 plants at the Montcalm Experimental Farm. Corn borer populations were not checked in this experiment and may have been much higher as indicated by the high lodging percentages.

Heavy fertilization with high nitrates in the stalk also tend to favor stalk rot. Higher yields with larger ears on each stalk may also have contributed to lodging.

Sulfur-coated urea significantly decreased lodging. This may have been a result of lower N in the stalk and reduced stalk rot.

Grain moisture indicates that the corn was quite dry at harvest time. These conditions along with high winds may also have caused increased lodging.

Grain from all N treatments was lower in moisture than grain from the checked plot, indicating increased maturity due to N fertilization.

K-Mg Study of Field Corn and Sweet Corn

These experiments were established to evaluate various rates of K fertilization with and without Mg on yield of field corn and sweet corn. Results of these two experiments are found in Tables 2 and 3.

Yields of field corn were significantly increased with the first 50 lb K_2O per acre with no additional increase due to higher rates of K. Sweet corn did not respond to K applications. Magnesium fertilization had no effect on yield of either experiment. Soil tests did not indicate

magnesium deficiency, however, with high rates of K on soils which test high in K the Mg situation becomes more critical. Further evaluation and study of this K and Mg interrelationship is needed.

Grain moisture and lodging of field corn were not significantly affected by the treatments used in this experiment.

N Carrier Study on Sweet Corn and Red Kidney Beans

These two experiments were established in 1968 to evaluate five sources of N on yield of sweet corn and red kidney beans. Yield data for 1970 along with the three-year average are presented in Tables 4 and 5.

Yields over this three-year period have not been significantly affected by these N carriers when all carriers have been applied at the same time and at equal rates.

In 1968 anhydrous ammonia gave higher sweet corn yields because it was applied later than the other N sources. The yield increase was attributed to less leaching loss and more efficient use of the N from anhydrous ammonia.

Residual N Study on Kidney Beans

This experiment received no N in 1970. The objective of the experiment was to evaluate any residual or carry-over N from the N treatments on potatoes in 1969.

Results of this experiment (Table 6) indicate no residual effect. Similar observations were found in 1968 and 1969. Note, however, that kidney beans which received 60 lb N per acre broadcast and plowed down prior to planting in 1970 gave about an eight bushel increase (Table 5 vs. Table 6). The three-year average indicates better than an eight bushel increase due to N fertilizer. Although red kidney beans are symbiotic N fixing plants they appear to be very inefficient N fixers as indicated by their response to N fertilizer.

One additional conclusion can be drawn in this experiment. Nitrogen fertilizer which is not utilized by the crop in the year of its application can be lost through leaching or denitrification and is not available to a following bean crop. Crops such as corn, however, may be able to recover some of the leached N because of its deeper rooting system. It should also be noted that this soil has a sandy loam surface with heavier texture subsurface horizons and may react quite differently than other soils, especially those with heavy surface horizons.

Zinc-Phosphorus Study on Pea Beans

In 1969 a significant reduction in yields of red kidney beans was observed with five lb Zn per acre banded annually for three years. A positive response at this location has not been observed on potatoes, sweet corn, or red kidney beans since these experiments were established in 1967. The question of zinc toxicity became apparent in 1969 with a yield reduction noted in red kidney beans.

In 1970 pea beans were planted to this area with the intent of further evaluating zinc toxicity. Pea beans, although quite responsive to Zn if it is deficient in soil, have also been noted to tolerate only a narrow range of soil Zn levels. Therefore, Sanilac pea beans were planted to this area where Zn had been previously applied.

Results in Table 7 indicate a definite yield reduction where 50 lb Zn per acre was broadcast in 1967. Slightly higher yields were obtained at the high P levels, however, there was no apparent P-Zn interaction. Yield reductions due to Zn were found at both high and low P levels. It may be concluded that Zn is very soluble in acid sandy soils and should not be used without a soil test recommendation.

N and K Study on Peppermint

This experiment was initiated in 1969 to evaluate cultural practices of growing this crop on mineral soils. The experiment involved five N rates and two K rates. All treatments for which yields are reported received one-half pound of Sinbar herbicide. One initial treatment received no herbicide, however, the weeds were so bad this treatment was not harvested for yields.

Disease-free peppermint roots were planted in 32-inch rows in the spring of 1969. In the fall of 1969 the roots and rhizomes were plowed under and allowed to propagate in 1970. The meadow mint was harvested with a mower on August 11, 1970. The samples were allowed to dry in the fields for several days and then distilled at the East Lansing Muck Farm. Oil and dry matter yields are shown in Table 8.

Oil yields increased up to the 180 lb N per acre rate and then decreased slightly with an additional 60 lb N per acre. The 240 lb N per acre rate appeared to cause considerable lodging and rank growth indicative of too much N. The relationship between dry matter yields and oil yields is also very interesting. Oil yields did not parallel dry matter production as one might expect. Oil yields were best where 120 or 180 lb N per acre were used.

Sinbar at a rate of one-half pound per acre appears to be very effective for controlling weeds for this crop on this soil. Oil prices on the 1970 market appear to have deteriorated badly. Only those growers which were under contract received prices comparable to 1969 which averaged $6.60 per pound.

Table 1 Effect of rate, source and time of nitrogen application on yield, moisture and lodging of two irrigated corn hybrids.

Nitrogen Application (a)				Mich 402 - 2X			Mich 500-2X			Average Effects		
Broadcast	Banded	Sidedressed	Total N	Yield (Bu/A)	Moisture (%)	Lodging (%)	Yield (Bu/A)	Moisture (%)	Lodging (%)	Yield (Bu/A)	Moisture (%)	Lodging (%)
---------lb N/A--------												
0	0	0	0	71	20	7	78	21	3	75	21	5
60 SCU	0	0	60	112	19	13	109	22	5	111	21	9
60 U	60 U	0	120	145	18	47	147	18	37	146	18	42
120 U	60 U	0	180	158	19	59	150	19	53	154	19	56
180 U	60 U	0	240	150	20	52	153	19	43	152	19	48
60 SCU	60 U	0	120	144	18	26	147	18	22	145	18	24
0	60 U	60 U	120	162	18	41	153	18	42	157	18	41
0	60 U	120 U	180	147	18	59	155	18	63	151	18	61
0	60 U	180 U	240	163	18	54	150	19	49	157	18	52
120 SCU	60 U		180	148	18	43	139	18	33	143	18	38
LSD (.05) treatments			---	---	--	--	---	--	--	12	2	14
LSD (.05) treatments within varieties				14	2	16	14	2	16	---	--	--
LSD (.05) varieties within treatments				NS	1	NS	NS	1	NS	---	--	--

(a) Broadcast urea (U) and sulfur-coated urea (SCU) was applied and plowed down one day before planting. Banded urea was applied at planting time 1½ inch to side and 1 inch below the seed. Sidedressed urea was applied to soil surface June 15, 1970.

Planted: April 30, 1970 Harvested: October 16, 1970

Plant Population: 24,000 Row Spacing: 28 inches

Basic Fertilizer: 0-50-100 banded at planting time

Irrigation: 4.0 inches Harvest Area: 233 sq. ft.

Soil Tests: pH = 7.0. P = 215. K = 161

Table 2 Effect of potassium and magnesium on yield, moisture and lodging of 402 - 2X corn hybrid under irrigation

Potassium-Magnesium Applications (a)				24,000		26,000		Average Effects		
Broad-cast	Band-ed	Broad-cast	Total K_2O	Yield (Bu/A)	Lodging (%)	Yield (Bu/A)	Lodging (%)	Yield (Bu/A)	Moisture (%)	Lodging (%)
lb K_2O/A		lb Mg/A								
0	0	0	0	131	56	127	60	129	18	58
0	50	0	50	148	60	141	62	145	18	61
50	50	0	100	138	66	145	60	141	19	63
100	50	0	150	163	49	155	58	159	18	54
150	50	0	200	148	64	146	58	147	19	61
250	50	0	300	150	57	154	60	152	19	59
0	50	50	50	138	68	146	67	142	18	68
50	50	50	100	150	52	144	62	147	19	57
150	50	50	200	150	60	150	58	150	18	59
250	50	50	300	156	57	151	52	153	18	55
LSD (.05) treatments				---	--	---	--	12	NS	NS
LSD (.05) treatments within plant population				18	NS	18	NS	---	--	--
LSD (.05) plant population within treatment				NS	NS	NS	NS	---	--	--

(a) Broadcast potassium and magnesium were applied and plowed down 5 day prior to planting. Banded potassium was applied 1½ inches to side and 1 inch below seed at planting time. Potassium and magnesium sources were KCl and $MgSO_4$.

Planting: May 4, 1970 Harvest: October 20, 1970

Row Spacing: 28 inches Harvest Area: 233 sq. ft.

Basic Fertilizer: 50-50-0 banded, 180 N sidedressed June 16, 1970

Irrigation: 4.0inches

Soil Test: pH = 6.6, P = 155, K range = 159 - 247, Mg = 168

Table 3. Effect of potassium and magnesium on yield of irrigated sweet corn.

Potassium-Magnesium Applications[a]				Sweet Corn Yield (Cwt/A)	
Broadcast	Banded	Broadcast	Total K_2O	1970	1968 - 70 Average
lb K_2O/A		lb Mg/A			
0	0	0	0	153	141
0	20	0	20	155	134
0	40	0	40	164	136
0	60	0	60	154	132
0	80	0	80	152	133
120	40	0	160	151	132
0	20	50	20	163	---
0	40	50	40	154	---
0	60	50	60	153	---
0	80	50	80	154	---
LSD (.05)				NS	NS

[a]Banded potassium was placed 1½ inches to side and 1 inch below seed at planting. Broadcast potassium and magnesium were applied and plowed down 5 days prior to planting. Potassium and magnesium sources were KCl and Mg SO_4.

Planted: May 19, 1970 Harvested: August 17, 1970

Row Spacing: 28 inches Plant Population: 25,000

Basic Fertilizer: 60 - 50 - 0 banded, 120 lb N/A sidedressed June 16, 1970

Harvest Area: 233 sq. ft. Irrigation: 4.0 inches

Soil Tests: pH = 6.3, P = 209, K = 276

Table 4. Effect of source of nitrogen on yield of irrigated sweet corn.

Source of Nitrogen	Sweet Corn Yield (Cwt/A)	
	1970	1968 - 70 Average
Ammonium Sulfate[a]	146	120
Ammonium Nitrate[a]	149	117
Calcium Nitrate[a]	143	113
Urea[a]	143	124
Anhydrous Ammonia[b]	144	127
LSD (.05)	NS	NS

[a] 150 lb N/A topdressed May 22, 1970

Planted: May 18, 1970 Harvested: August 17, 1970

Row Spacing: 28 inches Plant Population: 25,000

Harvest Area: 233 sq. ft. Irrigation: 4.0 inches

Basic Fertilizer: 0 - 50 - 100 banded at planting time

Soil Tests: pH = 6.3, P = 294, K = 272

Table 5. Effect of ource of nitrogen on yield of irrigated dark red kidney beans.

Source of Nitrogen[a]	Yield (Bu/A) 1970	1967 - 70 Average
Ammonium Sulfate	39	39
Ammonium Nitrate	35	39
Calcium Nitrate	40	39
Urea	38	41
Anhydrous Ammonia	38	39
LSD (.05)	NS	NS

[a]60 lbs N/A Applied Two Weeks Prior to Plowing and Planting

Planted: June 8, 1970 Harvested: October 28, 1970

Row Spacing: 28 inches Plant Spacing: 4 inches

Harvest Area: 466 sq. ft. Irrigation: 1.6 inches

Basic Fertilizer: 0 - 50 - 50 banded at planting time

Soil Tests: pH = 6.5, P = 201, K = 265

Table 6. Effects of residual nitrogen on yield of irrigated dark red kidney beans.

lb N/A[a]	Yield (Bu/A)	
	1970	1968 - 1970 Average
0	29	26
60	30	27
120	28	27
180	27	26
240	28	27
LSD (.05) Treatments	NS	NS

[a]Applied as ammonium nitrate in 1969

Planted: June 8, 1970 Harvested: October 28, 1970

Row Spacing: 28 inches Plant Spacing: 4 inches

Harvest Area: 466 sq. ft. Irrigation: 1.6 inches

Basic Fertilizer: 0 - 25 - 50 banded at planting time

Soil Tests: pH = 6.7, P = 187, K = 274

Table 7 Effect of Zinc on Yield of Irrigated Pea Beans at Two Phosphorus Levels.

Treatment (lb Zn/A)	Yield (Bu/A)		
	Low P[a]	High P[b]	Average Effects
None	38	37	38
25 lb ($ZnSO_4$)[c]	35	36	36
50 lb (AZCo C100)[c]	32	34	33
5 lb (AZCo 12)[d]	35	39	37
5 lb ($ZnSO_4$)[d]	37	39	38
LSD (.05) Treatments	--	--	3
LSD (.05) Treatments within P Levels	4	4	--
LSD (.05) P Levels within Treatments	4	4	--

(a) Low P = 22 lb P/A banded 1970.
(b) High P = 300 lb P/A broadcast 1967 + 22 lb P/A banded 1970.
(c) Zinc broadcast in 1967.
(d) Banded annually 1967,68 and 69.

Planted: June 8, 1970 Harvested: August 31, 1970
Harvest Area: 233 sq. ft. Row Spacing: 28 inches
Seeding Rate: 40 lb per acre Irrigation: 1.6 inches
Basic Fertilizer: 50-50-50
Soil Test pH = 5.6, P range = 268 to 316, K = 246,
Zn range = 6.1 to 8.4

Table 8. Effect of nitrogen and potassium on hay and oil yield of peppermint.

Treatment[a] lb N - P_2O_5 - K_2O/A	Dry Matter Yield (lb /A)	Oil Yield (lb /A)
0 - 50 - 150	1535	21
60 - 50 - 150	2707	45
120 - 50 - 150	2545	47
180 - 50 - 150	2573	51
180 - 50 - 0	2638	49
240 - 50 - 150	2719	46
LSD (.05)	843	8.5

[a]Topdressed April 29, 1970

Planted: spring 1969 Harvested: August 11, 1970

Irrigation: 4.8 inches Harvest Area: 800 sq. ft.

Basic Fertilizer: 0 - 50 - 150 topdress April 29, 1970

Soil Tests: pH = 6.5 P = 191 K = 270

INSECTICIDE EVALUATION ON BEANS

A. L. Wells
Department of Entomology

An evaluation of soil applications of systemic insecticides on field beans was made at the farm. Since the use of these materials has become a normal practice with the bean industry their continual reevaluation is necessary.

Procedures

Five experimental or recommended compounds were applied as a preplant, broadcast or a band at planting. The plots consisted of six treatments and four controls in three replications. Each plot included two 50 foot rows of Seaway and two rows of Charlevoix variety seed. Eptam was incorporated prior to planting on June 11 and a recommended fertilizer program was used.

Results

There were very few foliar insects present in the plots so it was difficult to assess the materials for insect control. Some green clover worm feeding was apparent in mid-summer but was found on all the treatments. The insecticides tested have very little affect on this insect. Due to the poor seeding rate of the Charlevoix variety, only the Seaways were harvested for yield evaluation. The yield data are presented in Table 9. It appears that the treatments resulted in a slightly higher yield than the untreated plots due to an unevaluated factor.

Table 9. Yields from systemic insecticide evaluation plots.

Treatment	Placement	Rate/A* (Toxicant)	Yield/Acre Cwt.	Bu.
DuPont 1410 10% Gran.	Band	1 lb	27	45
DuPont 1410 10% Gran.	Brdcst.	4 lb	25	41
Phorate 15% Gran.	Band	1 lb	26	44
Phorate 6 E.C.	Band	1 lb	25	42
DiSyston 15% Gran.	Band	1 lb	24	40
Furadan 10% Gran.	Band	1 lb	27	44
Untreated (Ave. of four)	----	---	23	38

*Rates based on 30 inch rows (17, 424 row ft/A.)

RED KIDNEY AND MISCELLANEOUS COLORED BEAN TRIAL

M. W. Adams and A. W. Saettler
Departments of Crop and Soil Sciences and
Botany and Plant Pathology

The strains in this test included 37 entries of which 28 were red kidney selections and commercial check varieties, and the remainder were miscellaneous colored beans, some domestic and some foreign. They were planted June 9 in 2-row plots, 20 feet long, row width 28 inches. A planting-time fertilizer, 5-20-20, with 2% Mn and 2% zinc, was applied. Thimet was added in the boot from a separate hopper.

The light red kidneys were the last to be harvested and because of their failure to mature had to be bagged and artificially dried before threshing.

The objectives of the test were:

a) Compare the yield and maturity and canning quality of the 25 halo-blight resistant kidney selections with 3 standard varieties, Manitou, Redkote and Charlevoix.

b) Compare 3 bush cranberry selections with the standard vine-type.

c) Take a look at some foreign beans to see whether we can produce these beans economically in Michigan and ship them overseas.

The results are presented in the following table (Table 1).

Table 1. Summary of yield, seed weight, and seed and canning quality of miscellaneous colored beans, including halo-blight resistant red kidney beans, grown in replicated small plots at the Montcalm County Research Farm, 1970. (Canned Bean Results by C. L. Bedford, Food Science Department).

Selection Number or Name	Type	Cwt/ Acre	Gms Wt/100 Seeds	Dry Bean Score	Canned Bean Notes	
					Flavor	Texture
01	LRK	19.15	57.2	B	Normal	Satisfactory
02	"	17.88	57.4	B-	"	"
03	"	16.75	54.0	B-	"	"
04	"	15.17	54.7	B-	"	"
05	"	13.07	52.0	C	"	"
06	"	10.70	51.7	C	"	"
07	"	13.98	52.0	B-	"	"
08	"	13.63	53.8	B-	"	"
09	"	14.39	51.4	B	"	"
10	"	17.98	56.9	B	Slight off-flavor	Soft
11	"	13.58	52.1	B	"	"
12	"	12.09	51.0	B	"	Firm
13	"	12.22	53.0	B	"	Satisfactory
14	"	11.14	51.2	B-	"	"
15	"	12.62	50.4	B-	"	"
16	"	12.88	51.6	B+	"	"
17	"	12.48	52.3	B+	Normal	"
18	"	13.46	51.8	B	"	"
19	DRK	16.22	62.5	B	"	Soft
20	"	12.67	59.9	D	"	Reject
21	"	16.03	45.6	A-	"	Satisfactory
22	LRK	13.80	54.3	B	"	"
23	DRK	15.01	47.0	B+	"	Firm & whole
24	LRK	12.01	51.6	B-	"	Satisfactory
25	"	13.68	52.2	B-	"	"
26	#8242 Cran	20.82	47.0	B+		
27	#8245 Cran	19.20	41.9	B+		
28	#8247 Cran	17.57	49.3	B+		
29	Mich. Imp. Cran	24.09	54.2	B-		
30	Charlevoix	18.52	53.6	C		

Table 1. Continued...

Selection Number or Name	Type	Cwt/ Acre	Gms Wt/100 Seeds	Dry Bean Score	Canned Bean Notes Flavor	Texture
31	Merithew G. N.	20.05	33.8	A		
32	Swedish Brown Bean	18.63	38.1	A		
33	Italian Bush Cran	21.27	55.0	B		
34	Charlevoix	19.76	54.9	C		
35	Manitou	23.05	60.8	C+	Normal	Satisfactory
36	Charlevoix	21.66	57.8	C	"	"
37	Redkote	15.53	55.6	B+	"	"

General Mean	16.02 cwt.
L. S. D. .05	4.58 cwt.
C. V.	20.39%

Discussion of Results:

No serious diseases affected the nursery, but near the end of the season the lines with green stems and pods - mostly the light red kidneys - became badly infested with Mexican bean beetle.

Objective #1 - The yield results were disappointing in terms of finding halo-blight resistant red kidneys equal to or superior in yield to Manitou or Charlevoix. The L. S. D. of 4.58 cwts, however, and the C. V. of 20% suggests a rather low level of precision in comparing means. None of the experimentals equaled the standards. At harvest it was clear that the experimentals had a poor set of mature pods due to the first set, and an abundant set of green pods due to a late second set. The standards had only one set of pods but this was substantial. We don't know why the experimentals behaved this way. The weather record for the flowering period showed no rain from about the 4th of August through the 16th, and this coincided with a high temperature period of 12 days in which the temperature ranged from the middle 80's to 90°F every day. Possibly the experimentals were caught in the critical phase of flowering or pod setting by the high temperature.

The processing results indicate that LRK #010, and DRK #019 and #020 must be rejected as too soft and/or too easily broken. DRK #023 turned out more firm and whole than Charlevoix

Objective #2 - The cranberry bean comparison points up a critical point in cultural conditions. The bush types in 28" rows will not yield equally with the vine type, even though the vine type will generally lodge very badly. We believe we should grow the bush types in 21" or even 14" rows to get the maximum yield from them. In 1971 our experiments will include narrow rows for these beans.

Objective #3 - The Italian bush cranberry yielded quite well at this site, and the maturity was not a problem. The beans themselves appear similar enough to the Michigan cranberry that the latter could easily substitute for the former in the Italian market. The canning trials on these beans are not finished; the Michigan type may not have the same processing behavior. The Swedish Brown bean also performed well in the field in 1970, but in canning trials it has been very slow to take up water. We need to look at these beans again before deciding definitely that they can be successfully produced here.

WEED CONTROL IN DRY BEANS

W. F. Meggitt
Department of Crop and Soil Sciences

The table lists the herbicide treatments applied for weed control in dry beans in 1970. In general weed control at the Montcalm Farm was not as good as in past years. The excessive amount of rainfall may have leached the preplant herbicides from the upper layer of soil. Eptam and Treflan still provide excellent control of annual grasses but were only fair on broad-leaved weeds.

Preemergence applications were generally more satisfactory in 1970. Rainfall immediately after application was ideal for moving herbicide into soil. However, subsequent rainfalls tended also to leach preemergence herbicides more readily and control was not as long lasting.

Dynoram, a combination of DNBP and Amiben provided very good control with no injury to beans. Preforan, a chemical not yet labeled for dry beans also provided good control. The tolerance to Preforan was not as good as Dynoram. The 4 1/2 lb/A rate of Preforan gave some bean injury, particularly to the white navy beans. Amiben at 2 lb/A which has been used for dry beans in the past gave good weed control with no bean injury.

Preplant and Preemergence Weed Control Evaluations in Dry Beans. Montcalm Co., 1970.

Planted - June 11, 1970
Rated - July 14, 1970

Treated - June 11, 1970
Variety - Seafarer and Charlevoix

Weeds Present - pigweed, lambsquarter, some barnyard grass, green foxtail. Thin grass population made grass control rating difficult.

Trmt No.	Treatment	Rate lb/A	Injury		Weed Control Rating	
			Seafarer	Charlevoix	Bd. Lv.	Grass
PREPLANT						
1	Eptam	2	0.0	3.3	6.0	10.0
2	"	3	0.0	3.0	7.3	9.3
3	Eptam + Amiben	2+1 1/2	0.0	0.0	6.3	9.3
4	Treflan	3/4	0.0	0.0	6.3	8.7
PREEMERGENCE						
5	Dynoram	1 gal	0.3	1.0	6.7	4.3
6	"	1 1/2 gal	0.0	0.3	9.3	8.7
7	"	2 gal	0.0	0.0	9.3	9.0
8	Amiben	2	0.0	0.0	8.0	9.0
9	Basimase	3	4.7	8.3	7.0	9.7
10	"	4 1/2	5.7	9.7	8.3	9.7
11	Preforan 3E	3	1.7	1.3	8.3	8.0
12	"	4 1/2	3.3	4.0	9.3	7.7
13	Preforan 50W	3	2.0	2.3	6.7	9.0
14	"	4 1/2	3.3	2.0	8.0	9.0
15	Lasso	1 1/2	1.7	4.7	5.7	9.7
16	"	2	2.7	6.3	6.0	9.7
17	Amiben + Lasso	1 1/2+1 1/2	1.3	3.7	9.0	10.0
18	" "	2 + 1	0.3	2.0	9.3	9.7
19	Preforan + Lasso	2 + 1 1/2	2.3	5.0	9.0	9.7
20	No Treatment	----	0.0	0.0	0.0	0.0

0 - no injury and no control; 10 - complete control or kill.

CORN HYBRIDS AND IRRIGATION EXPERIMENTS AT THE MONTCALM EXPERIMENTAL FARM - 1970

E. C. Rossman
Department of Crop and Soil Sciences

Agronomic data for 64 commercial and experimental corn hybrids, irrigated and not irrigated in 1970, are presented in Table 1. Irrigated corn averaged 143.6 bushels per acre compared to 102.9 not irrigated, a difference of 40.7 bushels for irrigation. The range (highest and lowest) in yields for the 64 hybrids was: irrigated = 193.8 to 94.9; not irrigated = 127.7 to 69.6. The highest yielding hybrid, Michigan Exp. 67-2023 (2X), yielded 66.3 bushels (193.8 vs. 127.5) more when irrigated than when not irrigated. The lowest yielding hybrid, Northrup King PX 417 (3X) -- an early maturing hybrid, yielded 25.3 bushels (94.9 vs. 69.6) more when irrigated.

Hybrid response to irrigation (irrigated minus not irrigated yield) was not entirely related to relative yielding ability of hybrids. Some of the lower yielding hybrids gave a good response to irrigation while others gave a relatively smaller response. Likewise, some of the high yielding hybrids gave a large response to irrigation while others gave a moderate response. Thus, irrigation response of a group of hybrids should be considered in light of their relative yielding abilities, i.e., a large irrigation response from a low yielding hybrid would be less desirable than an equal or even lower response from a high yielding hybrid.

Twelve of the 17 hybrids that were significantly better than average in yield irrigated were also significantly better than average in yield without irrigation. Twelve of the 14 hybrids that were significantly better than average in yield without irrigation were also significantly better than average in yield when irrigated.

The correlations of irrigated yields with unirrigated yields was highly significant, .927 in 1970. The correlation was .839 in 1969 and .860 in 1968. There was a strong tendency, in all three years, for the high yielding hybrids not irrigated to be also high yielding when irrigated. Likewise, the low yielding hybrids tended to be relatively low in both unirrigated and irrigated plots. High yielding hybrids for irrigation could be selected from unirrigated plots and vice versa with reasonable accuracy.

Hybrids significantly better than average in yield when irrigated in 1970 were (in order of early to late maturity): Pioneer 3909 (2X), Mich. Exp. 67-3123 (3X), Mich. Exp. 67-780 (3X), Blaney 6616 (3X), Super Crost S19 (2X), Mich. Exp. 67-2103 (2X), Blaney 6905A (2X), Pride R290 (2X), Michigan 500-2X (2X), Mich. Exp. 66-2025 (2X), Mich. Exp. 67-3110 (3X). Pioneer 3773 (2X), Mich. Exp. 67-3120 (3X), Michigan 555-3X (3X), Mich. Exp. 67-2023 (2X), Mich. Exp. 67-4007 (2X), DeKalb XL45 (2X).

Hybrids significantly better than average yield not irrigated in 1970 were (in order of early to late maturity): Northrup King PX 20 (2X), Mich. Exp. 67-3123 (3X), Mich. Exp. 67-780 (3X), Blaney 6616 (3X) Super Crost S19 (2X), Mich. Exp. 67-2103 (2X), Funk Bros. G17A, Blaney 6905A (2X), Pride R290 (2X), Michigan 500-2X(2X), Mich. Exp. 67-3110 (3X), Mich. Exp. 67-3120 (3X), Michigan 555-3X(3X), Mich. Exp. 67-2023 (2X).

Blight Ratings

Blight infection in both 1969 and 1970 averaged twice as high for irrigated plots. More favorable moisture and humidity on irrigated plots probably facilitated spread and development of the blight organisms.

Blight ratings reported in Table 1 are the averages from both irrigated and unirrigated plots rated in early September 1970. Ratings of 1-2 can be considered relatively resistant, 3-4 = moderately resistant, and 5-6 = susceptible. Small differences, less than 1.0, between hybrid ratings should not be considered significant.

It was not possible to distinguish in the field between lesions caused by Southern Corn Leaf Blight and Yellow Leaf Blight but we believe that the latter predominated in these plots. Yields of hybrids in these trials did not appear to be related to their blight ratings. Some hybrids with susceptible ratings, 5 and 6, had as good or better yields than hybrids with more blight resistance. The best yielding hybrids were not necessarily the most blight resistant.

Three-Year Averages 1968-1970

Table 2 presents a three-year summary of yields and stalk lodging.

Yields. Irrigated corn averaged 47.1 bushels more than unirrigated, 141.9 vs 94.8 for the three year period. The highest yielding hybrids averaged 67.2 bushels more when irrigated (187.0 vs 119.8) and the lowest yielding hybrids averaged 30.8 bushels more (94.6 vs 63.8). Irrigation response of the highest yielding hybrids was twice as great as the response of the lowest yielding hybrids, 67.2 vs 30.8 bushel increases from irrigation.

Stalk lodging. In all three years there has been consistently more stalk lodging for unirrigated corn, averaging almost three times more.

Table 1. NORTH CENTRAL MICHIGAN Zone 3

Montcalm County Trial - Irrigated vs Not Irrigated

One, Two, Three Year Averages - 1970, 1969, 1968

Hybrid	% Moisture			Bushels Per Acre						% Stalk Lodging						Blight Rating
				1970		2 Years		3 Years		1970		2 Years		3 Years		
	1970	2 yrs.	3 yrs.	Irr.	Not Irr.	Irr.	Not Irr.	Irr.	Not Irr.	Irr.	Not Irr.	Irr	Not Irr	Irr	Not Irr	
Michigan 200	18.6	19	--	123.1	90.4	120	80	--	--	3.9	5.5	3	11	--	--	6.0
Northrup King PX442 (Sp.)	21.5	22	--	134.5	99.7	129	93	--	--	7.9	7.5	6	10	--	--	6.0
Michigan 280	21.9	22	23	144.5	95.6	147	93	149	96	7.1	9.5	4	14	4	13	6.0
Northrup King PX417 (3X)	22.0	22	--	94.9	69.6	96	71	--	--	9.4	22.1	9	21	--	--	6.0
Michigan 270	22.1	22	22	113.3	78.2	114	83	117	87	9.8	11.8	10	22	8	15	6.0
[2]Northrup King PX20 (2X)	22.1	--	--	145.8	114.8	--	--	--	--	5.8	1.5	--	--	--	--	6.0
Northrup King PX476 (3X)	22.4	23	--	140.7	85.6	149	89	--	--	4.0	5.4	2	12	--	--	6.0
Michigan 250	22.4	22	23	138.6	109.4	133	96	137	97	9.6	8.0	8	14	6	12	5.5
Michigan 300	22.6	--	--	134.8	100.0	--	--	--	--	4.7	8.5	--	--	--	--	6.0
Northrup King PX428 (3X)	22.8	21	--	104.0	85.9	109	83	--	--	6.5	20.0	5	16	--	--	6.0
Funk Bros. G4175 (3X)	23.0	--	--	139.4	87.2	--	--	--	--	13.2	13.8	--	--	--	--	6.0
DeKalb XL304 (3X)	23.0	24	25	123.0	70.7	121	73	125	72	8.0	20.0	5	17	4	13	6.0
Michigan 275-2X (2X)	23.0	23	23	140.9	98.7	146	96	151	100	3.9	7.8	4	18	2	15	5.5
Weather Master EPX4P(2X)	23.0	--	--	134.5	97.7	--	--	--	--	0.8	3.1	--	--	--	--	5.3
Northrup King PX446 (Sp.)	23.1	23	24	131.6	105.5	145	103	148	99	6.3	8.2	4	14	3	10	6.0
Pioneer 3956 (2X)	23.1	24	--	119.4	79.8	136	80	--	--	8.6	24.4	4	18	--	--	6.0
Super Crost S17 (2X)	23.2	--	--	150.1	110.3	--	--	--	--	7.3	8.8	--	--	--	--	6.0
Blaney B401 (2X)	23.3	--	--	125.7	100.4	--	--	--	--	1.6	4.0	--	--	--	--	6.0
Weather Master EP35(3X)	23.4	25	--	130.8	94.3	138	88	--	--	11.8	10.6	7	15	--	--	5.5
Jacques JX952(2X)	23.5	22	24	109.8	86.9	112	89	110	90	18.3	14.7	10	13	7	9	5.8
Pride R200A (2X)	23.5	--	--	146.8	100.9	--	--	--	--	6.2	8.1	--	--	--	--	6.0
Michigan 380-3X (3X)	23.5	--	--	139.2	102.1	--	--	--	--	8.7	6.5	--	--	--	--	5.3
Weather Master EXP2P(2X)	23.6	23	--	104.5	79.9	126	80	--	--	14.8	13.5	9	14	--	--	6.0
Super Crost 163	23.6	25	26	135.3	95.1	138	96	140	95	2.4	6.4	2	18	1	5	6.0

Table 1. Continued

Pioneer 3909 (2X)	23.8	--	--	158.1	100.7	--	--	--	--	2.3	4.8	--	--	--	--	2.5
Cowbell 102SX (2X)	23.9	--	--	146.0	108.0	--	--	--	--	3.2	5.8	--	--	--	--	5.8
Michigan 400	23.9	25	26	137.5	101.7	149	99	147	98	0.8	3.1	2	6	2	7	5.0
Mich. Exp. 67-3123(3X)	24.0	25	--	159.0	115.1	160	106	--	--	3.8	8.8	4	14	--	--	2.8
Mich. Exp. 67-780 (3X)	24.0	--	--	165.0	120.9	--	--	--	--	1.4	0.8	--	--	--	--	3.3
Pioneer 3911 (2X)	24.1	24	25	132.4	102.2	140	97	146	102	0.8	3.9	5	14	3	12	2.5
Michigan 402-2X (2X)	24.1	25	26	141.8	100.0	153	99	152	103	2.5	3.2	5	14	4	12	5.0
Jacques 951E	24.2	25	25	134.7	103.5	146	96	136	91	3.1	6.3	2	14	1	10	5.8
Blaney 6616 (3X)	24.3	--	--	163.3	118.3	--	--	--	--	3.9	6.0	--	--	--	--	5.0
Super Crost S19 (2X)	24.4	25	25	169.1	119.0	162	105	157	104	3.3	1.6	2	6	2	6	6.0
Weather Master EPX4A(2X)	24.4	--	--	109.1	71.7	--	--	--	--	16.1	14.7	--	--	--	--	5.8
DeKalb XL306 (3X)	24.5	26	--	133.7	90.7	144	83	--	--	9.0	9.8	5	17	--	--	5.5
Teweles SXT61 (3X)	24.6	26	27	146.6	94.0	150	94	150	98	2.4	3.1	2	4	2	4	6.0
Weather Master EPX3P(2X)	24.7	25	26	132.0	97.4	138	98	131	93	7.8	9.1	4	12	3	9	5.5
Pioneer 3799 (3X)	24.8	--	--	130.0	98.3	--	--	--	--	8.0	7.7	--	--	--	--	4.0
Mich. Exp. 67-2103(2X)	24.8	25	--	165.2	127.6	168	118	--	--	0.8	1.6	1	4	--	--	2.0
Mich. Exp. 69-3001(3X)	24.9	--	--	151.3	95.9	--	--	--	--	4.1	3.2	--	--	--	--	3.0
Weather Master EP30 (3X)	25.0	25	26	112.5	92.1	132	83	120	77	16.6	14.0	9	17	6	13	5.5
Funk Bros. G17A	25.2	26	26	154.6	116.9	160	103	156	102	6.2	6.0	6	9	4	8	5.0
DeKalb XL315 (3X)	25.2	26	27	128.3	96.6	129	85	133	83	3.9	4.7	4	11	3	8	6.0
Funk Bros. G4287 (3X)	25.4	26	26	152.9	99.1	151	94	148	93	8.1	9.7	6	12	4	8	5.0
Blaney 6905A (2X)	25.6	--	--	173.8	127.7	--	--	--	--	6.3	5.0	--	--	--	--	5.0
Mich. Exp. 67-4006 (2X)	25.6	--	--	132.8	97.3	--	--	--	--	1.6	2.4	--	--	--	--	3.5
Mich. Exp. 67-164 (2X)	25.7	26	--	146.0	95.6	148	98	--	--	14.1	8.7	10	14	--	--	3.3
Pride R290 (2X)	25.9	--	--	177.7	118.5	--	--	--	--	1.6	1.6	--	--	--	--	5.0
Michigan 500-2X (2X)	25.9	27	28	167.6	126.7	171	111	174	113	1.6	1.6	2	8	1	7	5.0
Michigan 463-3X (3X)	25.9	27	27	129.9	97.0	142	96	146	99	11.8	7.4	7	13	6	10	5.0
Mich. Exp. 66-2025 (2X)	25.9	26	--	166.0	109.5	169	104	--	--	1.6	4.8	2	11	--	--	2.8
Mich. Exp. 67-2101 (2X)	25.9	--	--	144.4	91.0	--	--	--	--	3.9	1.6	--	--	--	--	2.5
Mich. Exp. 67-3110 (3X)	26.0	26	--	181.0	124.4	180	114	--	--	2.4	3.3	2	13	--	--	3.0
DeKalb XL24 (2X)	26.2	27	--	155.8	110.4	152	99	--	--	3.1	5.0	2	8	--	--	3.8
Mich. Exp. 65-3005 (3X)	26.3	--	--	153.5	108.1	--	--	--	--	7.6	4.8	--	--	--	--	2.8

Table 1, Continued

Funk Bros. G4222 (2X)	26.5	27	28	148.1	100.7	145	91	140	94	3.9	3.1	3	9	2	7	5.0
[1,2] Pioneer 3773 (2X)	26.7	27	28	167.6	110.5	176	106	165	110	3.1	2.3	2	9	2	6	5.0
[1,2] Mich. Exp. 67-3120 (3X)	26.8	26	--	178.3	121.3	171	113	--	--	3.9	1.6	3	11	--	--	2.0
[1,2] Michigan 555-3X (3X)	26.8	28	29	161.2	119.8	167	111	172	115	3.8	1.6	2	8	2	6	5.0
[1,2] Michigan 568-3X (3X)	26.9	28	29	150.3	109.0	154	107	158	111	4.0	1.6	3	9	2	6	3.5
[1,2] Mich. Exp. 67-2023 (2X)	27.0	--	--	193.8	127.5	--	--	--	--	0.0	0.8	--	--	--	--	2.0
[1,2] Mich. Exp. 67-4007 (2X)	27.2	--	--	175.2	112.2	--	--	--	--	0.0	0.0	--	--	--	--	2.0
DeKalb XL45 (2X)	28.0	29	30	157.0	106.1	162	95	161	98	5.6	7.0	4	10	3	6	5.0
Average	24.3	25	26	143.6	102.9	145	95	145	97	5.8	7.1	4	12	3	9	4.7
Range	18.6 to 28.0	19 to 29	22 to 30	94.9 to 193.8	69.6 to 127.7	96 to 180	71 to 118	110 to 174	72 to 115	0.0 to 18.3	0.0 to 24.4	1 to 10	4 to 21	1 to 8	4 to 15	2.0 to 6.0
Least significant difference	0.7	0.6	0.4	13.3	10.9	7	6	6	5							

[1] Significantly better than average yield, irrigated, 1970.

[2] Significantly better than average yield, not irrigated, 1970.

	1970	1969	1968
Planted	May 8	May 3	May 4
Harvested	Oct. 16	Oct. 31	Oct. 26
Soil type	Montcalm sandy loam	Montcalm sandy loam	Montcalm sandy loam
Previous crop	Sorghum-sudan seeded to rye in fall	Sorghum-sudan seeded to rye in fall	Sorghum-sudan seeded to rye in fall
Population	19,900	19,500	19,600
Rows	30"	30"	30"
Fertilizer	213-160-160	205-160-160	236-190-190
Soil test: pH	6.3	6.2	6.2
P	246 (very high)	242 (very high)	256 (very high)
K	225 (high)	237 (high)	220 (high)
Irrigation:	5.5"	6.0"	7.5"

Cooperator: Theron Comden, Lakeview
County Extension Director: James Crosby, Stanton

Table 2. Average, highest, and lowest yields and % stalk lodging for corn hybrids irrigated and not irrigated for 3 years, 1968-1970.

Year	No. of Hybrids Tested	Average		Highest yielding hybrids		Lowest yielding hybrids	
		Irrigated	Not Irrigated	Irrigated	Not Irrigated	Irrigated	Not Irrigated
				YIELDS			
1970	64	143.6	102.9	193.8	127.7	94.9	69.6
1969	63	146.0	85.5	184.9	108.6	96.7	56.3
1968	56	136.1	96.0	182.2	123.2	92.2	65.4
3 Year Average		141.9	94.8	187.0	119.8	94.6	63.8
				% STALK LODGING			
1970	64	5.8	7.1	18.3	24.4	0.0	0.0
1969	63	2.9	17.5	10.9	57.8	0.0	5.6
1968	56	1.1	4.3	5.0	13.9	0.0	0.0
3 Year Average		3.3	9.6	11.4	32.0	0.0	1.9

1970 Irrigation = 5.5"

July 20 = 1"
July 27 = 1"
July 30 = .5"
August 4 = 1"
August 11 = 1"
August 13 = 1"

1969 Irrigation = 6"

July 26 = 1.5"
August 8 = 1.5"
August 14 = 1.5"
August 27 = 1.5"

1968 Irrigation = 7.5"

July 16 = 1.5"
August 2 = 1.5"
August 12 = 1.5"
August 20 = 1.5"
September 7 = 1.5"

LUPINE RESEARCH

H. L. Kohls
Department of Crop and Soil Sciences

Lupine research was designed to develop varieties adapted to Michigan and show how they may be used in good farming practices. The 1970 work was concerned with variety trials, selecting high yielding low alkaloid strains, crossing and selecting non-shattering strains of blue lupines, lupines to precede potatoes in crop rotations, lupines in dairy cattle rations, chemical weed control, and seed increase for possible release for commercial use.

The variety trials were on an area of Montcalm loamy sand except that a portion of the varieties were on an area which was more sandy and lower in fertility than normal for this soil type. This low grade soil type may account for the low yields of both white and blue lupine varieties as shown in Table 1 and 3. The breeding strains were in an area having both Montcalm loamy sand and McBride loamy sand. The lupine seed increases and the lupine-potato rotation were on McBride sandy loam.

Irrigation was applied on the variety trials but was not needed on the rest of the lupines. No fertilizer was used on any of the lupines as tests showed considerable fertility in the soil carried over from fertilizer applied to potatoes the previous year.

No significant difference was found in yield between varieties of white lupines shown in Table 1. MSU-2 had a very high percentage of plants that were alkaloid free.

A comparison, in Table 2, of white lupines grown in 34.0" and 19.4" rows shows less than .4 of a ton difference in total yield, (roughage and seed), and only .05 of a ton for roughage in favor of the narrow rows. Neither comparison is significant. But differences are shown for bushels of grain per acre and percentage of grain in the total plant yield. Both are highly significant and in favor of the narrow rows.

Another point of interest in Table 2 is the relationship of yield to number of plants per acre. A graph plotting yield of grain and number of plants per acre shows a positive straight line correlation between the two with no indication of the yield leveling off at 50.6 bushels and a stand of 107,551 plants per acre. This leads us to conclude that, under the conditions of this experiment, a stand of over 107,551 plants may have given a yield of over 50.6 bushels per acre. Apparently 50.6 bushels is not the maximum yield that can be expected of white lupines grown in optimum conditions.

The blue lupine variety trial was sown on the same day as the white lupine trial and the two were adjacent to each other. This was true in 1969 also.

The blue lupine yields are shown in Table 3. There is no significant difference in yield of grain between varieties. MSU-103 is very low in alkaloids and MSU-104 is a week or more earlier in maturity than the other varieties.

Blue and white lupines are not equally adapted to the same environment. White lupines averaged 39.70 bushels in 1969 and 18.83 bushels per acre in 1970, a difference of 24.14 bushels, (Table 1). In Table 3 the average yield of blue lupines in 1969 is 15.56 bushels and 11.24 in 1970, a difference of only 7.59 bushels per acre. The difference in yield of the blue lupines grown on good and poor soil is not nearly as great as between white lupines grown in similar conditions. White lupines outyield blue lupines under good growing conditions but under less favorable growing conditions blue lupines become more competitive.

Several high yielding varieties of both blue and white species have been developed in our breeding program. Seed increases of some of these have been made in sufficient quantity for possible trials on farms. Some seed was used last year for feeding trials with dairy calves with satisfactory results. Over a ton of white lupine grain was provided to the Dairy Department this fall and is now being used in a dairy cow feeding trial.

Very low alkaloid blue and white varieties and non-seed shedding blue strains are being bred in our improvement program. Some of the sweet (very low alkaloid) strains are very promising and the seed quantity of these will be increased as fast as possible.

A project was started last spring to determine the relative value of certain crops to precede potatoes. Sudangrass has been used on the Montcalm Experimental Farm but it appeared that other crops may be more suitable as a plow-down crop. The extensive fine root system of ryegrass and the nitrogen fixation of lupines suggested their use in this trial. Lupines also would offer a cash return from the grain produced.

The yields of these various crops are shown in Table 4. The yield of 2.95 tons for ryegrass is too low. Considerable growth of this crop took place late in the season. We have had 4 tons per acre on previous ryegrass plots on this farm and we believe this year's growth was just as good as any in the past. Potato yields will be taken on these plots next year.

Herbicides of various kinds were used in a trial on lupines. The results this year confirmed those of last year. Lorox at 3/4 lb plus Lasso at 1 1/2 lb per acre gave good control of weeds when used as a preemergence spray. However, a few weeds appeared about July 1. This was not true in previous years as control was complete in those trials.

Table 1. White lupine seed yields in bushels per acre for 1969 and 1970.

		Yield		
		1969	1970*	Average
Blanca		39.32	17.63	28.48
Gela		41.52	19.16	30.34
MSU-1		39.02	23.56	31.29
MSU-2	Alkaloids very low	39.40	19.49	29.45
MSU-3		39.53	15.28	27.41
MSU-4		39.38	17.84	28.61
Average		39.70	18.83	

*Planted April 30.

Table 2. A comparison of two width of row - 34.0" and 19.4" using Blanca white lupines. Yields are based on 12 percent moisture.

Replication number	34.0" rows	total tons per acre	roughage per acre	bu of grain per acre	percent grain	number of plants per acre
1		2.16	1.20	29.24	42.19	40,862
2		2.20	1.28	30.62	41.62	50,113
3		2.83	1.69	37.93	41.18	73,242
4		2.47	1.44	33.97	41.31	81,723
Average		2.42	1.40	32.94	41.58	61,485
	19.4"					
1		2.77	1.43	44.64	48.23	95,408
2		2.70	1.42	42.60	47.30	78,061
3		2.50	1.26	41.22	49.44	85,000
4		3.22	1.70	50.49	47.13	107,551
Average		2.80	1.45	44.74	48.03	91.505

Table 3. Blue lupine seed yields in bushels per acre for 1969 and 1970

		Yield 1969	1970*	Average
MSU-101		13.77	10.73	12.25
MSU-102		19.13	9.81	14.47
MSU-103	Alkaloids very low	15.40	9.42	12.41
MSU-104	Early maturity	15.50	13.14	14.32
MSU-105		15.40	11.17	13.29
Borre		16.07	10.51	13.29
P.I. 237721 X Borre		14.40	12.73	13.57
P.I. 237721 x S-13 (sel)		14.83	12.42	13.63
Average		15.56	11.24	

*Planted April 30

Table 4. A comparison of tons per acre of some crops in a ro a bn to precede potatoes. Yields are based on 12 percent moisture.

	Roughage			Roughage	Grain	Total Roughage
	7/21	9/10	total	9/10	9/10	Plus Grain
Ryegrass	1.29	1.66	2.95*			
Sudangrass	1.62	4.34	5.96			
Lupines 34" rows				1.40	1.02	2.42
Lupines 19" rows				1.45	1.35	2.80

*Considerable growth was made after September 10 but was not harvested.