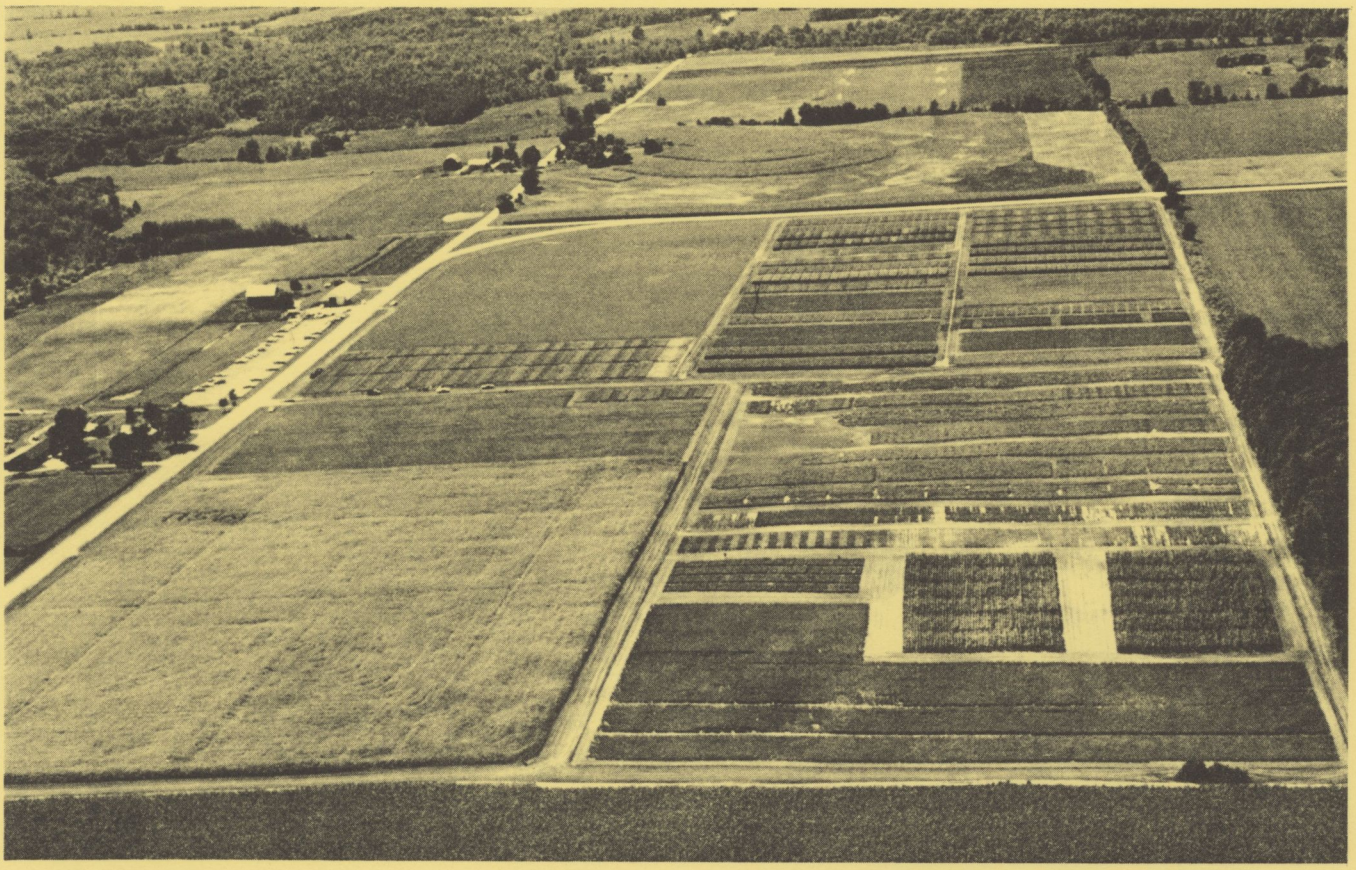
Meeting Copy

1973 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.

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MONTCALM BRANCH EXPERIMENT STATION RESEARCH REPORT

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INTRODUCTION

The Montcalm Experiment Station was established in 1966 with the first experiments initiated in 1967. This report marks the completion of seven years of studies. The 40 acre facility is leased from Mr. Theron Comden and is located in west-central Michigan one mile west of Entrican. The original 80 acre facility was reduced to 40 acres in 1973 primarily for budgetary reasons. The farm is used primarily for research on potatoes and is located in the heart of a major potato producing area.

This report is designed to coordinate all of the research data obtained at the facility during 1973. Much of the data herein reported 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 trials are necessary before definite conclusions and recommendations can be made.

Weather

Temperature and rainfall recordings for the 1973 growing season are shown in Figure 1. Tables 1 and 2 summarize the 5 year rainfall and temperature data. Average maximum and minimum temperatures for 1973 were very near the 5 year average with some deviations in May and June. In the months of June, July, August and September, however, it was appreciably warmer than in 1972, while May was much cooler. An extended hot period occurred between August 26 and September 5 when there were three days of 90° and the average minimum temperature was never lower than 64°. This period undoubtedly had some effect on reducing the maximum potential yields.

The total rainfall for the 6 month period was very near the 5 year average. Within the 5 year period there have been marked differences between monthly and 6 month totals. Most notable as being significantly below the 5 year average was the 1971 total whereas the 1970 totals were significantly higher. Rainfall in April, May and June of 1973 were all above the 5 year average and did contribute to less effective weed control. September, however was substantially below the 5 year level. This in part accounts for the excellent September and fall that we had for plot harvest.

Irrigation applications of 1 inch each were made 7 times (July 10, 13, 20, 24, August 17, 28 and September 5).

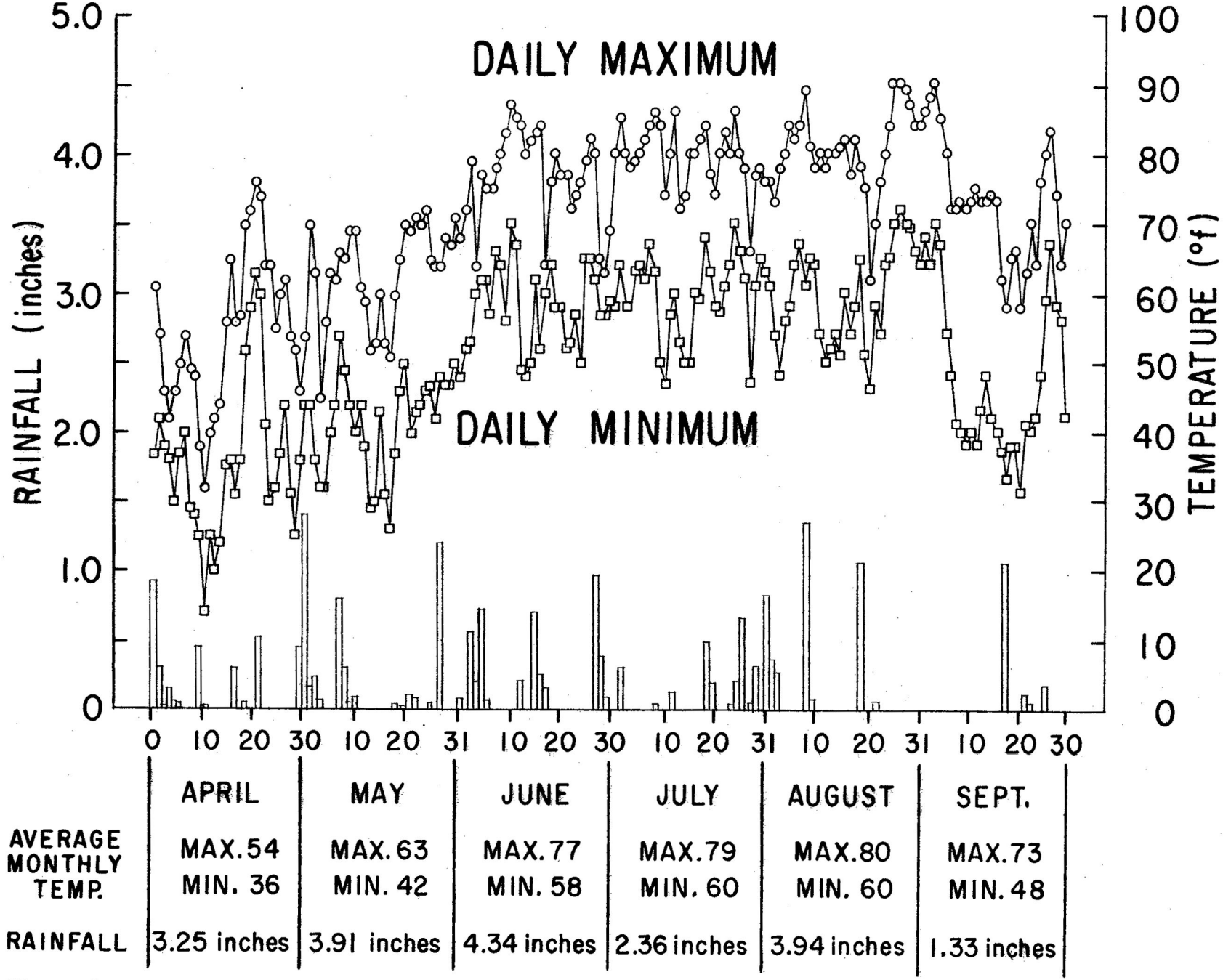

Figure 1. Climatology Observations at the Montcalm Experimental Farm in 1973.

TABLE 1. The 5 year summary of recorded maximum and minimum terperatures during the growing season at the Montcalm Experimental Station.

	April		May		June		July		August		September		6 month Average	
Year	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1969	56	35	67	43	70	50	80	59	82	56	73	49	74	49
1970	54	35	65	47	72	55	80	60	80	57	70	51	73	45
1971	53	31	65	39	81	56	82	55	80	53	73	54	76	48
1972	47	30	70	47	72	50	79	57	76	57	69	49	73	48
1973	54	36	63	42	77	58	79	60	80	60	73	48	74	51
5 Yr. Ave.	53	33	66	44	74	54	80	58	80	57	72	50		

TABLE 2. The 5 year summary of precipitation recorded during the growing season at the Montcalm Experimental Station (inches per month).

Year	April	May	June	July	August	September	Total
1969	3.33	3.65	6.18	2.63	1.79	0.58	18.16
1970	2.42	4.09	4.62	3.67	6.54	7.18	28.52
1971	1.59	0.93	1.50	1.22	2.67	4.00	11.91
1972	1.35	1.96	2.51	3.83	7.28	2.60	19.53
1973	3.25	3.91	4.34	2.36	3.94	1.33	19.13
5 Yr. Ave.	2.39	2.91	3.83	2.74	4.44	3.14	19.45

Soil Tests

For specific projects where more detailed analysis are needed, the results are reported with the individual reports. Soil test results for the general plot area are:

	Pounds/Acre			
pH	P	K	Ca	Mg
6.0	453	341	869	139

Fertilizers used

Except for specific fertility studies where the fertilizers used are specified in the report, the following fertilizers were used on the potato plot area:

plow down with rye	0-0-60	200 lbs/A
banded with planter sidedress	20-10-10	600 lbs/A
	33 1/3-0-0	420 lbs/A

Disease and Insect Control

A granular systemic insecticide (phorate or disulfoton) was applied to most of the potato plots at planting time at 3 pounds per acre. A second application of Disulfoton at 3 lb/A was applied to the late maturing varieties. The foliar insecticide program began on June 29 and continued on a weekly schedule until terminated on September 5. All spray applications were made with an air blast sprayer. The foliar insecticides used were Endosulfan (Thiodan), Meta-Systox-R, and Monitor. The fungicide used was Dithane M-45. Linuron (Lorox) at 1 3/4 lb/A applied preemergence was used for weed control. The fungicides used were Dithene M-45, Bravo and KoKocide 101. Dinitro at 2 qt/A plus a crop oil concentrate (Herbimax) at 1 qt/A was used as the topkiller.

POTATO BREEDING

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One hundred seeds from each of 40 hybridizations were grown in the greenhouse. Two tubers from each plant were saved to grow in the field to determine which seed lots produced the most desirable cultivars.

Ten thousand new cultivars were grown in East Lansing. Those meeting varietal requirements were saved for planting in 1974. These will be divided and planted in 2 locations - one in East Lansing for seed and one at the Montcalm Experimental Farm.

The major emphasis for the year was seed production. Advanced cultivars were either greenhouse or Alabama tested. For the Alabama test, tubers were numbered and halved. One half was grown in Alabama and the half of all that passed the Alabama test were planted in East Lansing. Seed lots were harvested by hills within clones for 1974 plantings. Seed of MS709 harvested this way will plant 2 to 2 1/2 acres in 1974. Approximately 1000 hills of MS711-8, MS503-14 and Ia1111-2 are also available.

NEW VARIETY EVALUATIONS

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Seventeen varieties of potatoes were tested for adaptation to Michigan. Overstate variety plots were conducted at six locations: Henry and Andy Leep, Allegan County; Donald and Jerry Meyer, Bay County; Oscar Overholt, Emmet County; Montcalm Experimental Farm; Leon and Tony Delekta, Presque Isle County; and Joe Hassle, Van Buren County. These locations provided a range of climatic, soil and management conditions which promotes the expression of their potential - good and bad alike. Variety test results should be considered on their relative performance. In other words, how a variety responds at each location, or when locations are summarized, in comparison with a standard or known variety is perhaps more valuable than the fact of whether it produced 300 cwt or 400 cwt/acre.

The summary of planting dates and harvest dates is as follows:

County Location	Planting Date	Harvest Date	Days
Allegan	May 9	September 27	141
Bay	May 8	August 31	115
Emmet	May 19	September 25	129
MEF	May 10	September 20	133
Presque Isle	May 15	September 11	119
Van Buren	May 7	September 7	123

Plant spacings were 12 inches. Chip samples were processed and scored on October 30-November 13.

Table 1 summarizes the results of all the locations and Table 2 summarizes the yield and specific gravity data for each of the locations. There is a very definite variation in yield performance between locations with the Allegan and Van Buren locations producing the highest yields and the Bay and Emmet locations producing the lowest. The role of the fertilization factor is uncertain but there was a very definite weather influence between trials. In Bay County heavy rains occurred at planting and in the early growing season. In Emmet County there was an extended period of hot, dry weather in July and August which no doubt reduced yield potentials. And, in Presque Isle County excessive rains occurred particularly in July but also later in the season which probably accounts for the much lower specific gravity readings.

Culinary qualities were also evaluated to determine after cooking darkening. Tubers from each variety and two locations, Allegan and Montcalm Experimental Farm were cooked by steaming for approximately 35 minutes. Ratings as to the degree of after cooking darkening were made immediately after cooking, at 1 hour and at 24 hours after cooking. After the samples were rated at 1 hour they were stored in a refrigerator and again rated at 24 hours. Ratings are based on a 1-5 scale with a 1 representing no flesh discoloration and a 5 being completely darkened. Table 3 summarizes these data. Additional samples have been stored at 40° and will be scored after storage in March.

Table 1. The average yield, size distribution, maturity and quality of several potato varieties grown at six locations.

Variety	Total Yield (Cwt/A)	Marketable Yield (Cwt/A)	Percent Size Distribution			Specific Gravity	Chip[1] Rating	Maturity[2] Class
			-1 7/8"	+3 1/4"	-1 7/8-3 1/4"			
Hudson - 1973	480	457	5.7	22.4	71.9	1.074	4.9	3.5
Katahdin	478	450	6.9	18.8	74.3	1.075	3.5	3
MS-709	459	437	5.5	26.5	68.0	1.071	4.5	3
Onaway	431	408	5.8	27.9	66.3	1.065	7.1	2
MS-503	435	404	7.8	12.6	79.6	1.078	3.5	3
Abnaki - 1971	410	386	6.7	17.6	75.7	1.070	4.3	3
ND7196-18	414	362	16.0	4.9	79.1	1.071	2.6	3
Rushmore	372	356	5.1	18.5	76.4	1.067	3.3	1.5
Superior	377	353	7.2	16.0	76.8	1.074	3.1	2
Jewel	373	335	12.0	11.4	76.6	1.082	2.8	3
Targhee - 1973	378	331	14.9	11.3	73.8	1.081	6.8	4
Hi Plains	343	314	10.3	8.3	81.4	1.072	2.3	3
Norchip	346	302	14.5	7.2	78.3	1.077	3.0	2.5
ND6925-13	342	286	18.9	4.1	77.0	1.073	5.2	3
MS-1111-2	310	282	9.5	11.1	79.4	1.065	4.2	2
Nampa - 1973	316	276	14.8	9.2	76.0	1.082	4.8	4.5
York - 1969	246	209	16.0	5.4	78.6	1.075	2.4	1

[1]Based on a color reference standard of 1-10 prepared by the Potato Chip Institute International. The higher the number the darker the chip and the less acceptable. Generally a rating of 2-4 is most desirable for the Michigan area.

[2]Based on a scale of 1-5. A 1 is the earliest maturity similar to the Irish Cobbler.

Table 2. The marketable yield and specific gravity of several potato varieties grown at each of 6 locations.

	Allegan		Bay		Emmet		MEF		Presque Isle		Van Buren	
	Cwt/A	S.G.	Cwt/A	S.G.	Cwt/A	S.G.	Cwt/A	S.G.	Cwt/A	S.G.	Cwt/A	S.G.
Hudson	643 (2)	1.068	256 (7)	1.073	293 (3)	1.091	484 (1)	1.077	376 (8)	1.064	694 (1)	1.073
Katahdin	727 (1)	1.075	303 (2)	1.075	303 (1)	1.089	432 (3)	1.079	420 (3)	1.061	515 (6)	1.073
MS-709	613 (3)	1.065	279 (6)	1.072	290 (4)	1.077	460 (2)	1.078	426 (2)	1.062	558 (4)	1.072
Onaway	541 (7)	1.063	312 (1)	1.066	245 (5)	1.069	396 (4)	1.068	381 (7)	1.057	576 (3)	1.069
MS-503	597 (4)	1.079	282 (4)	1.075	296 (2)	1.082	378 (5)	1.083	393 (6)	1.070	482 (7)	1.076
Abnaki	562 (5)	1.066	293 (3)	1.071	228 (8)	1.075	298(12)	1.077	407 (5)	1.061	529 (5)	1.071
ND7196-18	521 (8)	1.069	218(12)	1.073	136(15)	1.075	379 (4)	1.077	342(11)	1.061	580 (2)	1.071
Rushmore	515 (9)	1.060	281 (5)	1.073	214(11)	1.073	359 (8)	1.070	332(12)	1.060	435(11)	1.067
Superior	504(10)	1.068	229(10)	1.075	228 (7)	1.082	276(14)	1.078	412 (4)	1.069	474 (8)	1.073
Jewel	398(13)	1.079	242 (9)	1.085	158(12)	1.088	365 (7)	1.091	441 (1)	1.068	410(14)	1.079
Targhee	557 (6)	1.076	156(17)	1.073	236 (6)	1.095	329(10)	1.089	250(15)	1.070	463(10)	1.083
Hi Plains	382(14)	1.070	212(13)	1.077	154(14)	1.073	335 (9)	1.078	359(10)	1.062	443(12)	1.071
Norchip	490(11)	1.073	245 (8)	1.082	156(13)	1.078	251(16)	1.085	368 (9)	1.069	---	-----
ND6925-13	326(16)	1.070	209(14)	1.076	122(17)	1.082	293(13)	1.077	295(14)	1.064	471 (9)	1.071
MS-1111-2	335(15)	1.062	228(11)	1.067	225 (9)	1.068	312(11)	1.069	312(13)	1.060	---	-----
Nampa	413(12)	1.072	158(16)	1.083	218(10)	1.097	254(15)	1.087	197(17)	1.068	421(13)	1.086
York	300(17)	1.064	168(15)	1.078	131(16)	1.082	197(17)	1.081	212(16)	1.070	251(15)	1.073
Location Average	495	1.069	239	1.075	213	1.081	341	1.079	348	1.064	486	1.074

( ) The rank by yield of each variety.

Variety observations

Hudson is a new variety released by New York in 1973. It possesses resistance to golden nematode and is projected as replacing Katahdin acreage on Long Island. It does have a high yield potential, however, its tendency to roughness may be greater than Katahdin. Based on these results it seemed to be slightly later than Katahdin and its specific gravity and chip ability were less. Considerable pink eye and off-type were noted at the Bay County location. It is worthy of further study.

Katahdin used as a standard late variety for comparisons. It performed well at all locations.

MS-709 - a Michigan seedling which continues to have a high yield potential. Its maturity is similar to a Katahdin with a lower specific gravity.

Onaway - included as a standard early variety.

MS-503- this Michigan seedling performed exceptionally well this year compared to earlier tests. Its maturity is similar to 709, however, its specific gravity and chip ability appear to be better. It rated the best in terms of absence of any after cooking darkening.

Abnaki - a 1970 release by the U.S.D.A., New York and Maine, it has demonstrated an above average yield potential. Its gravity is low and it is not a good chipping variety. Although not always observed in our trials, some growers have reported of commercial plantings where hollow heart was serious.

Table 3. The ratings* of several potato varieties for after cooking darkening at 0, 1 and 24 hours after cooking.

	Aftercooking		1 Hour		24 Hours		
	Allegan	MEF	Allegan	MEF	Allegan	MEF	Average
Hudson	2	2	2	2	2	2	2.0
Katahdin	2	2	2	2	2	2	2.0
MS-709	1	2	1	2	1	2	1.5
Onaway	2	2	2	3	4	3	2.7
MS-503	1	1	1	1	1	2	1.2
Abnaki	2	1	2	2	2	2	1.8
ND7196-18	1	2	2	3	2	4	2.3
Rushmore	1	2	2	2	2	4	2.2
Superior	2	2	2	3	3	3	2.5
Jewel	2	1	2	1	2	1	1.5
Targhee	2	2	3	2	5	4	3.0
Hi Plains	2	2	3	2	3	2	2.3
Norchip	2	2	3	2	4	2	2.5
ND6925-13	1	1	3	2	3	3	2.2
MS 1111-2	2	2	3	2	3	3	2.5
Nampa	2	1	2	2	4	2	2.2
York	1	2	3	3	4	4	2.8

*Ratings based on a 1-5 scale with a 1 representing no discoloration and a 5 being completely darkened.

-ohio, hollow

ND 7196-18 - a round white North Dakota seedling which is reported to be ready for release in 1974.? It is more long to oblong in shape than is the Norchip and is reported to set a large number of tubers. This is evidenced by the high percentage of B size tubers and the low percentage of tubers over 3 1/4 inch. The specific gravity appears lower than Norchip.

Rushmore - an older variety released in 1956 by Louisiana. It is an early maturing long russet type with low specific gravity. It was included in the 1973 trials for consideration as a variety for the early frozen processing market.

Superior - included as a standard comparison variety.

Jewel - relative yields in 1973 were lower than previous years. It does have a high yield potential, high specific gravity and is an excellent chipping variety. Some pitted scab noted at Bay County location.

Targhee - a new release from Idaho in 1973. It is a long russet type variety, later maturity than a Katahdin and a high specific gravity. It does have Norgold Russet in its pedigree. In the two years of tests the Targhee has shown more promise than the Nampa. It is a late variety as evidenced by the difference in yields between locations and it did not produce an acceptable chip. It had a high percentage of B size tubers which perhaps relates to its lateness in maturity, particularly at the trials harvested earlier. This variety rated the poorest in terms of after cooking darkening.

Hi Plains - is a 1965 release from Nebraska. It was included in our 1967 and 1968 trials where it was above average in yields. It is a long tuber with a white to slightly russetted skin. Its maturity is similar to Katahdin and medium to low in specific gravity.

Norchip - included as a comparison variety. Yields in nearly all locations were below average. Poor stands and vigor were noted in some plots.

ND6925-13 - an unreleased North Dakota round russet. Yields were very low and the percentage of B size tubers was the greatest of those tested. It does set a large number of tubers which did not adequately size. It is medium to medium low in specific gravity and was undesirable as a chipping potato.

MS 1111-2 - a Michigan seedling which matures early, however, yields and specific gravity are well below average.

Nampa - released by Idaho in 1973 at same time as Targhee. It too has the Norgold Russet in its pedigree. Its performance in the two years of Michigan trials has been undesirable. Specific gravity readings are high, however, it is a late maturing potato, tuber shape was variable with more of a tendency to off-type than the Targhee.

York - a Canadian variety which has been in our trials 3 years. It has a very early maturity, earlier than Onaway, however, yields are well below average. It does not appear to be well suited to Michigan conditions.

PLANTING DATES, HARVEST DATES, STORAGE AND PRODUCTION PERFORMANCE OF RUSSET BURBANK SEED POTATOES

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Procedure

Foundation Russet Burbank seed was planted on May 9, 18 and 31, 1972 and harvested on August 15, September 1 and 15 and October 1 in 1972. Yield, grade and quality data were collected and 2 bushel samples were collected from each treatment for storage. Before placing in terminal storage, the samples were stored for 2 weeks at 60-65 F and 80-85% relative humidity to allow for proper curing. At the end of this time 1 bushel sample of each of the 12 treatments was stored at 40 F and the second at 34 F.

Two weeks before planting in 1973, the seed was removed and warmed at 50-55 F. Except for the 1 treatment of the May 31 planting and August 15 harvest where tubers did not size, all plantings were made from 1 seed piece cut from each tuber in the sample. The balance of the tuber was discarded, therefore, each plant represented a different tuber.

The seed was planted on May 11, 1973 in 1 row plots 25 feet long in 6 replications. Data on emergence, plant stand, vigor, yield and quality were obtained.

Results and Discussion

Table 1 summarizes the total yield and percent size distribution for the seed harvested at 4 different planting dates and stored at 2 temperatures. There is a general decline in yield from the later harvested seed. The greatest reduction in yield occurred between the September 15 and October 1 harvests. In terms of percent size distribution, there was no appreciable difference between any of the harvest dates.

Table 2 summarizes the data for the 3 planting dates. Seed from the latest planted potatoes produced the lowest yields the following year. In terms of percent size distribution there was no effect, nor was there any effect related to storage temperature.

Table 3 summarizes the effect of the 4 harvest dates for each of the planting dates. These data show that for each planting date the latest harvested seed resulted in the lowest yields when planted the following year. Similarily with the later plantings, the effect of a later harvest was more severe with the lowest yield resulting from seed planted late and harvested late. Storage temperature made no apparent difference on yield potential.

Table 1. The total yield and size distribution of Russet Burbank potatoes grown from seed harvested at 4 different times and stored at 2 temperatures.

Harvest Date*	Total cwt/A	Percent Size Distribution: less than 1 7/8"	off type	over 10 oz.	1 7/8"-10 oz.
Seed Stored at 40 F					
Aug. 15	344	10.0	7.7	15.0	67.3
Sept. 1	333	12.9	9.2	13.6	64.3
Sept. 15	307	14.7	12.3	14.5	58.5
Oct. 1	265	15.0	12.1	15.6	57.3
Seed Stored at 34 F					
Aug. 15	363	11.2	7.8	17.7	63.3
Sept. 1	349	13.8	6.8	13.1	66.3
Sept. 15	319	13.4	7.3	16.5	62.8
Oct. 1	257	16.0	10.4	15.1	58.5

*Harvest dates are for the seed grown the previous year.

Table 2. The total yield and size distribution of Russet Burbank potatoes grown from seed planted at 3 different times and stored at 2 temperatures.

Planting Date*	Total cwt/A	Percent Size Distribution: less than 1 7/8"	off type	over 10 oz.	1 7/8"-10 oz.
Seed Stored at 40 F					
May 9	330	13.1	8.4	14.6	63.9
May 18	320	11.7	9.3	14.6	64.4
May 31	287	14.7	13.3	14.8	57.2
Seed Stored at 34 F					
May 9	330	12.8	7.0	15.8	64.4
May 18	330	13.6	7.1	16.1	63.2
May 31	306	14.4	10.2	14.9	60.5

*Planting dates are for the seed grown the previous year.

Table 3. The effect of planting dates, harvest dates, and storage temperature on the subsequent yields of Russet Burbank seed potatoes.

Planting Date*	Harvest Date*	No. of Days Planting to Harvest	Storage Temp.* 40 F (cwt/A)	34 F (cwt/A)
May 9	Aug. 15	98	343	340
	Sept. 1	115	340	336
	Sept. 15	130	325	338
	Oct. 1	149	314	307
May 18	Aug. 15	89	346	358
	Sept. 1	106	317	347
	Sept. 15	121	328	341
	Oct. 1	140	289	272
May 31	Aug. 15	76	344	390
	Sept. 1	93	343	363
	Sept. 15	108	268	279
	Oct. 1	127	194	193
	Average		313	322

*Dates and storage temperatures are those for seed grown the previous year.

The number of weak plants and ratings of plant vigor made early in the growing season were closely related to the subsequent yields. Vigor ratings of potatoes planted with seed harvested from the early and intermediate planting dates were about equal but were superior to that from seed planted late. The poorest vigor was observed in those plots planted from seed harvested on the October 1 date, regardless of the planting date. The number of weak plants was the greatest in the late planted seed and exceeded that of the early and intermediate planted seed by more than 60%.

In part, the reduction in plant vigor, the high counts of weak plants and the reduced yields of potatoes planted from seed harvested late was due to late season virus infections of the plants before harvest. The highest counts occurred in the seed from the potatoes planted May 31 and harvested on October 1. This was 56% higher than the seed planted on May 9 and harvested October 1 and 70% higher than seed planted May 18 and harvested on October 1. Apparently the late planted and late harvested seed had a lusher foliage later in the season and was more attractive to aphids resulting in late season virus infection.

These data are based on 1 year results of a 3 year study so interpretations should be judged accordingly. It does suggest, however, that there could be real concern for the spread of late season virus infections on potatoes planted late, harvested late and having lush vine growth late in the season.

SOIL FERTILITY RESEARCH WITH POTATOES

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Considerable change in Soil Fertility investigations at the Montcalm Experimental Farm has taken place since 1967 when the farm was first established. This past year the farm was reduced in size and as a result many of the soil fertility experiments were discontinued.

In 1973 two soil fertility experiments were conducted. One was a liming study to evaluate its effect on potato yield, quality and the incidence of scab disease. This study was a follow-up of work done in 1972 where scab was more highly related to soil Mg levels than soil PH. Past research has also tended to indicate that Russet Burbanks yield better at PH 6.5 than 6.0.

The other study was a N time of application study. Data in 1972 indicated that N applied through the irrigation system and spaced throughout the growing season tended to give larger potato yields than the conventional sidedress N treatment. The 1973 study was a follow-up of the experiment in 1972.

Lime Study

This experiment included 3 lime rates (0,2 and 4 tons/acre) and 2 liming materias (dolomitic agriculture limestone and dolomitic hydrated lime). The Dol-Ag lime had a neutralizing value of 106 compared to 166 for dolomitic hydrated lime. The actual amount of lime applied was adjusted so that each treatment contained an equivalent amount of lime based on a neutralizing value of 100 (pure calcium carbonate). This was done so that the 2 materials would neutralize approximately the same amount of acidity. If applied on a weight basis the hydrated material would have neutralized considerably more acidity.

The soil PH on this site was 6.1. Normally this soil would not be limed where potatoes are the primary crop in the rotation; however, the intent of this study was to determine the effect of lime on incidence of scab disease, quality and the subsequent effects on yield.

The results of the study are shown in Table 1. The cultural and management practices are listed at the bottom of the table. Potato tubers were sized into 3 categories (those greater than 3 1/4 inch, those less than 1 7/8 inch and those between 1 7/8 and 3 1/4 inch). Specific gravity was determined on tubers at East Lansing shortly after harvest. Ten tubers sampled at random from each plot were given a scab rating of 0 to 10. Those receiving a 0 rating had no evidence of scab. Those receiving a 10 rating would have had nearly the entire surface covered with scab or partially covered with deep pitted scab. The rating of 10 tubers were added together to give the value reported in percent.

The 2 varieties, Kennebec and Katahdin were not significantly affected by any of the treatments. Scab ratings were very low with average ratings

Table 1. Effect or rate and source of lime on yield, size and specific gravity or irrigated Kennebec and Katahdin potatoes.

Lime Treatments[a]	Kennebec						Katahdin					
	Total Yield	over 3 1/4"	1 7/8" to 3 1/4"	less than 1 7/8"	SP GR	Scab Rating	Total Yield	over 3 1/4"	1 7/8" to 3 1/4"	less than 1 7/8"	SP GR	Scab Rating
	cwt/A	%				%	cwt/A	%				%
No Lime	351	13	82	5	1.070	7.5	438	11	85	3	1.073	6.2
2 Ton Dol-Ag Lime	330	12	82	5	1.071	7.5	418	16	81	4	1.072	4.5
4 Ton Dol-Ag Lime	343	12	83	5	1.070	6.2	427	13	83	4	1.073	6.8
2 Ton Hyd-Ag Lime	331	12	83	5	1.070	9.5	413	11	84	4	1.072	2.8
4 Ton Hyd-Ag Lime	320	10	83	6	1.072	7.5	423	13	84	4	1.072	5.2
LSD (.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

[a]Lime was applied on an equivalent basis using a neutralizing value of 100 for pure calcium carbonate.

Planted: May 18, 1973
Row Spacing: 32 Inches
Basic Fertilizer: 600 lbs. 20-10-10 at planting
Seed Spacing: 10 Inches
Irrigation: 5 Inches
Harvested: September 27, 1973
Harvest Area: 266 sq. ft.
Soil Tests: PH=6.1, P=330, K=346, Ca=841, Mg=128

of less than 1 (less than 10% scab). These varieties were selected because of their susceptability to scab disease. Many growers are afraid to lime because they fear that liming may cause scab. This study does not substantiate their fears. The study will be continued to help growers develop a sound and profitable liming program. Yield and specific gravity likewise were uneffected by liming.

Time of N Application Study

Nitrogen fertilizer was applied to obtain 3 comparable treatments, all receiving the same amount but at various times of application throughout the growing season. All treatments received 84 lbs N/A as a starter fertilizer. The first treatment received 140 lbs N/A in one sidedress application on June 15. The second treatment received 70 lbs of sidedress N on June 15 and another 22 lbs N/A biweekly through the irrigation system for the next 6 weeks. The third treatment received 22 lbs N/A on a weekly schedule through the irrigation system over a 6 week period.

Soil water samplers were positioned in each plot to monitor nitrate movement in the soil profile. Water samples were collected weekly or biweekly throughout the growing season. Soil samples were also collected at the same time as the water samples and at the same depth. Nitrate N was determined on both soil and water samples.

Neither yield nor specific gravity were significantly affected by the N treatments (Table 2). The Kennebec variety, however, tended to yield better where N was applied in 6 applications through the irrigation system. The 2-year average would indicate that this method of application is a good method of applying N and will produce high quality yields.

Both soil NO_3-N and NO_3-N in soil water samples were significantly correlated with the Kennebec yield (Table 3). No correlations were obtained for the Russet Burbank variety. Yields for this variety were essentially unaffected by the N treatments. Soil NO_3-N in the surface foot was better related to Kennebec yields than soil NO_3-N at the 2 foot depth. Soil water samples at the 2 foot depth were about as good as surface water samples in predicting potato yield.

Nitrate-N levels in soil were in many cases significantly correlated with NO_3-N levels in soil water samples, however, none were significantly related on the same sampling date at the same depth of sampling. The water samples contained much higher NO_3-N concentrations than the soil. Average concentration of NO_3-N in soil water samples were between 27 and 157 PPM while soil NO_3-N concentrations were on the order of 3.1 to 10.1 (Table 4).

Table 2. Effect of time of nitrogen application on yield, size and specific gravity of Kennebec and Russet Burbank potatoes.

Nitrogen[a] Applications	Kennebec					Russet Burbank					
	Total Yield	over 3 1/4"	1 7/8" to 3 1/4"	less than 1 7/8"	SP GR	Total Yield	over 10 oz	1 7/8" to 10 oz	less than 1 7/8"	off type	SP GR
	cwt/A	%				cwt/A	%				
84PT, 140 ESD	387	12	81	8	1.079	360	9	78	10	3	1.071
84PT, 70ESD, 3*22 Irr.	414	13	80	7	1.079	364	8	75	11	6	1.073
84PT, 6*22 Irr.	438	12	81	7	1.078	357	7	78	11	4	1.071
LSD (.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

[a]PT = planting time, 5-17-73, ESD = Early sidedress 6-15-73
3*22 Irr. - three biweekly applications of 22 lb N/A, 6*22 = six weekly applications of 22 lbs N/A through the irrigation system.

Planted: May 17, 1973
Row Spacing: 34 Inches
Basic Fertilizer: 600 lbs. 14-14-14 at planting
Irrigation: 6.5 Inches
Seed Spacing: 12 Inches
Harvested: September 26, 1973
Harvest Area = 255 sq. ft.

Table 3. Simple correlation coefficients for potato yields and nitrate nitrogen levels in soil and soil water samples taken throughout the growing season.

Variable[a]			r
Yield vrs. soil 0-1 foot			
Kennebec Yield	x	1S7-25	+.626*
" "	x	1S7-11	-.689*
" "	x	1S9-13	-.607*
Yield vrs. water 0-1 foot			
Kennebec yield	x	1W8-30	-.768**
		1W9-20	+.704*
Yield vrs. water 1-2 foot			
Kennebec yield	x	2W7-25	-.641*
		2W9-13	+.620*
		2W9-20	+.667*
Yield vrs. soil 0-2 foot			
Kennebec yield	x	S7-11A	-.689*
" "	x	S7-25A	+.626*
" "	x	S9-13A	-.607*
Yield vrs. water 0-2 foot			
Kennebec yield	x	W8-30A	-.768**
" "	x	W9-20A	-.704*

Variable			r
soil vrs. soil 0-1 foot			
1S6-28	x	1S8-15	+.695*
1S6-28	x	1S8-30	-.602*
1S7-18	x	1S9-13	+.681*
1S8-15	x	1S8-30	-.665*
water vrs. water 0-1 foot			
1W7-25	x	1W8-15	+.762**
1W8-15	x	1W8-30	+.656*
1W8-30	x	1W9-20	+.820**
soil vrs. water 0-1 foot			
1S6-28	x	1W9-20	+.690*
1S7-18	x	1W8-30	+.671*
1S9-13	x	1W8-15	+.832**
1S9-13	x	1W8-30	+.832**

Variable			r
soil vrs. soil 0-2 foot			
S7-18A	x	S8-30A	+.681*
S7-18A	x	S9-13A	+.671*
S8-15A	x	S8-30A	-.665*
water vrs. water 0-2 foot			
W8-15A	x	W8-30A	+.656*
W9-20A	x	W8-30A	+.820**
soil vrs. water 0-2 foot			
S9-13A	x	W8-15A	+.832**
S9-13A	x	W9-13A	+.836**
S8-15A	x	W7-25A	+.762**

[a]Soil and Water sample code: 1W8-30 NO_3-N in soil water samples at 1 foot depth taken 8-30-73

2S7-11 NO_3-N in soil samples at 1 foot depth taken 7-11-73

S6-28A Average NO_3-N in soil samples at 1 and 2 foot depth taken 6-28-73

Table 4. Nitrate-Nitrogen concentration of soil and soil water sampled throughout the growing season.

N Application[a] lbs/A	Depth Ft.	Sampling Date: 6-28	7-11	7-18	7-25	8-15	8-30	9-13	7-25	8-15	8-30	9-13	9-20
		Soil samples							Soil water samples				
		PPM NO_3-N											
84PT, 140 ESD	0-1	9.8	6.0	2.8	4.4	6.2	11.7	10.3	282	70	27	14	17
	1-2	1.6	2.9	4.2	3.1	6.2	9.0	8.7	49	47	51	20	30
	2-3	1.7	2.4	4.0	4.1	5.2	9.5	7.8	130	85	73	71	59
	Ave.	4.4	3.8	3.7	3.9	5.9	10.1	8.9	154	67	50	35	35
84PT, 70 ESD 3*22 Irr.	0-1	5.0	4.1	3.0	4.4	5.3	8.9	6.6	74	22	26	34	27
	1-2	1.7	2.6	3.5	2.8	4.9	7.8	5.7	58	58	79	69	56
	2-3	2.1	2.2	2.1	4.2	5.4	9.3	8.4	28	24	22	58	22
	Ave.	2.8	2.9	2.9	3.8	5.2	8.7	6.9	54	35	42	54	35
84PT, OESD 6*22 Irr.	0-1	9.1	3.2	3.4	5.0	7.1	7.4	7.6	90	25	21	24	22
	1-2	3.2	2.8	3.2	2.8	5.8	5.8	6.1	26	28	44	46	47
	2-3	4.1	5.8	2.6	2.8	6.2	6.4	7.0	44	29	28	28	24
	Ave.	5.5	4.0	3.1	3.5	6.4	6.5	6.9	53	27	31	33	31

[a]See footnote "a" table 2 for definition of N treatments.

POTATO INSECT RESEARCH -- 1973

Arthur L. Wells
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The 1973 entomological research on potatoes was planned to better understand insect populations and to study new materials and techniques for their control. The work at the Montcalm Farm consisted of 3 main projects: (1) Evaluation of soil systemic and foliar insecticides; (2) Comparison of single and double applications of Disyston on 5 varieties under irrigated and non-irrigated conditions; and (3) Comparison of seed and soil treatments of Orthene on potatoes. An additional study to evaluate foliar applications of insecticides was conducted at the Muck Experimental Farm.

A. Montcalm Experimental Farm

Evaluation of systemics

Seventeen treatments were compared for insect control on Norchip and Burbank varieties. Three replications of paired 50-ft. rows of each variety were planted and treatments applied on May 15 and 16. Sidedress applications of Disyston were made on June 27 at time of hilling at which time the first foliar applications were made on certain plots. An additional foliar application was made on August 2 on these same plots. Leaf samples were taken periodically on both varieties to determine flea beetle, leafhopper and aphid populations. Foliar sampling of the plots were made with a sweep net (10 sweeps/replication) on July 31 and August 20. Yields and size gradings were made at harvest of the plots on September 24 and 26. The insect data and yields are presented in Tables 1 and 2 respectively.

Disyston - Variety study

Paired non-replicated plots of 5 commercial varieties of potatoes treated with single and double applications of Disyston were compared with untreated plots under irrigated and non-irrigated conditions. The purpose of the study was to determine if the movement of the insecticide was adequate in the non-irrigated plots to provide insect control and affect subsequent yields. The plots were sprayed on a commercial schedule to simulate grower use of the materials. Leaf samples were checked periodically to determine differences in insect populations and yields and quality were determined at harvest (Table 3).

Orthene seed and soil treatments

The purpose of this study was to determine the effects of Orthene on foliar insects when applied as dry seed treatments to cut seed. A granular formulation was applied in the seed row for comparison with the seed treatments. Leaf samples were taken periodically to determine effects on flea beetles and aphids. Yields and quality of the tubers were determined at harvest (Table 4).

Table 1. Soil systemic evaluation on potatoes at Montcalm Farm
Foliar insect control

Dates of sampling: July 31 and August 20 (10 sweeps/each of 3 replications)

	Potato Leafhopper		Flea Beetle		Tarn. Plant Bug		Aphids		Colorado Potato Beetle			
									July 31		Aug. 20	
	July 31	Aug. 20	July 31	Aug. 20	July 31	Aug. 20	July 31	Aug. 20	A	L	A	L
Thimet B	9	0	1	0	12	15	6	53	0	0	0	8
Thimet B Foliars	12	1	5	0	17	22	4	22	2	0	0	1
Disyston B	12	2	8	1	15	17	0	18	0	0	0	69
Disyston B+S	9	1	6	1	10	20	0	25	2	0	0	15
Disyston B+F	18	0	7	0	16	13	1	11	2	0	0	8
Disyston B+S+F	10	0	11	3	25	16	5	12	2	0	0	7
Disyston F	27	1	20	0	10	16	6	11	1	0	0	26
DS 15647 2	1	0	0	0	8	15	5	33	0	0	0	0
DS 15647 3	2	0	4	0	17	14	4	27	0	0	0	0
Temik 10	5	0	6	0	3	7	0	7	0	0	0	2
Temik 15	7	0	4	1	8	4	0	8	0	0	0	0
Furadan 2	6	0	1	3	6	14	21	95	0	0	0	0
Furadan 3	6	0	2	0	9	5	10	96	0	0	0	0
CGA 12223	32	3	10	2	18	28	10	78	0	3	2	17
Monitor	26	1	20	2	16	11	4	8	0	0	1	5
Untreated	25	3	38	2	11	13	2	22	4	0	0	50
Untreated	25	3	33	5	21	21	9	5	1	0	0	10

*For rates and placement refer to Table 2.

Table 2. Soil systemic evaluation on potatoes.
Yields, size distribution and specific gravity of tubers at harvest.

Date planted: May 15 and 16; Date harvested: Norchip-Sept. 24, Burbank-Sept. 26.
Foliars applied: June 27 and August 2, 1973.

Material and Formulation	Rate/A (Tox.)	Placement*	Norchip Yield/A Cwt.	Norchip Yield/A Bu.	Norchip % Size Distribution to 1-7/8"	Norchip % Size Distribution 1-7/8-3 1/4"	Norchip % Size Distribution 3-1/4"+	Norchip Spec. Gravity	Burbank Yield/A Cwt.	Burbank Yield/A Bu.	Burbank % Size Distribution to 1-7/8"	Burbank % Size Distribution 1-7/8-10 oz	Burbank % Size Distribution 10oz+	Burbank Off type	Burbank Spec. Gravity
Thimet 15G	3 lb	Band	296	491	3	90	7	1.073	360	598	4%	83%	8%	5%	1.071
Thimet 15G + (Thiodan 50WP + Cygon 267)	3 lb 3/4+1/2	Band Foliar	249	413	5	90	5	1.063	351	583	4%	83%	8%	5%	1.070
Disyston 15G	3 lb	Band	280	465	3	89	8	1.069	384	637	3%	80%	9%	8%	1.077
Disyston 15G + Disyston 15G	3 lb 3 lb	Band Side	279	463	3	91	6	1.075	384	637	3%	77%	10%	10%	1.072
Disyston 15G +Disyston 15G	3 lb 1 lb	Band Foliar	252	418	3	91	6	1.072	371	616	4%	79%	10%	7%	1.074
Disyston 15G + Disyston 15G + Monitor 4E	3 lb 3 lb 3/4 lb	Band Side Foliar	280	465	4	89	7	1.077	373	619	4%	78%	10%	8%	1.077
Disyston 6SC	1 lb	Foliar	250	415	3	92	5	1.068	370	614	4%	82%	8%	6%	1.078
D.S.-15647 10G	2 lb	Band	279	463	3	92	5	1.070	380	631	4%	75%	10%	11%	1.076
D.S.-15647 10G	3 lb	Band	263	437	3	88	9	1.066	387	642	3%	82%	9%	6%	1.079
Temik 10G	3 lb	Band	326	541	3	88	9	1.068	430	714	4%	76%	12%	8%	1.076
Temik 15G	3 lb	Band	339	563	3	88	9	1.073	428	710	3%	75%	13%	9%	1.078
Furadan 10G	2 lb	Band	314	521	3	90	7	1.073	391	649	4%	77%	13%	6%	1.076
Furadan 10G	3 lb	Band	308	511	3	91	6	1.075	379	629	4%	78%	11%	7%	1.074
CGA 12223 5G	3 lb	Band	248	412	4	93	3	1.071	252	418	6%	80%	5%	9%	1.072
Monitor 4E	3/4 lb	Foliar	270	448	3	91	6	1.073	370	614	8%	80%	4%	8%	1.068
Untreated	--	--	274	455	3	92	5	1.067	363	603	8%	80%	4%	8%	1.074
Untreated	--	--	280	465	2	91	7	1.067	363	603	3%	77%	12%	8%	1.074

*Granular treatments applied in 4 in. band in seed row (rates based on 34" rows (15,390 row ft/A).

**Side dress application applied at time of hilling, June 27.

Results

The differences in insect control between any of the systemic plots when measured by leaf sampling were insignificant due to the low levels of infestations. The sweep samples indicated a trend in certain plots on late aphids and Colorado potato beetles. Definite differences in yields of the plots are noted on both varieties especially the Temik and Furadan treatments on the Norchips and Temik on the Burbanks.

The most apparent differences in the yields of the varieties in the Disyston irrigation study were the effects of irrigation water during mid-season since very few insects were present on any of the plots. The plots should have been replicated to determine if the variability of the yields between the treatment rates of the insecticide were significant or not.

The phyto-toxic affects of the 1 and 2 ounce rates of the Orthene to the cut seed were apparent soon after emergence of the seedlings. These differences were soon masked by early growth and were not apparent later on. The Orthocide fungicide had a safening effect on the germinating seed since the effects did not show up in the combination treatments. There were very few insects in the plots as determined by leaf samples although they were not sprayed during the season. There were very few differences between the yields at harvest.

Table 3. Soil Systemic Evaluation on Potatoes at Montcalm Farm. Varietal Response to Disyston Treatments under Irrigated and Non-irrigated Conditions.

Date Planted: May 18.
Date Harvested: Sept. 27, 1973.
Size of Plots: Paired 50 ft. rows each with 50 seed pieces.

Variety	Lbs. Di-syston/A.	Yield/A. Cwt	Yield/A. Bu	%Size Distribution to 1-7/8	1-7/8"-3-1/4"	3-1/4"+	Off-type	Specific Gravity
Norland								
Irrigated	0	356	591	2%	92%	6%	-	1.056
"	3	335	556	2%	96%	2%	-	1.055
"	6	339	563	3%	93%	4%	-	1.057
Non-irrigated	0	244	405	6%	91%	3%	-	1.057
"	3	295	490	3%	96%	1%	-	1.056
"	6	281	466	5%	93%	2%	-	1.054
Onaway								
Irrigated	0	395	656	1%	73%	26%	-	1.063
"	3	397	659	1%	78%	21%	-	1.061
"	6	439	729	1%	72%	27%	-	1.061
Non-irrigated	0	363	603	2%	83%	15%	-	1.060
"	3	349	579	1%	88%	11%	-	1.064
"	6	294	488	2%	80%	18%	-	1.061
Sebago								
Irrigated	0	389	646	1%	83%	16%	-	1.061
"	3	415	689	2%	87%	11%	-	1.064
"	6	372	618	1%	84%	15%	-	1.063
Non-irrigated	0	304	505	2%	84%	14%	-	1.064
"	3	331	549	2%	85%	13%	-	1.062
"	6	323	536	2%	76%	22%	-	1.067
Norchip								
Irrigated	0	350	581	1%	85%	14%	-	1.073
"	3	336	558	1%	92%	7%	-	1.073
"	6	337	559	1%	88%	11%	-	1.068
Non-irrigated	0	215	357	4%	92%	4%	-	1.071
"	3	235	390	2%	90%	8%	-	1.079
"	6	276	458	4%	89%	7%	-	1.066
Russet Burbank						10 oz +		
Irrigated	0	308	511	2%	79%	9%	10%	1.073
"	3	320	531	2%	78%	12%	8%	1.072
"	6	377	626	4%	74%	14%	8%	1.072
Non-irrigated	0	273	453	5%	80%	1%	14%	1.078
"	3	285	473	9%	81%	1%	9%	1.072
"	6	236	392	8%	82%	1%	9%	1.068

Table 4. Seed and Soil Treatments with Orthene for Potato Insect Control
Type of applications: Seed treatments on cut seed or ganular band in row with seed.
Size of plots: 3 replications of single 50 ft. rows (50 seed pieces/plot).
Variety: Russet Burbank
Date planted: May 21; Harvested: October 1, 1973

Material and Formulation	Rate of Appl. oz/cwt		Yield/A. cwt.	Bu.	% Size Distribution to 1 7/8"	1 7/8-10 oz	10 oz +	Off-type	Specific Gravity
Seed Treatments	**Tox.**	**Form.**							
Orthene 75S	0.5 oz	.67 oz	293	486	7%	76%	4%	13	1.072
Orthene 75S	1.0 oz	1.33 oz	290	481	6	78	4	12	1.072
Orthene 75S	2.0 oz	2.67 oz	269	447	11	79	2	8	1.075
Orthene 15%-Orthocide 15% dust	0.5 oz	3.36 oz	299	496	7	73	75	15	1.072
Orthene 15%-Orthocide 15% dust	1.0 oz	6.72 oz	287	476	7	76	3	14	1.074
Orthene 15%-Orthocide 15% dust	2.0 oz	13.28 oz	290	481	8	74	4	14	1.073
Orthocide 15% dust	1.2 oz	8.00 oz	282	468	6	79	1	14	1.067
Soil Treatments	**Rate/A.***								
Orthene 5% Gran.	2 lb	40 lb	293	486	5	74	4	17	1.074
Orthene 5% Gran.	4 lb	80 lb	286	475	8	72	4	16	1.068
Orthene 5% Gran.	3 lb	60 lb	294	488	5	74	4	17	1.071
+Orthene 5% Gran.(sidedress)**	2 lb.	40 lb.							
Di-Syston 15% Gran.	3 lb.	20 lb.	306	508	5	72	7	16	1.074
Untreated	--	--	270	444	8	70	5	17	1.071

*Granular treatments applied in 4 in. band in seed furrow. Rates based on 34" rows (15,390 row ft./A)

**Sidedressed at hilling (June 27, 1973)

B. Muck Experimental Farm

Foliar Insecticide Evaluation

A project was initiated in May to evaluate 25 labeled or candidate materials for foliar insect control on potatoes. The plots using Sebago seed were laid out in 3 replications of paired 25 foot rows. Applications were made on August 3, 14, 22 and 30 using a hydraulic sprayer with drop nozzles and delivering 100 gallons per acres. (Note: The Thiodan treatment was included in the first 2 applications after it was replaced with the Pirimor treatment for evaluation on aphids).

Foliar insect populations were evaluated at intervals during and after this period on the plots by sampling with a sweep net (10 sweeps/plot). The data for the potato flea beetle and green peach aphid populations during the study are presented in Table 5 and the totals for the other major potato insects are shown in Table 6.

The plots were harvested on October 9 to determine yields and graded for size classification. These data are presented in Table 7.

Results

The seasonal fluctuation of flea beetle adults due to generation development is clearly shown in Table 5 by the high numbers in the samples in early August and again in early September. A sample from the untreated plot on July 26 prior to any treatments indicated 181 beetles/30 sweeps. The samples on August 3 were taken immediately after the first application and thus provide data on the knock down ability of the materials. The samples on August 10 compare their population effects after 1 week. The populations on the untreated plot remained comparatively low during and after this period due possibly to loss of vigor in the plants from leafhopper feeding. The samples on September 7 again measure the residual effects 1 week after application. There are definite differences between the materials when compared in this manner.

The aphididal effects of these treatments are also shown in the table. Although the populations were lower than in previous years, the seasonal development when not controlled, is obvious in several of the treatments. The residual or systemic effects are again measured by the population build-up 1 week after the last application (August 30 - September 7). There was practically no foliage left on the untreated plots at this time -- thus the low aphid counts.

The potato leafhopper populations were at their peak at the start of the foliar sampling and tapered off in August. The totals as shown in the table were predominately from the second sampling (August 10) seven days after the first application. The potato beetle population was much lower at the Muck Farm than it has been in recent years.

There was considerable variation in yields between the replications of the treatments and even though there appear to be differences it is doubtful if they are highly significant from the untreated plot. The differences between treatments cannot be explained only from the insect population data. The quality of the tubers was excellent with good size resulting from all of the treatments.

Table 5. Flea beetle and Aphid control from foliar treatments.

	Insects/30 Sweeps													
	Potato Flea Beetle							Green Peach Aphid						
Material*	8/3	8/10	8/22	8/30	8/31	9/7	totals	8/3	8/10	8/22	8/30	8/31	9/7	totals
Bay Hox	35	66	5	17	6	126	255	2	13	2	3	0	3	23
Bay Hox + Guthion	11	91	6	26	1	82	217	0	11	2	2	0	11	26
Monitor	11	72	5	10	1	36	135	0	14	2	0	1	1	18
DiSyston	8	81	7	15	0	44	155	0	0	0	0	2	0	2
Orthene	6	59	9	6	6	69	155	1	2	1	0	7	3	14
Lannate 90	3	63	5	1	1	52	120	0	2	6	3	2	3	16
Lannate L	7	57	1	9	0	29	103	0	9	17	21	8	84	139
Vydate	17	124	19	32	4	134	330	3	14	22	31	53	322	445
Vydate + Lannate	7	67	3	13	0	258	348	3	10	21	24	22	312	392
CGA 18809	5	61	5	8	2	18	99	4	3	22	30	31	97	157
CGA 15324	3	84	5	13	0	76	181	1	3	4	2	1	11	22
Thiodan (Pirimor)	5	64	3	6	5	152	232	3	4	7	2	5	4	25
R-30956-M	62	80	5	5	1	38	191	7	69	13	7	1	3	100
MGK RV-111679	18	56	2	3	2	113	194	1	42	15	28	30	101	217
Furadan	0	20	19	4	10	5	58	1	26	13	73	29	121	263
Zolone	6	40	3	6	1	18	74	1	5	4	5	1	102	118
Azodrin	2	62	6	4	1	36	111	0	7	1	8	160	532	708
Imidan	16	46	5	7	7	34	115	1	27	6	10	13	89	146
Dyfonate	7	54	2	5	0	16	84	1	13	1	3	2	17	37
N-2596	7	31	1	6	0	55	100	6	22	27	41	23	35	154
Phosvel	7	32	3	2	3	16	63	5	22	70	135	188	940	1359
Pen-Cap	13	60	10	9	2	48	142	0	29	3	7	20	1318	1377
SN-334B	9	63	4	7	3	62	148	3	20	4	6	15	149	197
UNI-K840	24	80	5	10	4	100	223	9	32	16	31	46	37	171
Cygon + Sevin	15	104	6	13	1	26	165	3	5	2	2	0	2	14
Untreated	53	53	2	13	11	47	169	4	28	9	10	14	26	91
Untreated	67	40	3	16	20	91	237	10	28	36	24	14	52	164

*For rates and dates of application refer to Table 6.

Table 6. Foliar insect control with foliar applications of insecticides.

Dates of application: August 3, 14, 22 and 30, 1973.
Dates sampled: August 3, 10, 22, 30, 31 and September 7 (one week after last appl.)

Material & Formulation	Rate (Tox.) per Acre	Total insects collected (No./30 sweeps) Potato leafhopper*	Aster leafhopper	Tarnished plant bug	Colorado potato beetle (adults & larvae)	Predators & parasites**
Bay Hox 4 EC	1/2 lb.	427*	88	213	9	18
Bay Hox 4 EC + Guthion 2SC	1/2 + 1/2 lb.	169	63	130	1	10
Monitor 4 EC	1 lb.	132	44	67	3	4
DiSyston 6 SC	1 lb.	114	104	82	4	8
Orthene 75% S	3/4 lb.	117	50	87	3	11
Lannate 90 WDP	1/2 lb.	142	51	92	54	18
Lannate 1.8 L	1/2 lb.	165	81	80	4	12
Vydate 2 L	1/2 lb.	213	86	113	1	22
Vydate 2 L + Lannate 1.8 L	1/4 + 1/4 lb.	201	68	78	2	8
CGA 18809 50 WP	1 lb.	208	85	86	0	12
CGA 15324 500 ml./kl. EC	1 lb.	158	118	111	2	7
Thiodan 50 WP	1 lb.					
Pirimor 50 WP	1/2 lb.	176	110	107	4	11
Stauf. R-30956 M	1 lb.	704	78	145	0	15
MGK RV-11679	1 pt.	318	90	154	5	20
Furadan 4 F	3/4 lb.	162	62	97	1	26
Zolone 3 EC	1 lb.	200	38	83	1	15
Azodrin 3.2 EC	3/4 lb.	90	90	87	1	30
Imidan 50 WP	1 lb.	133	86	131	0	14
Dyfonate 4 EF	1 lb.	199	34	91	0	11
Stauf. N-2596 4 F	1 lb.	160	78	127	0	31
Phosvel 45 WP	1 lb.	217	91	143	2	31
Penn-Cap 2 EC	1/2 lb.	120	71	119	4	25
NorAm SN-334 B 97%	1 lb.	172	92	80	4	19
UNI-K840 4 EC	1/2 lb.	291	60	83	12	25
Cygon 267 + Sevin 80 S	1/2 + 1 lb.	224	48	62	4	14
Untreated	--	622	107	357	11	28
Untreated	--	945	122	404	14	32

*High populations on August 10, 7 days after application, were predominant contributor to these totals.

**Ladybird beetles, lace wings, wasps and spiders.

Table 7. Yields and size grades from potato foliar plots

Materials*	YIELD/A Bu.	YIELD/A Cwt.	PERCENT SIZE DISTRIBUTION Less than 1-7/8"	1-7/8"-3-1/4"	Greater than 3-1/4"
Bay Hox	464	280	6%	70%	24%
Bay Hox + Guthion	500	301	5%	64%	31%
Monitor	443	267	6%	69%	25%
DiSyston	460	277	6%	66%	28%
Orthene	484	291	5%	68%	27%
Lannate 90	479	288	6%	69%	25%
Lannate L	493	297	6%	63%	31%
Vydate	420	253	6%	74%	20%
Vydate + Lannate	474	286	6%	71%	23%
CBA 18809	392	236	6%	64%	30%
CBA 15324	499	300	6%	64%	30%
Thiodan (Pirimor)	529	319	5%	66%	29%
R-30956-M	505	304	5%	61%	34%
MGK RV-111679	546	329	4%	66%	30%
Furadan	538	324	5%	60%	35%
Zolone*	395	238	8%	68%	24%
Azodrin	442	266	6%	67%	27%
Imidan	395	238	7%	64%	29%
Dyfonate	483	291	7%	65%	28%
N-2596	517	312	5%	62%	33%
Phosvel	439	266	6%	67%	27%
Pen-Cap	423	255	8%	70%	22%
SN-334B	433	261	5%	63%	32%
UNI-K840	529	318	6%	58%	36%
Cygon + Sevin	518	312	7%	66%	27%
Untreated	409	246	7%	68%	25%

*For rates and dates of application refer to Table 5.

WEED CONTROL EVALUATIONS IN POTATOES ON MINERAL SOILS

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Russet Burbank potatoes were planted on May 20 on a sandy clay loam with 2 to 3% organic matter, Montcalm County, Michigan. The plots were 10 X 50 ft. in a randomized complete block design with 3 replications. The preemergence treatments were applied May 31 and the postemergence treatments June 16. Treatments were applied with a tractor mounted sprayer delivering 23 gpa. Rainfall was 1.62 inches within 7 days after preemergence application and 1.10 inches 7 days after postemergence application. The soil surface temperature at the time of postemergence application was 80°F and the air temperature 82°F. The Russet Burbank potatoes were 4-6 inches with the broadleafs and grass being 3-4 inches at the time of postemergence application. The major weeds present were redroot pigweed, lambsquarter, barnyardgrass. The plots were visually rated on June 21.

The preemergence and postemergence herbicide treatments all gave 93% or more control of the broadleaf weeds. The control of grass was 90% or more for all treatments with exception of these treatments: M & B 14255, 2 lb/A and S-6044, 2 lb/A preemergence; chlorbromuron, 2 lb/A postemergence. Preemergence treatments controlling 93-100% of both the broadleaf and grass species were metribuzin, 1/2 and 1 lb/A; alachlor + dinoseb 2 + 4 1/2 lb/A; alachlor + metribuzin 2 + 1/2 lb/A; alachlor + chorobromuron 2 + 1 lb/A; chlorobromuron 2 lb/A; linuron 2 lb/A; MBR-8251 2 lb/A; R-25823 2 lb/A and S-6044 lb/A. Metribuzin gave satisfactory broadleaf weed control at 1/2 lb/A, but does show some weakness on barnyardgrass control with only a preemergence application. Metribuzin as a split treatment at 1/2 lb/A preemergence and 1/2 lb/A postemergence controlled 100% of the weed population rated. Metribuzin preemergence 1/2 lb/A and bentazone 3/4 lb/A postemergence gave 93-100% control of grasses and broadleaf weeds. Crop injury was not at a high enough level on any of the treatments to cause concern with exception of postemergence chlorbromuron at 2 lb/A; which received a rating of 53% crop injury.

Table 1. Preemergence and Postemergence Weed Control Evaluations in Potatoes on Mineral Soil, Montcalm Co., 1973.

Planted: May 20, 1973 Variety: Burbanks
Treated: Pre-May 31, 1973 Soil Type: Sandy clay loam
Post-June 16, 1973 Organic Matter: 2.4%

Rated: June 21, 1973

Weeds present: lambsquarter, pigweed, barnyardgrass

Tmt. No.	Treatment		Rate lb/A	Injury	Weed Control Rating Grass	Bd.Lv.
1	Pre	Sencor	1	0.7	10.0	10.0
2	Pre	Sencor	1/2	0.3	9.3	10.0
3	Pre + Post	Sencor	1/2+1/2	0.3	10.0	10.0
4	Post	Sencor	1/2	1.7	9.0	9.3
5	Pre + Post	Sencor(super)	1/2+1/2	0.3	10.0	10.0
X6	Pre	Lasso + Sencor	2+1/2	0.0	10.0	10.0
X7	Pre	Lasso + DNBP	2+4 1/2	1.7	10.0	10.0
X8	Pre	Lasso + Bromex	2+1	0.3	10.0	10.0
9	Pre	Bromex	2	1.3	9.7	10.0
10	Pre	Lorox	2	0.7	9.3	10.0
11	Pre + Post	Sencor + Basagran	1/2+3/4	0.7	9.3	10.0
12	Pre	M&B 14255	2	1.0	8.0	10.0
13	Pre	Deston	2	2.0	10.0	10.0
14	Pre	Probe	2	1.3	9.7	10.0
15	Pre + Post	Sencor	1/2+1/4	0.7	10.0	10.0
16	Post	Maloran	2	5.3	7.0	10.0
17	Pre	S-6044	2	1.3	8.0	9.3
18	Pre	S-6044	4	1.3	10.0	10.0
19	Weed free check		-	0	10.0	10.0
20	Weedy check		-	0	0.0	0.0

0 = No control and no injury; 10 = Complete control or kill

X = Tank mix

1973 POTATO VINE KILLING DEMONSTRATIONS

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Research plots of potato vine killing treatments were not conducted in 1973 as efforts were directed to on-the-farm demonstrations. Two locations were established in Otsego and Emmet Counties using the Sebago variety. The farm cooperators were Leo Marker of Elmira and Oscar Overholt in Levering. At both locations the growers boom sprayer was calibrated and used for the application. A summation of these demonstrations is as follows:

Cooperator: Leo Marker, Elmira — Sebago variety

Treatments applied September 10. Partially cloudy, 68 F Noon.

Treatments	Rate/A	Ratings* Sept. 17 Leaves	Sept. 17 Stems	Sept. 25 Leaves	Sept. 25 Stems
1. General + oil conc.	1 1/2 qt + 1 qt	25	5	75	70
2. Des-i-cate	2 gal	85	60	--	--
3. Des-i-cate+oil conc.	1 1/2 gal + 1 qt	85	60	90	90
4. Evik 80W	2 1/2 lb	10	5	65	65
5. Evik 80W + oil conc.	2 lb + 1 qt	30	10	80	70

Remarks:
Applied with growers boom sprayer at 55 gpa. Treatment 2 was oversprayed between September 12 and 25, thus no second rating could be made.

Cooperator: Oscar Overholt, Levering — Sebago variety

Treatments applied September 11. Partially cloudy, 61 F.

Treatments	Rate/A	Ratings* - Sept. 17 Leaves	Stems
1. General	2 qt	40	20
2. General + oil conc.	1 1/2 qt + 1 qt	50	25
3. Des-i-cate	1 1/2 gal	80	65
4. Des-i-cate	2 gal	90	80
5. Des-i-cate + oil conc.	1 1/2 gal + 1 qt	90	80
6. Evik 80W	2 1/2 lb	30	10
7. Evik 80W + oil conc.	2 lb + 1 qt	30	10

Remarks:
Applied with growers boom sprayer at 57 gpa. Grower used Des-i-cate on balance of field. Grower had oversprayed before September 25, also frost.

*Expressed as percent of kill.

EFFECTS OF LATE SPRING FUMIGATION ON THE STAND AND YIELD OF FIVE POTATO VARIETIES

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A study of the effects of fumigation on several varieties of potatoes was planned for 1973 at the Montcalm Experimental Farm. Due to wet weather between the time of fumigation and the time of planting, it was believed that the fumigant was not sufficiently released from the soil despite 2 diskings.

On April 30, the fumigant Vorlex was applied to one half of a 100 ft. x 50 ft. randomized complete block design with 5 replications. Fumigant was injected about 10 inches beneath the surface with a broadcast eleven-shank pump-driven applicator.

The entire plot was disked twice, once on May 11 and again on May 14. Planting of 5 varieties (Katahdin, Kennebec, Norchip, Russet Burbank, and Superior) was done on May 18. Russet Burbank and Norchip were planted at 12 inch intervals, the others at 10 inch intervals. Rows within a block were 3 feet apart. The west 100 x 20 ft. (fumigated) and the east 100 x 20 ft (non-fumigated) were planted, leaving a 10 x 100 ft. buffer planting between them. Fertilizer treatments consisted of 600 lbs/acre 20-10-10 banded at planting, and a sidedress of 70 lb/acre nitrogen on each of June 13 and June 21.

EFFECT ON EMERGENCE

The number of plants produced was counted after emergence was completed. The results, tabulated in Table 1, indicate that the fumigated side of the plot suffered sprout losses in every variety. The Norchip results may be artificially low due to the poor condition of the seed at planting.

Table 1. The effect of late soil fumigation on the emergence of 5 varieties (F: fumigated; N: not fumigated).

	No. of Plants Emerged									
	KATAHDIN		KENNEBEC		NORCHIP		R. BURBANK		SUPERIOR	
	F	N	F	N	F	N	F	N	F	N
Block 1	21	22	14	22	14	16	16	18	20	21
Block 2	25	25	16	19	12	16	19	20	17	21
Block 3	16	19	13	19	8	13	16	21	20	21
Block 4	17	21	19	17	5	12	17	19	18	18
Block 5	16	22	5	13	6	16	18	18	18	18
Total plants	95	109	67	90	45	73	86	96	93	100
Possible plants	120	120	120	120	100	100	100	100	120	120
% Stand	79	91	56	75	45	73	86	96	78	83

Because most fumigants are phytotoxic, these results indicate that 2 diskings were not sufficient to release the fumigant gas. It is believed that the wet conditions of the spring partially sealed the soil, even after disking, and trapped fumes still in the soil.

Yields of each variety were graded and weighed to determine the effect of fumigation on tuber production. The yields for each row, fumigated and non-fumigated, are tabulated in Table 2.

Besides showing that the 19 day interval between fumigation and planting was not long enough, the data also indicate that some varieties are more tolerant of at least this phytotoxic fumigant (Vorlex) than are other varieties.

EFFECT ON YIELD

Varieties were harvested on September 21, hand-graded, and weighed. Later, average yields/plant were computed. The results show, in contrast to the stand results, that the yield/plant in the fumigated area was higher than in the non-fumigated area.

Table 2. Effect of fumigation on the yields of 5 varieties (yields in lbs. per plot).

	KATAHDIN		KENNEBEC		NORCHIP		R. BURBANK		SUPERIOR	
	F	N	F	N	F	N	F	N	F	N
Block 1	61.0	63.0	42.0	52.2	43.4	34.0	36.5	41.0	46.5	35.5
Block 2	51.6	56.0	65.0	66.0	15.0	38.0	61.0	51.0	59.5	48.0
Block 3	62.0	62.0	39.0	48.0	27.0	27.5	46.0	49.0	52.5	46.0
Block 4	67.5	68.5	61.5	69.0	11.5	33.5	37.5	53.0	45.0	44.5
Block 5	59.5	65.5	9.5	42.0	14.0	35.5	45.5	55.5	41.0	58.5
Total Yield	301.6	315.0	217.2	277.2	108.0	168.5	226.5	249.5	244.5	232.5
No. of Plants	95.0	109.0	67.0	90.0	45.0	73.0	86.0	96.0	93.0	100.0
Yield/plant	3.17	2.89	3.24	3.08	2.40	2.33	2.63	2.60	2.63	2.33

Analysis of the yield showed that there was a greater proportion of tubers over 1 7/8" in the fumigated areas than in the non-fumigated, and, in the Russet Burbanks, a much higher proportion of oversized tubers and offtypes. It is probable, therefore, that the fumigated plants were provided more room for tuber growth because of the poorer stands, and that this extra space may account for the increase in yield per plant.

CONCLUSIONS

The usual recommendation is that fumigation precede planting by at least 3 weeks and fall applications are preferable. The above results indicate that for a spring application a longer time may be required particularly if the weather is rainy and the gound wet, heavy and cold. Further tests are to be conducted next year.

1973 GRAIN SORGHUM HYBRID TRIAL

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Eight grain sorghum hybrids were selected based on their previous record in SW Michigan tests. Seed was planted on June 7 in 2 row plots, 34 inch rows, 20 feet long and each variety was replicated 4 times. A combination of Atrazine and Ramrod at 1 and 3 pounds per acre respectively, active ingredient, was applied preemergence for weed control with good results.

Six varieties were harvested on October 11 and 1 on October 24 with all varieties showing some bird damage. One very early variety was damaged almost 100% by birds and was not harvested for yield. Yield per acre and moisture percent at date of harvest are listed below:

Hybrid	Yield per Acre @ 14% moisture	% moisture in grain on the date of harvest
NK 121	53.4	22.0 (Oct. 11)
Pride 550 BR	75.3	22.0 (" ")
Pride 500 A	63.3	24.5 (" ")
S. Dak. 104	47.3	25.0 (" ")
S. Dak. RS 506	74.0	31.5 (" ")
DeKalb A-26	56.9	38.0 (" ")
Dorman 100 RB	89.8	30.5 (Oct. 24)

This is the second year of grain sorghum hybrid trials at this location. Six hybrids were tested in 1972. Average yields for those hybrids entered in the trials both years are given below along with other pertinent information:

Hybrid	2 Yr. Aver. Yield per acre @ 14% moisture	Remarks
NK 121	64.6	Matured both years
Pride 500 A	63.2	Slightly immature in 1972
So. Dak. RS 506	64.4	Matured both years
Dorman 100 RB	81.6	Considered slightly late both years

BEAN BREEDING PROJECT

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The results of a test of several colored bean varieties and strains grown at a 14-inch and a 28-inch row width are shown in the accompanying table (Table 1).

The following conclusions can be drawn:

1. There is no consistent advantage to the 14-inch row width for colored beans at this location, and under the fertility and moisture status that prevail.

2. There is no consistent evidence that certain varieties or growth types do relatively better at the narrower spacing.

3. Late-maturing strains have performed relatively better in yield than early-maturing strains.

4. As in recent previous years, Swedish Brown and Black Turtle Soup beans have given the best yields. This may be due to their higher harvest indexes, which is a measure of the partition efficiency of the variety, that is, the proportion of total growth or dry weight that is apportioned to seeds. It is interesting to note in this connection that the third highest ranking strain in yield, Michigan Improved Cranberry, was also relatively high in harvest index.

5. There is rather good agreement in harvest index between the 14- and 28-inch row widths for most varieties.

6. On the basis of all available data, including 1973, the red kidney strains 023 and 03, dark red and light red respectively, have been approved for release as new varieties to replace Charlevoix and Manitou. The principal advantage is in halo-blight resistance. The new strains will not differ from the standards in yield or maturity.

Table 1. Yield and Harvest Index results from a test of miscellaneous Colored Beans grown at 2 row widths on the Comden Farm, 1973.

Variety or Strain	Yield in lbs/A		Average yield in lbs/A over both row widths	Harvest Indexes*	
	28" rows	14" rows		14" rows	28" rows
Charlevoix DRK	2342	2647	2494	53.1	51.4
Calif. Dark R. Kid.	2833	2686	2760	47.1	49.7
DRK 023	2342	2251	2296	43.9	48.3
Manitou LRK	3073	2290	2682	48.7	48.5
LRK 03	2511	2612	2562	40.7	47.6
Redkote LRK	2734	1995	2364	41.8	49.2
Mich. Imp. Cranberry	2843	2772	2808	51.9	56.6
Expt. Cran. 026	2651	2777	2714	50.0	50.6
Expt. Cran. 027	2486	2874	2680	51.1	49.9
Expt. Cran. 028	2543	2201	2372	42.3	48.9
Commercial Yellow Eye	2347	2656	2502	47.8	51.5
Swedish Brown	3317	3385	3351	58.4	58.2
LRK 01	2827	2345	2586	47.0	48.7
Black Turtle Soup	3032	3319	3176	61.1	59.1
Big Bend Red Mexican	2421	2392	2406	56.0	55.7
Averages	2687	2614	2650		

*Harvest Index is the ratio (X100) of weight of seed to total air-dry weight of plant and seed at harvest time.

EVALUATION OF PICKLING CUCUMBERS PLANTED WITH STANHAY AND DAHLMAN SEEDERS

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Department of Horticulture

The objectives of this study were to evaluate the plant population established and the subsequent yield of pickling cucumbers planted with Stanhay and Dahlman precision seeders.

Procedure

Pickling cucumber varieties Premier and Spartan Jack were planted with Stanhay and Dahlman seeders. Both seeders were calibrated to space seed drops five inches apart in the row. Four rows were planted 16 inches apart on seven foot beds. (A single plant established every 5 inches would result in 60,000 plants per acre.) Seed germination for Premier and Spartan Jack was 70 and 90% respectively. Plots were hand harvested when the estimated dollar value per acre was greatest.

TABLE 1. Established pickling cucumber plant populations observed from 60,000 seed drops per acre with two varieties using two seeding machines.

Variety and Seeder	Plants Per Acre	Percentage of Plants Growing As: Singles	Doubles	Triples	Quadruples
Premier -Stanhay seeder	32,000	55	38	8	2
Premier -Dahlman seeder	24,000	100	0	0	0
Spartan Jack -Stanhay seeder	59,000	40	22	21	17
Spartan Jack -Dahlman seeder	44,000	86	14	0	0

TABLE 2. Yield and grade size distribution of pickling cucumbers from two varieties seeded with two seeding machines.

Variety and Seeder	Plants Per Acre	Yield* bu/A	Yield* $/A	Grade size (% by wt) To 1 1/16"	1 1/16"- 1 1/2"	1 1/2"- 2"	Over 2"
Premier -Stanhay seeder	32,000	112	275	4	26	63	7
Premier -Dahlman seeder	24,000	112	257	2	14	60	24
Spartan Jack -Stanhay seeder	59,000	143	374	7	26	56	11
Spartan Jack -Dahlman seeder	44,000	154	400	6	24	50	20

* Bu/A based on pickles less than 2" in diameter
$/A based on the following values:

Grade Size		Value
up to 1 1/16"	-	$6.00/bushel
1 1/16" - 1 1/2"	-	$3.00/bushel
1 1/2" - 2"	-	$2.00/bushel
over 2"	-	No value

Results and Discussion

Vegiben 2E at 1.5 lb/A did not give satisfactory control of barnyard grass which competed with the pickling cucumbers. Fifty lb/A of N was broadcast incorporated on all plots. One half of the plots were sidedressed with an additional 50 lb N/A at vine tip over. Yield and grade size distribution was not influenced by the N sidedress application, so the data was combined in the tables.

The results shown in Table 1 indicate the Dahlman seeder resulted in fewer plants being established per acre than with the Stanhay seeder. The Stanhay seeder tended to "clump plant" pickling cucumber seeds while the Dahlman gave a high degree of singulation. Since both seeders were releasing seeds 60,000 times per acre, more seeds were planted per acre by the Stanhay seeder.

No difference in yield per acre of pickles resulted between the two seeders (Table 2). All plots of a variety were harvested on the same day. However, the percentage of cucumbers over 2 inches in diameter was greater in both varieties when planted with the Dahlman seeder. This indicates either slightly faster development under lower plant population or slightly faster development due to the high degree of singulation.

Planted: 6/15/73
Herbicide: Vegiben 2E 1.5 lb/A
Soil Test: pH = 6.1, P = 275, K = 225
Fertilizer: 50-0-100
Sidedress N: 50 lb N/A 7/18/73
Irrigation: 2 inches
Harvest Area: 210 sq. ft.
Days from planting to harvest:
Premier - 50 days
Spartan Jack - 52 days

CORN HYBRIDS, PLANT POPULATION AND IRRIGATION

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Table 1 presents performance data for 72 commercial and experimental hybrids evaluated in 1973 with irrigation and without irrigation. Five inches of irrigation water were applied (1 1/4" on July 13 and 24, August 17 and September 1). Buoyoucous soil moisture blocks were placed at 6, 12, 18 and 24-inch depths in both irrigated and unirrigated plot areas.

Irrigated yields in 1973 were the lowest obtained at the Montcalm farm during the 6 years, 1960-1973 (Table 2) -- 113.6 irrigated versus 101.0 unirrigated. The average difference in favor of irrigation was only 12.6 bushels (12.5%). During the previous 5 years, 1968-1972, irrigated yields averaged 149.1 and not irrigated yields averaged 89.8 -- a difference of 59.3 bushels (66%).

Wet soil conditions at and following planting hindered early growth and development.

Soil moisture was below 50% water holding capacity at all soil depths (6-24") in both irrigated and unirrigated plots during the last 10 days of August. Reduced soil moisture and 90°F and above temperatures created a stress during late August and early September in both irrigated and unirrigated areas. Soil moisture data indicated that the irrigated areas received inadequate moisture during this stress period.

Hybrids ranged in yield from 78.4 to 137.5 irrigated and 72.9 to 119.7 not irrigated. Irrigation response of the highest yielding hybrid was about 7 times greater for the highest yielding hybrid than for the lowest yielding hybrid, 19.7 versus 2.8 bushel increases from irrigation.

Hybrids significantly better than the average yield (arranged in order of increasing grain moisture content at harvest) are listed on the following page. Twenty one of these 24 hybrids were in the highest yielding group for both irrigated and unirrigated plots.

Irrigated

Michigan 396-3X (3X)
Mich. Exp. 71-2069 (2X)
Michigan 410-2X (2X)
Migro M-1101 (2X)
Mich. Exp. 71-2002 (2X)
Now Michigan 407-2X
Mich. Exp. 71-2665 (2X)
Blaney BX-AA (2X)
Asgrow RX53 (2X)
Migro M-1212 (2X)
Pioneer 3780 (2X)
Mich. Exp. 71-2915 (2X)
Funk 26191 (2X)
Now G4321
Michigan 572-3X (3X)
Super Crost S27 (2X)
Funk G4366 (3X)
Mich. Exp. 71-2831 (2X)
Michigan 500-2X (2X)
Acco UC3301 (2X)
Michigan 511-3X (3X)
P.A.G. SX69 (2X)
Migro M-Exp. 1130 (2X)
Funk G4444 (2X)
Acco UC3201 (2X)
Migro M-0501 (2X)

Not Irrigated

Michigan 396-3X (3X)
Michigan 410-2X (2X)
Migro M-1101 (2X)
Mich. Exp. 71-2002 (2X)
Now Michigan 407-2X
Mich. Exp. 71-2665 (2X)
Blaney BX-AA (2X)
Asgrow RX53 (2X)
Migro M-1212 (2X)
Pioneer 3780 (2X)
Mich. Exp. 71-2915 (2X)
Funk 26191 (2X)
Now G4321
Michigan 572-3X (3X)
Super Crost S27 (2X)
Funk G4366 (3X)
Acco UC3301 (2X)
Michigan 511-3X (3X)
P.A.G. SX69 (2X)
Migro M-Exp. 1130 (2X)
Funk G4444 (2X)
Acco UC3201 (2X)
Migro M-0501 (2X)

Plant Population X Irrigation

Five hybrids at 4 plant populations irrigated and not irrigated were grown in each of 6 years, 1968-1973, Table 3.

In 1973, highest yields were reached at a population of about 19,200 for both irrigated and unirrigated plots. Yields decreased as population was increased to 23,100 and 27,300 for both irrigated and unirrigated. In 5 previous years, 1968-1972, highest yields with irrigation were reached at a population of about 23,100 -- 4,000 more plants per acre than without irrigation.

Irrigated yields at all 4 populations were lower in 1973 than in any of the previous 5 years. Inadequate irrigation and 90°F or above temperature during late August and early September appeared to have reduced response to irrigation.

Table 1

NORTH CENTRAL MICHIGAN

Zone 3

Montcalm County Trial - Irrigated vs. Not Irrigated
One, Two, and Three Year Averages - 1973, 1972, 1971

Hybrid (Brand--------Variety)	% Moisture			Bushels per acre						% Stalk lodging					
				1972		2 Years		3 Years		1972		2 Years		3 Years	
	1972	2 Yrs	3 Yrs	Irrig	Not Irrig	Irrig	Not Irrig	Irrig	Not Irrig	Irrig	Not Irrig	Irrig	Not Irrig	Irrig	Not Irrig
Asgrow RX30(2X)	20.1	--	--	90.9	81.2	--	--	--	--	4.0	5.9	--	--	--	--
Michigan 280(4X)	20.5	23	24	99.6	93.0	118	108	130	81	3.4	3.9	8	8	8	6
Michigan 275-2X(2X)	20.7	23	23	103.7	95.9	115	98	126	75	5.2	7.2	10	4	9	3
Teweles TXT53X(3X)	20.8	--	--	83.2	73.7	--	--	--	--	4.1	6.7	--	--	--	--
Mich.Exp.68-3613(3X)	21.0	--	--	113.6	101.7	--	--	--	--	5.0	7.0	--	--	--	--
Mich.Exp.68-3635(3X)	21.3	--	--	112.5	103.4	--	--	--	--	2.7	7.0	--	--	--	--
DeKalb XL311 (3X)	21.5	--	--	103.3	87.4	--	--	--	--	4.9	4.6	--	--	--	--
Jacques JX863(3X)	21.7	25	--	79.6	77.2	96	84	--	--	7.4	5.0	19	14	--	--
Funk G4195(3X)	21.9	--	--	100.3	85.9	--	--	--	--	3.2	7.8	--	--	--	--
Blaney B200(2X)	22.0	--	--	78.4	75.6	--	--	--	--	4.1	8.2	--	--	--	--
Wolverine 24(4X)	22.0	--	--	89.7	77.1	--	--	--	--	0.0	3.2	--	--	--	--
Michigan 333-3X(3X)	22.3	25	25	117.2	105.8	131	121	143	94	4.3	2.0	8	2	6	1
Asgrow Rx42 (2X)	22.8	--	--	117.8	106.9	--	--	--	--	1.7	2.0	--	--	--	--
Acco UC1901 (2X)	23.0	--	--	109.7	103.3	--	--	--	--	4.3	5.1	--	--	--	--
Super Crost 1692(2X)	23.1	--	--	105.8	89.6	--	--	--	--	4.8	2.8	--	--	--	--
Michigan 396-3X(3X) [1,2]	23.2	26	26	129.1	111.2	141	129	154	92	3.1	2.8	4	4	5	3
Stanton SX1095N (3X)	23.5	--	--	92.1	81.0	--	--	--	--	2.7	2.2	--	--	--	--
Stanton SX1090N (3X)	23.5	--	--	90.2	93.1	--	--	--	--	13.8	2.1	--	--	--	--
Wolverine W128 (2X)	23.8	--	--	106.0	86.3	--	--	--	--	0.0	2.9	--	--	--	--
Mich.Exp.71-2001A 9(2X)	23.9	27	--	108.5	88.0	129	106	--	--	5.3	2.4	5	2	--	--
Mich.Exp.71-2001(2X)	24.0	27	--	116.6	105.4	136	120	--	--	5.3	3.0	3	2	--	--
DeKalb XL12 (2X)	24.1	--	--	104.6	94.6	--	--	--	--	4.0	2.1	--	--	--	--
Pioneer X9379A(3X)	24.2	--	--	100.7	90.9	--	--	--	--	0.9	2.2	--	--	--	--
Cowbell SX102(2X)	24.2	27	26	118.2	108.4	127	117	133	90	4.7	2.8	8	4	7	3
Pride R252(2X)	24.2	--	--	81.0	75.5	--	--	--	--	3.7	8.3	--	--	--	--

Table 1 Continued

Mich.Exp. 71-2069(2X)[1]	24.5	--	--	127.5	110.2	--	--	--	--	10.5	7.3	--	--	--	--
Michigan 410-2X (2X)[1,2]	24.5	28	27	132.6	110.9	144	127	162	95	4.3	6.5	5	5	7	3
Migro M-1101 (2X) [1,2]	24.7	28	--	135.4	112.7	143	125	--	--	3.1	2.0	3	1	--	--
Mich.Exp. 71-2002(2X)[1,2]	24.7	28	--	135.0	118.0	167	144	--	--	5.0	3.8	6	3	--	--
Blaney B401 (2X)	24.8	--	--	118.1	93.5	--	--	--	--	0.8	3.5	--	--	--	--
Pioneer 3958(2X)	24.8	--	--	97.1	92.3	--	--	--	--	2.6	2.7	--	--	--	--
DeKalb XL15A(2X)	24.8	28	27	102.2	94.0	119	108	137	82	3.3	1.9	12	7	10	5
Teweles 263NBT(4X)	25.0	--	--	84.0	72.9	--	--	--	--	6.5	7.0	--	--	--	--
Jacques JX162A(2X)[1]	25.4	28	28	124.6	97.8	142	113	156	87	5.5	0.0	10	2	12	2
Funk G4343(2X)	25.4	28	--	112.1	103.9	144	123	--	--	1.6	0.9	5	1	--	--
Mich.Exp. 71-2665(2X)[1,2]	25.5	--	--	135.0	116.8	--	--	--	--	3.3	0.9	--	--	--	--
Super Crost S25(2X)	25.6	31	29	118.0	101.8	152	127	164	90	0.8	0.0	4	4	4	3
Funk G4252(3X)	25.6	27	--	86.4	85.9	121	107	--	--	3.2	4.5	7	3	--	--
Funk 26189(3X)[1,2]	25.6	--	--	130.8	110.6	--	--	--	--	5.7	0.9	--	--	--	--
Teweles SXT14(2X)	25.6	--	--	81.2	76.8	--	--	--	--	6.5	7.4	--	--	--	--
Blaney BX-AA(2X)[1,2]	25.6	29	29	125.1	115.0	152	135	163	100	1.5	2.8	4	5	4	3
Pride R290(2X)	25.7	29	28	109.4	93.7	144	129	158	93	5.5	2.6	8	6	8	4
Asgrow RX53(2X)[1,2]	25.8	--	--	132.0	119.7	--	--	--	--	0.7	3.5	--	--	--	--
Acco DC231(4X)	25.8	--	--	88.4	86.5	--	--	--	--	8.8	4.0	--	--	--	--
Pioneer 3786(2X)	26.2	--	--	111.6	98.5	--	--	--	--	4.0	1.1	--	--	--	--
Acco UC2301(2X)	26.4	28	27	120.9	107.3	142	127	154	91	6.7	1.0	10	3	9	3
Migro M-1212 (2X)[1,2]	26.4	--	--	126.6	117.8	--	--	--	--	2.3	0.0	--	--	--	--
Super Crost 1712(2X)	26.6	29	--	102.9	94.2	129	116	--	--	1.8	2.1	5	2	--	--
Pioneer3773 (2X)	26.7	--	--	127.3	106.8	--	--	--	--	0.8	3.1	--	--	--	--
Acco U334 (3X)	26.7	29	--	99.7	91.8	132	112	--	--	2.6	1.3	6	1	--	--
Cowbell SC7300 (2X)	27.2	--	--	113.7	98.4	--	--	--	--	5.8	2.9	--	--	--	--
Pioneer 3780(2X)[1,2]	27.2	30	--	126.2	111.3	154	134	--	--	4.9	3.2	8	2	--	--
Blaney B501A(2X)	27.3	30	--	109.2	102.3	138	118	--	--	3.1	1.1	6	2	--	--
Mich.Exp. 71-2915(2X)[1,2]	27.4	--	--	137.3	117.4	--	--	--	--	6.6	4.9	--	--	--	--
Funk 26191(2X) [1,2]	27.4	--	--	124.5	113.6	--	--	--	--	5.6	2.1	--	--	--	--

Table 1 Continued

Michigan 572-3X(3X)[1,2]	27.4	29	29	133.8	116.8	160	137	168	100	2.4	4.1	6	4	6	3
DeKalb XL21(2X)	27.4	--	--	116.3	106.4	--	--	--	--	3.6	5.1	--	--	--	--
Super Crost S27(2X)[1,2]	27.7	31	30	134.6	118.2	154	139	165	102	4.6	3.9	6	3	5	2
Stanton SX10100(3X)	27.8	--	--	110.5	101.1	--	--	--	--	4.8	1.0	--	--	--	--
Funk G4366(3X)[1,2]	27.8	--	--	134.6	120.4	--	--	--	--	4.0	2.7	--	--	--	--
Mich.Exp. 71-2831(2X)[1]	27.8	--	--	135.9	109.2	--	--	--	--	2.0	2.4	--	--	--	--
Renk R235A(3X)	27.9	--	--	110.8	103.0	--	--	--	--	2.5	6.3	--	--	--	--
Michigan 500-2X(2X)[1]	28.0	31	30	128.9	108.9	154	134	164	99	3.5	2.2	5	1	6	1
Acco UC3301 (2X)[1,2]	28.2	31	--	136.9	118.8	160	134	--	--	6.1	10.3	5	7	--	--
Blaney 5616 (Sp.)	28.3	--	--	104.3	94.7	--	--	--	--	3.0	3.2	--	--	--	--
Michigan 511-3X(3X)[1,2]	28.3	30	30	128.3	113.5	158	143	175	105	2.5	4.0	4	4	4	3
P.A.G SX69(2X)[1,2]	28.3	31	30	135.8	116.7	169	139	175	103	2.4	5.5	3	3	4	2
Migro M-Exp.1130(2X)[1,2]	28.5	--	--	127.9	114.8	--	--	--	--	1.8	1.9	--	--	--	--
Cowbell SX112(2X)	28.5	30	--	110.5	102.8	140	121	--	--	3.4	3.7	11	3	--	--
Funk G4444(2X)[1,2]	28.8	31	30	133.9	116.9	169	140	178	105	4.8	1.7	5	4	6	3
Acco UC3201 (2X)[1,2]	28.8	31	---	137.5	117.8	155	131	--	--	2.3	1.7	3	3	--	--
Migro M-0501 (2X)[1,2]	31.8	--	--	133.6	110.9	--	--	--	--	0.0	0.0	--	--	--	--
Average	25.2	28	28	113.6	101.0	142	123	156	94	3.9	3.5	7	4	7	3
Range	20.1 to 31.8	23 to 31	23 to 30	78.4 to 137.5	72.9 to 119.7	96 to 169	84 to 144	126 to 178	75 to 105	0.0 to 13.8	0.0 to 10.3	3 to 19	1 to 14	4 to 12	1 to 6
Least significant difference	1.0	.7	.5	10.8	9.5	7	6	5	5						

1 Significantly better than average yield, irrigated 1973.

2 Significantly better than average yield, not irrigated, 1973.

Table 1 Continued

	1973	1972	1971
Planted	May 8	May 5	May 6
Harvested	Oct. 17	Oct. 25	Oct. 29
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	18,700	20,100	20,300
Rows	30"	30"	30"
Fertilizer	277-130-130	258-145-145	160-140-140
Soil test: pH	5.6	5.5	6.0
P	297 (very high)	420 (very high)	340 (very high)
K	175 (medium)	178 (medium)	246 (high)
Irrigation	5 inches	6 inches	12.5 inches

Farm Cooperator: Theron Comden, Lakeview

County Extension Director: James Crosby, Stanton

Table 2. Average, highest, and lowest yields for corn-hybrids irrigated and not irrigated for 6 years, 1968-1973.

Year	No. of hybrids tested	Average		Highest		Lowest	
		Irrigated	Not Irrigated	Irrigated	Not Irrigated	Irrigated	Not Irrigated
1973	72	113.6	101.0	137.5	119.7	78.4	72.9
1972	72	157.3	136.6	206.3	179.1	98.5	90.5
1971	56	162.5	28.2	210.5	41.9	91.0	10.6
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
Average		143.2	91.7	185.8	116.7	92.0	60.9

Irrigation:

1973 = 5"	1972 = 6"	1971 = 12.5"	1970 = 5.5"
July 13 = 1.25"	July 7 = 1.5"	June 23 = .75"	July 20 = 1.0"
July 24 = 1.25"	July 11 = 1.5"	June 27 = 1.0"	July 27 = 1.0"
Aug. 17 = 1.25"	July 24 = 1.5"	July 3 = 1.0"	July 30 = 0.5"
Sept. 1 = 1.25"	July 30 = 1.5"	July 7 = .75"	Aug. 4 = 1.0"
		July 12 = 1.0"	Aug. 11 = 1.0"
		July 16 = 1.0"	Aug. 13 = 1.0"
1969 = 6"	1968 = 7.5"	July 23 = 1.0"	
July 26 = 1.5"	July 16 = 1.5"	July 27 = 1.0"	
Aug. 8 = 1.5"	Aug. 2 = 1.5"	Aug. 2 = 1.0"	
Aug. 14 = 1.5"	Aug. 12 = 1.5"	Aug. 6 = 1.0"	
Aug. 27 = 1.5"	Aug. 20 = 1.5"	Aug. 13 = 1.0"	
	Sept. 7 = 1.5"	Aug. 17 = 1.0"	

Table 3. Average yield at 4 plant populations irrigated and not irrigated for 6 years, 1968-1973.

Year	15,100		19,200		23,100		27,300	
	Irrigated	Not Irrig.	Irrigated	Not Irrig.	Irrigated	Not Irrig.	Irrigated	Not Irrig.
1973	107.5	97.1	134.3	115.5	127.6	105.5	108.0	101.8
1972	151.9	132.4	186.5	158.8	191.2	149.3	161.2	143.9
1971	172.9	36.6	189.1	35.3	190.9	20.2	180.6	10.5
1970	122.2	91.0	144.1	111.7	158.2	93.4	151.2	85.1
1969	125.5	90.7	157.5	108.5	173.2	95.7	147.8	86.3
1968	143.5	113.9	169.3	130.2	193.1	107.0	178.4	89.4
Average	137.3	93.6	163.5	110.0	172.3	95.2	154.5	86.1