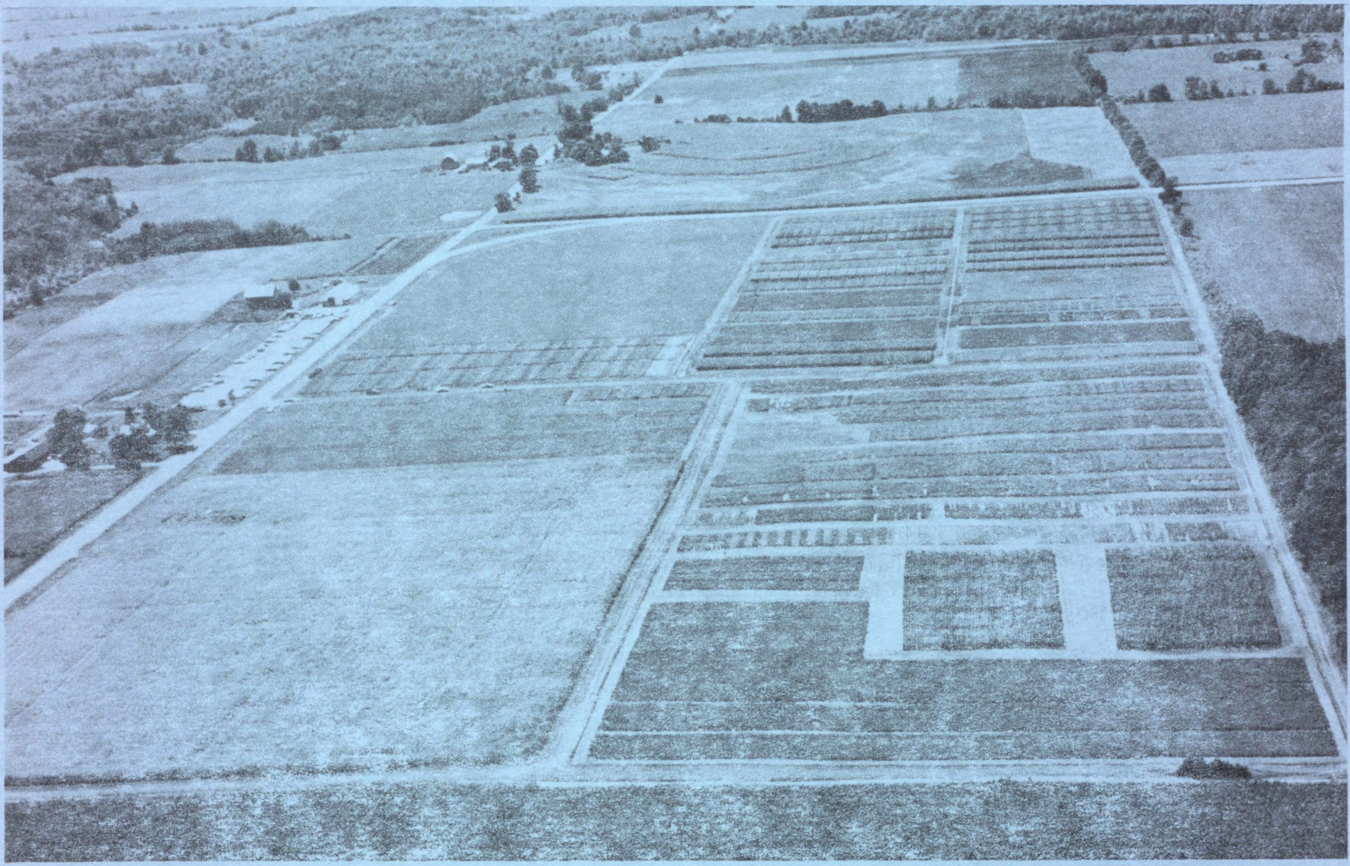
File Copy

1972 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

	Page
INTRODUCTION, WEATHER, AND GENERAL MANAGEMENT	1
A. POTATO STUDIES	
Introduction of New Varieties N. R. Thompson and R. W. Chase	5
Potato Breeding N. R. Thompson	8
Plant Spacing Studies R. W. Chase	10
Soil Fertility Research with Potatoes M. L. Vitosh	12
Variety Stage of Growth Study in Potatoes with Sencor J. S. Ladlie, W. F. Meggitt and R. C. Bond	27
Weed Control Evaluations in Potatoes on Mineral Soils J. S. Ladlie, W. F. Meggitt and R. C. Bond	33
Vine Killing Evaluation in Potatoes in 1972 J. S. Ladlie, W. F. Meggitt, R. W. Chase, and R. C. Bond	35
Insecticide Evaluation for Pest Management of Potatoes A. L. Wells	37
Phosphorus-Potassium Soil Test Correlation Study D. R. Christenson, C. Bricker and F. Wedel	44
Water Management of Potatoes Ana Garay, R. J. Kunze, R. W. Chase and E. Kidder	46
The Effect of Harvest Date and Storage on the Yield Potential of Onaway and Sebago Seed Potatoes R. W. Chase	54
The Relationship of Planting Date, Harvest Date, and Storage on the Yield Potential of Russet Burbank Seed Potatoes R. W. Chase	59
B. OTHER CASH CROPS	
Soil Fertility Research with Dent Corn, Sweet Corn, and Dark Red Kidney Beans M. L. Vitosh	61
Insecticide Evaluation for Bean Insect Control A. L. Wells	71

Preplant Incorporated and Preemergence Herbicides for Weed Control in Field Beans
D. L. Wyse, W. F. Meggitt, and R. C. Bond. 72

Report of Results of Dry Bean Variety Test
M. W. Adams. 75

1972 Grain and Sorghum Trials
S. Hildebrand. 77

Corn Hybrids, Plant Population and Irrigation
E. C. Rossman and B. M. Darling. 78

MONTCALM BRANCH EXPERIMENT STATION RESEARCH REPORT

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

INTRODUCTION

The Montcalm Experiment Station was established in 1966 with the first experiments initiated in 1967. This report marks the completion of six years of studies. The 80 acre facility is leased from Mr. Theron Comden and is located in west-central Michigan 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 rotation with potatoes are also being investigated.

This report is designed to coordinate all of the research data obtained at the facility during 1972. 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.

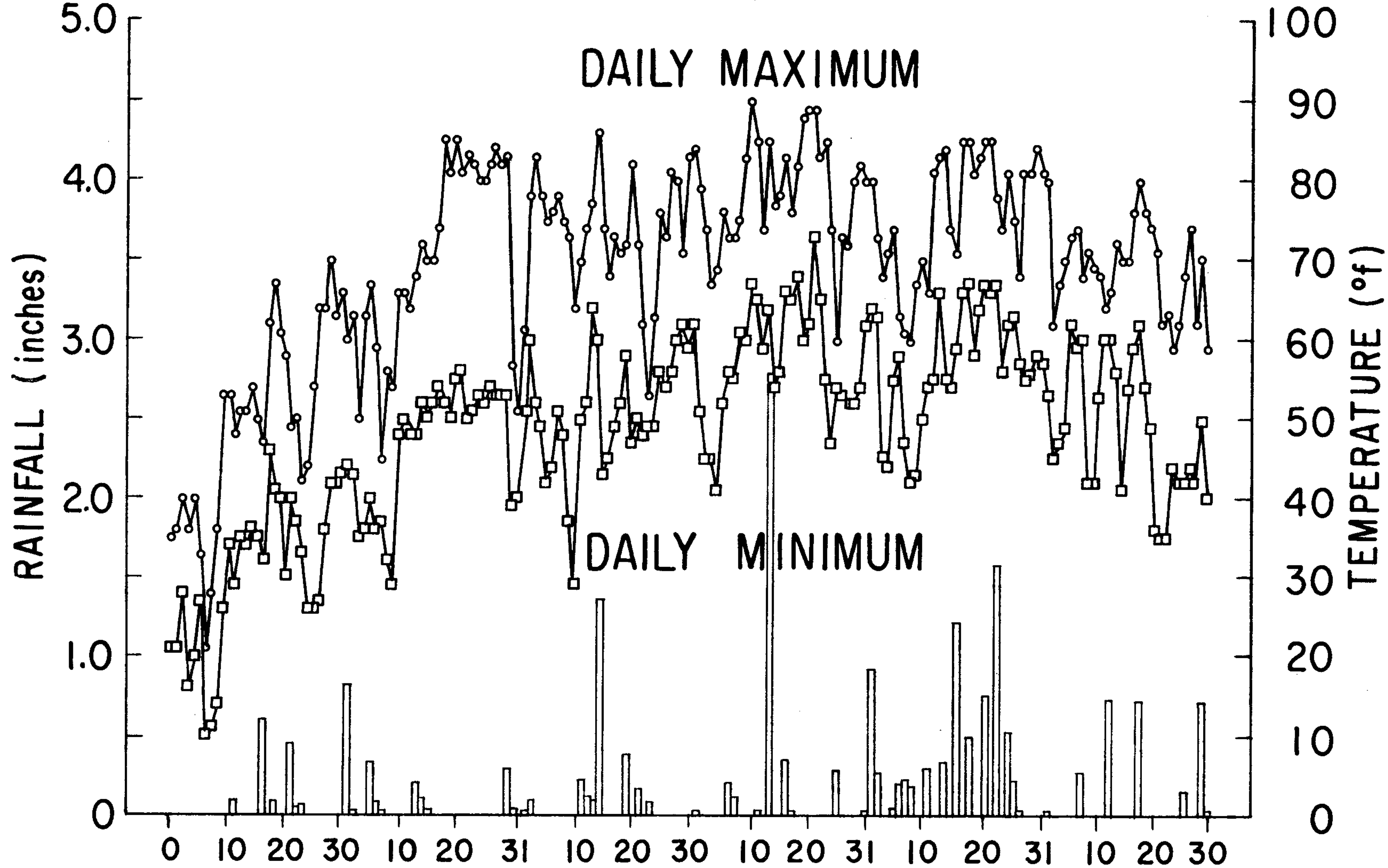
Weather

Temperature and rainfall recordings for the 1972 growing season are shown in Figure 1. Tables 1 and 2 summarize the 5 year rainfall and temperature data. Average maximum temperatures for 1972 were below the five year average in June, July, August and September of 1972 but were considerably higher in May. There was little deviation in the average minimum temperature.

The longest extended warm period occurred between May 19 and 30 when the maximum daily temperature exceeded 80F. Only on one day, July 12, did the temperature reach 90F.

The lowest recorded temperature occurred on June 11 with a reading of 29F. Only very slight frost damage was noticed and this appeared on an occasional leaf. Other production areas reported more serious damage. Several below freezing readings occurred in October, the first on October 9 and 10 with low temperatures of 29F and 30F, respectively. It again dropped to 27F on October 13 and 15, however, the most damaging freezes occurred on October 17, 18, 19, 20 and 21 with temperatures of 26, 19, 21, 24 and 30F. An 8 inch depth soil temperature reading made on October 20 under an unharvested row of potatoes was 39F.

Rainfall was adequate and uniformly distributed throughout the entire growing season. The total rainfall compares very closely with the five year average, however, it was considerably greater than 1971. The five year summary tabulations show the 1971 season to be an unseasonably dry year whereas 1970 was unseasonably wet in terms of totals. Irrigation applications were reduced considerably with 5 applications of approximately 1 inch each and these were all applied in July.



	APRIL	MAY	JUNE	JULY	AUGUST	SEPT.
AVERAGE MONTHLY TEMP.	MAX. 47 MIN. 30	MAX. 70 MIN. 47	MAX. 72 MIN. 50	MAX. 79 MIN. 57	MAX. 76 MIN. 57	MAX. 69 MIN. 49
RAINFALL	1.35 inches	1.96 inches	2.51 inches	3.83 inches	7.28 inches	2.60 inches

Figure 1. Climatology Observations at the Montcalm Experimental Farm in 1972.

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

	April		May		June		July		August		September	
Year	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1968	61	37	62	41	74	53	80	55	81	58	74	50
1969	56	35	67	43	70	50	80	59	82	56	73	49
1970	54	35	65	47	72	55	80	60	80	57	70	51
1971	53	31	65	39	81	56	82	55	80	53	73	54
1972	47	30	70	47	72	50	79	57	76	57	69	49
5 Yr. Ave.	54	34	66	43	74	53	80	57	80	56	72	51

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

Year	April	May	June	July	August	Sept.	Total
1968	2.84	4.90	3.74	1.23	1.31	3.30	17.32
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
5 Yr. Ave.	2.31	3.11	3.71	2.52	3.92	3.53	19.10

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
6.4	353	259	1029	177

The preceding crop grown was a rye winter cover crop plowed down just prior to plot establishment. The 1971 crop was Wheeler rye which was harvested for grain.

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 27 and continued on a weekly schedule until terminated on September 3. All spray applications were made with an air blast sprayer. The foliar insecticides used were Endosulfan (Thiodan), Meta-Systox-R, and Diazinon. The fungicide used was Dithane M-45. Linuron (Lorox) at 1 3/4 lb/A applied preemergence was used for weed control.

INTRODUCTION OF NEW VARIETIES

N. R. Thompson and R. W. Chase
Department of Crop and Soil Sciences

Twenty varieties of potatoes were tested for adaptation to the Michigan environment. Plots were located on the Don and Jerry Meyer Farm in Bay County; Andy and Henry Leep Farm in Allegan County; Leon Delekta Farm in Presque Isle County, and the Montcalm Experimental Farm. Planting the plots in the different areas exposes the varieties to a range of climatic and soil conditions which promotes expression of their potential - both good and bad. Result of the 1972 trials are shown in Table 1.

Of the white varieties tested, three were outstanding in all locations, Abnaki, Jewel and MS 709. While plot yields varied, the plot yields are indicative of the potential of the variety. The true test is established when growers plant commercial acreages.

The variety Sioux is an exceptionally high yielding red. Its good color and white flesh should have appeal in any red marketing area. It has a tendency to oversize but this could be controlled by spacing and vine killing.

Chip color and specific gravities of the earlier maturing cultivars were considered good. The wet August and September resulted in poorer chip color of the later varieties. Specific gravity was also adversely affected.

Phase II of the variety introduction, i.e. tests on a commercial scale, was initiated. Of the cultivars which merited larger plantings only seed of MS 709 was available. Acreages were planted by:

Wayne Lennard, Samaria
Paul Lapointe, Dundee
Marvin Smith, Erie
Robert Johnston, Essexville
Andrew Meyer, Saginaw
Paul Van Damme, Cornell
Ore-Ida Co., Greenville

Comments on yield ranged from satisfactory to very good. Neither chip color nor specific gravity was comparable to plot values of previous years. However, only one grower was not interested in an acreage in 1973. His decision was based on chip color. He rated the variety as good for tablestock.

MS 709 will be grown commercially in 1973. A more normal season, without frost at both the beginning and end and abnormally wet harvest conditions, may produce different results.

MS-709 - a potential high yielding variety that sizes tubers early although the tops may remain green. Shallow eyes and has a tendency to oversize, however to date hollow heart has been negligible. Medium specific gravity and without adverse conditions it will chip out of the field. Leak and pythium has been observed in storage, however, this may be minimized by proper top killing, conditioning and harvesting. Plant spacing should be 7-8".

Jewel - released by private breeders in New York in 1968. A late maturing variety with high specific gravity and an excellent chipper from the field or storage. A potential high yielder with heavy tuber set per hill and a tendency to produce small tubers.

Sioux - released in 1969 by Nebraska. A high yielding, late, red variety with very desirable skin color which seems to hold in storage. Tends to oversize so closer spacing and top killing are essential.

Abnaki - released in 1970 by U.S.D.A., New York and Maine. Midseason to late maturity with roundish flattened tubers. A potential high yielder, medium to low in specific gravity and may chip out of the field, but not out of storage. Resistant to verticillum wilt and virus leaf roll. Although hollow heart was not observed in our plots in 1971 or 1972 there have been reports that this has been a weakness of the variety. Plant spacing should be 7-8".

Raritan -released by Rutgers University. A late maturing variety with high specific gravity. Tubers were not uniformly shaped and the chip ability is variable.

Shurchip - released in 1969 by Nebraska. Low specific gravity and its maturity is midseason to late. Its reliability as a chipper is uncertain. Tubers do have a scaly russet on the skin.

Hi Plains - released in 1965 by Nebraska. Medium early in maturity, medium to medium-low in specific gravity and the tubers are elongated. It was included in the 1972 trials primarily to determine its adaptation to an earlier variety for frozen processing.

Wauseon - released in 1967 by U.S.D.A. and New York particularly because of its resistance to the golden nematode. It is late maturing and is medium in specific gravity.

MS-645-2 - midseason cultivar with a potential high yield of very smooth tubers, chips well at harvest.

MS-711-3 - medium late cultivar with excellent processing quality. Consistently reconditions from storage.

Ia-1111-2 - an early cultivar with smooth uniform tubers. Yield and chip quality varies with the season.

York - released in 1969 by Canada. Responded as an early maturing variety and was well below average in yield. The results were similar in 1971.

Cascade - released in 1969 by the U.S.D.A. and Washington. Appears to be a thin skin variety and storability has been a problem. Fusarium dry rot occurs in storage and if not eliminated reduces stand. Because of this acceptability is questionable.

TABLE 1

	Montcalm Co.			Allegan Co.			Presque Isle Co.			Bay Co.			Average		
Variety	Total Yield	Specific Gravity	Chip Color	Total Yield	Specific Gravity	Chip Color	Total Yield	Specific Gravity	Chip Color	Total Yield	Specific Gravity	Chip Color	Total Yield	Specific Gravity	Chip Color
MS 709	619	1.068	5	322	1.064	3	639	1.072	8	423	1.074	4	501	1.070	5.0
Jewel	535	1.086	3	423	1.078	2	482	1.087	5	438	1.082	2	470	1.083	3.0
Sioux	377	1.066	7	310	1.068	5	589	1.072	9	450	1.075	7	432	1.070	7.0
Onaway	466	1.062	8	365	1.063	7	412	1.065	8	462	1.067	7	426	1.064	7.5
Abnaki	373	1.066	5	448	1.068	5	448	1.075	8	383	1.068	4	413	1.069	5.5
Raritan	376	1.081	4	383	1.082	5	413	1.087	8	428	1.083	3	400	1.083	5.0
Shurchip	339	1.060	4	288	1.061	3	407	1.066	7	330	1.069	4	341	1.064	4.5
Norchip	336	1.077	3	316	1.068	2	401	1.076	3	306	1.076	2	340	1.074	2.5
Hi Plains	318	1.062	4	330	1.067	2	401	1.070	5	312	1.071	3	340	1.068	3.5
Wauseon	332	1.065	4	271	1.061	3	435	1.071	8	320	1.074	3	340	1.068	4.5
MS645-2	276	1.071	5	360	1.073	4	403	1.069	6	314	1.076	4	338	1.072	4.8
MS711-3	367	1.079	3	200	1.072	2	319	1.084	7	330	1.075	3	304	1.078	3.8
Ia1111-2	367	1.065	5	247	1.062	3	253	1.062	7	288	1.066	2	289	1.064	4.3
Superior	280	1.066	5	237	1.066	4	261	1.070	7	267	1.071	4	261	1.068	5.0
York	247	1.072	3	248	1.072	2	253	1.073	4	256	1.074	2	251	1.073	2.8
Rushmore	241	1.061	4	273	1.061	2	297	1.064	8				270	1.062	4.1
6334-19	491	1.077	7	401	1.075	7	287	1.073	9				393	1.075	7.7
63126-2	434	1.076	7	142	1.069	5	267	1.073	9				281	1.073	7.0
Haig										300	1.068	3	300	1.068	3.0
Cascade										169	1.066	7	169	1.066	7.0
Average	376	1.070	5	309	1.068	4	387	1.073	7	340	1.073	4	353	1.071	4.8

	Montcalm Co.	Allegan Co.	Presque Isle Co.	Bay Co.
Date Planted:	May 16	May 24	May 31	May 1
Date Harvested:	September 20	September 26	October 11	August 17
Date Chipped:	November 15	November 15	November 14	September 8

POTATO BREEDING

N. R. Thompson
Department of Crop and Soil Sciences

Unselected Seedlings

Approximately 10,000 new seedling tubers grown in the greenhouse in 1971 were planted in the field in 1972. Emergence and growth was vigorous and rapid. Aphids became a problem by September 1 and the plants were killed while most seedlings were in full bloom. However, many outstanding selections were made for tuber set, yield and shape. Processing characteristics will be determined as time permits.

Two Hill Clones

The unprecedented number of selections made in 1971 were planted as two hill clones, not only to reduce the volume of potatoes that would have to be stored but to determine the amount of disease spread by the severe aphid infestation of 1971. Of the 1550 selections planted 621 or 40% were rogued during the growing season, primarily for virus leaf roll. Only random samplings of families have been made to date. Few were discarded for poor horticultural type in the field and as data is accumulated (weight per hill, specific gravity, chip color, etc.) selections will be made for increase in 1973. A high percentage of cultivars appear to have varietal potential as shown in Table 1.

TABLE 1

Cross		No.	Yield/2 hills			Specific Gravity			Chip Color		
No.	Parentage	Tested	High	Mean	Low	High	Mean	Low	Good	Mean	Poor
001	322-6X709	4	8.0	5.6	3.5	1.090	1.078	1.066	3	4	5
002	321-38X709	49	10.5	8.0	2.5	1.100	1.079	1.061	1	4	7
003	321-65X709	7	9.9	7.0	5.0	1.090	1.080	1.074	2	3	5
004		60	11.0	6.3	2.0	1.094	1.078	1.065	1	4	7
005		9	11.5	6.6	4.5	1.076	1.065	1.053	3	5	7
006		4	9.0	5.5	3.5	1.079	1.071	1.060	5	6	7
007		19	12.0	7.7	4.5	1.072	1.063	1.055	2	5	8
008		8	10.5	7.9	3.0	1.082	1.068	1.062	4	7	9
010		5	12.0	8.5	5.5	1.072	1.067	1.060	3	5	6

Advanced Seedling Yield Trial

Twenty-nine cultivars were planted in a randomized replicated trial for yield and quality evaluation. Some plots required heavy roguing hence the yield data from these was not utilized. However, 14 selections exceeded the 400 cwt/A minimum requirement. Their performance is shown in Table 1. Before chipping the potatoes were held in 55° storage. Specific gravities and chip color of the later maturing cultivars was generally lower than previous years.

Cultivar	Total	Over 3 1/4"	1 7/8 to 3 1/4"	Below 1 7/8	Specific Gravity	Chip Color
503-14	690	374	296	19.5	1.064	5
711-8	639	195	421	23.0	1.064	7
709	523	203	312	8.0	1.072	8
321-55	519	39	441	39.0	1.095	3
645-1	504	47	402	55.0	1.084	7
706-1	488	19	434	35.0	1.071	3
613-7	480	285	164	31.0	1.069	4
321-89	472	12	398	62.0	1.115	3
637	464	00	448	16.0	1.082	9
623	461	168	281	12.0	1.069	5
706-34	437	234	187	16.0	1.068	7
Mer. 249	436	62	359	15.0	1.083	5
735-1	434	47	367	12.0	1.080	8
Mer. 58	425	23	390	19.5	1.067	7

MS 709 will be named and released as soon as sufficient seed is available. Its high yield early in the season, attractive appearance, and processing quality at harvest should prove useful in Michigan markets.

MS 711-8, a high yielding cultivar with very smooth attractive tubers which cook white will be considered for the tablestock market. Seed will be increased in 1973.

PLANT SPACING STUDIES

R. W. Chase
Department of Crop and Soil Sciences

Procedure

Two seedlings and three recently named varieties were evaluated in a uniform spacing trial. The identification numbers and names were MS-709, MS-711-3, Abnaki, Jewel, and Shurchip.

Planted: May 11, 1972

Fertilizer: Plowdown 0-0-60 at 200 lb/A

Planting time 14-14-14 + 2% Mg at 800 lb/A

Sidedress 115 lb N/A

Harvested: September 19, 1972

Cut seed of each was hand planted at row spacings of 34 inches and plant spacings within the row of 7, 10, 13 and 16 inches. Each plot was 10 feet long and replicated four times.

Results and Discussion

Table 1 gives a summary of yield, size distribution and specific gravity response for each of the varieties. All were very favorable in terms of yields with MS-709, Abnaki and Jewel showing exceptionally good yield potential. Without exception, the greatest total yield occurred at the 7 inch spacing, with decreasing yields at increasingly wider spacings.

The size distribution data shows that MS-709 and Abnaki do have a tendency to develop oversize tubers and for this reason a closer spacing of 7-8 inch would be important. To date there has been no evidence of hollow heart as a problem with MS-709, however, there has been some reported with the Abnaki. Based on these observations MS-709 and Abnaki should be spaced at a 7-8 inch plant spacing.

The 1972 data differed from that of 1971 in that the specific gravity readings did not relate to plant spacings. In 1971 the specific gravity readings for each of the seedlings MS-709, MS-503 and MS-711-3 was the lowest at the 16" spacing. In 1972 this occurred only with the Jewel variety.

The increased plant vigor and initial growth of the closer plant spacings is quite apparent during the early stages of growth. Later in the season when the rows are filled and vines begin to drop, this difference is less obvious.

Table 1. The yield, size distribution, and specific gravity of MS-709, MS-711-3, Abnaki, Jewel and Shurchip when grown at different plant spacings.

Variety	In-row space (inches)	Total cwt/A	Percent size distribution -1 7/8	+ 3 1/4	1 7/8 to 3 1/4	Specific Gravity
MS-709	7	582	2.3	40.0	57.7	1.067
	10	566	2.0	43.9	54.1	1.068
	13	498	2.4	47.8	49.8	1.065
	16	490	2.0	56.6	41.4	1.068
MS-711-3	7	426	7.8	6.4	85.8	1.074
	10	396	7.4	8.4	84.2	1.075
	13	395	5.0	7.9	87.1	1.078
	16	318	6.1	17.2	76.7	1.076
Abnaki	7	512	3.8	16.4	79.8	1.067
	10	440	3.1	24.0	72.9	1.067
	13	426	1.8	34.4	63.8	1.068
	16	396	2.5	35.5	62.0	1.067
Jewel	7	576	6.8	7.8	85.4	1.085
	10	544	4.7	4.7	90.6	1.083
	13	490	3.6	14.7	81.7	1.084
	16	446	4.8	16.7	78.5	1.081
Shurchip	7	480	6.5	5.7	87.8	1.061
	10	454	3.9	3.0	93.1	1.061
	13	434	6.3	8.9	84.8	1.062
	16	362	4.9	11.9	83.2	1.062

SOIL FERTILITY RESEARCH WITH POTATOES

M. L. Vitosh
Department of Crop and Soil Sciences

Five long term soil fertility experiments were initiated in 1967 when the Montcalm Experimental Farm was established. The zinc experiment was dropped from the study in 1970. Although there have been slight modifications over the years, this year's data represents the sixth and final year of these experiments.

The soil type at the Montcalm Experiment Farm has been classified as either McBride or Montcalm sandy loam. A detailed examination of the area, shows small scattered areas of other soil types. Since these small areas cannot be managed separately, no attempt has been made to make any adjustments for the variable soil type. Nevertheless the variability in soil type is responsible for some of the yield variation and may explain why some experiments require a rather large difference in yield for treatment differences to become statistically significant.

A fertilizer materials study conducted in 1971 was repeated this year. The soil test data and cultural practices are given at the bottom of Tables 1, 4, 7, 10 and 12. The potato yields obtained in 1972 were the largest recorded for these experiments since their initiation.

Source, Rate, and Time of Nitrogen Application

This experiment was established in 1967 on three different areas so that a three year rotation could be implemented. In 1969 and 1970, potatoes were preceded in the rotation by sweet corn. The last two years potatoes followed dent corn. The experimental design was a split plot with 10 whole plot treatments and two variety sub-plot treatments. The original experiment was modified in 1970 when several N treatments were changed to obtain yield data for higher N rates and to evaluate sulfur-coated urea, a slow release form of nitrogen.

Results of this year's study are presented in Table 1. Total yields for both varieties were more than doubled with 60 lb N/A as sulfur-coated urea (SCU) broadcast and plowed down prior to planting plus 60 lb N/A banded at planting. Yield increases beyond the 120 lb rate were not significant but some general trends were noted. Sidedress N generally gave larger yields than broadcast N. Broadcast applications on sandy soils prior to planting are generally inferior due to greater leaching losses. Leaching losses this past year were minimal due to a dry period immediately after planting. Sulfur-coated urea applied at the 120 lb N/A yielded slightly less than an equivalent amount of urea N, however, the opposite trend was observed when 180 lb N/A (SCU) was broadcast and plowed down. Maximum yield for both varieties was obtained with 60 lb N/A banded and 180 lb N/A sidedressed June 16 just prior to killing.

Specific gravity of the tubers was slightly reduced by the highest N rates. Previous yields at this location have not shown this decline, however many other investigators have shown that an excess of N can cause low specific gravity.

A summary of the data since 1970 (Table 2) shows that the Russet Burbank variety requires slightly higher rates of N fertilizer, when compared to other varieties, to obtain maximum yields. This is indicated by the lower relative yield of Russet Burbanks for the first two treatments (39% vs 41% and 85% vs 91% for Russet Burbank and Sebago, respectively). Slightly better yields of Russet Burbanks were obtained with sidedress N compared to broadcast N prior to planting. No differences due to time of application were found with the Sebago variety. Leaching losses were minimal the past three years under this system of management and did not appear to be a factor when more than 180 lb N/A was used. Sulfur-coated urea did not show any superior qualities as a source of N. Rates of less than 120 lb N/A (SCU) may be more efficient but yields would not be optimum. The four year average for specific gravity was not appreciably affected by any of the N treatments.

Potato petiole analysis for 1972 (Table 3) shows that the concentrations of Mg, Fe, Cu, Ba, Mn, Al and B were significantly affected by the N treatments. The N content was not significantly affected but higher rates of N generally gave higher N contents. Based on the last three years data, potato petioles should contain at least 2.7% N at 45-50 days after plant emergence and more than 2.3% N at 50-60 days after emergence for optimum yields. The K concentration of this year's petiole samples was extremely high. The values are above the normal detection range and may represent unrealistic values. Magnesium concentrations were considerably lower for treatments 1, 2, and 6 compared to most other treatments. Micronutrient concentrations were slightly higher in samples from the check plot. Higher concentrations of Fe, Al and Mn also tended to be associated with higher rates of N fertilizer. Increased acidity due to higher N rates may increase the uptake of these elements.

Potassium-Magnesium Study

Three different areas were set up in 1967 to evaluate rate and placement of K with potatoes, red kidney beans and field corn. In 1971 the experiment was changed to include four rates of K with and without Mg.

Results of this year's study are reported in Table 4. Total yield of both potato varieties was significantly increased with the first 60 lb K_2O/A. Additional broadcast K resulted in slightly larger yields but not enough to be statistically significant. Larger Russet Burbank yields were accompanied by a larger percentage of medium size tubers (1 7/8 in. up to 10 oz) and fewer small tubers (less than 1 7/8 in. diameter). Larger yields of Sebago were primarily due to larger tubers especially those over 3 1/4 in. diameter.

Magnesium fertilizer did not affect potato yield at any of the K rates. Specific gravity decreased with increasing rates of K. A decrease of .01 was obtained with 480 lb K_2O/A for both varieties.

A summary of the past two year's data (Table 5) shows that maximum yields were obtained with 60 lb K_2O/A plowed down and 60 lb K_2O banded at planting. Higher and lower rates generally resulted in less than maximum yields. The use of Mg was not beneficial with regard to yields or specific gravity. Specific gravity of both varieties has decreased at a rate of .001 per 50 lb K_2O when more than 180 lb K_2O/A has been applied.

Potato petiole analysis (Table 6) indicates that K, Ca, Mg, Al, Ba and B concentrations in the petioles were significantly affected by the K-Mg treatments. Potassium values are extremely high and may not be accurate because they are above the normal detection range for spectrographic analysis. Variations between samples, however, are expected to be real. Increasing rates of K resulted in higher concentrations of K and lower Ca and Mg. Magnesium fertilizer had the greatest influence on the Mg content of petioles at the lowest rates of K fertilizer. Increasing K fertilizer tended to lower the Al and B content while Ba was most closely associated with uptake of Mg. High uptake of Mg at low rates of K where Mg fertilizer was applied was related to decreased uptake of Ba.

Potassium Carrier Study

This experiment was initiated in 1967. It was discovered in 1969 and 1970 that potassium-magnesium sulfate was used in place of potassium sulfate. The data for this treatment in 1969 and 1970 should be ignored because the rate of K applied was not equal to that of the other sources.

Results of this year's study are shown in Table 7. Total yields were increased with all sources of K, especially for the Sebago variety. Potassium sulfate resulted in the largest yields for both varieties. Potassium chloride (muriate of potash) resulted in a lower percentage of Russet Burbank tubers over 10 oz. Specific gravity of the Russet Burbank variety was slightly lower in the potassium sulfate plots than all other sources. Potassium chloride gave the lowest specific gravity for the Sebago variety.

A four year summary is in Table 8. The four year averages show little or no effect of potassium sources on yield and specific gravity. All sources of K are equal.

Potato petiole analysis (Table 9) indicates that K, Ca, Mg, Al, Ba and Mn were significantly affected by the fertilizer treatments in 1972. All sources of K increased the K content and lowered Ca and Mg. Potassium nitrate caused the greatest decrease in Ca, Mg, Al and Mn content. Potassium sulfate accounted for the lowest Ba content while potassium chloride gave the highest Mn concentrations.

Nitrogen Carrier Study

The objective of this study was to evaluate five sources of N on yield and quality of potatoes. Prior to 1971 the N fertilizers were either applied as half plow down and half banded on all just prior to emergence. In 1971 and 1972, 20 lb N/A (ammonium nitrate) was banded on all treatments to eliminate early growth differences due to fertilizer placement. All sources except anhydrous ammonia were topdressed prior to emergence. Anhydrous ammonia was knifed in the same day.

Results of this year's study are reported in Table 10. A significant treatment by variety interaction occurred. Calcium nitrate resulted in a lower yield of Russet Burbank potatoes while ammonium sulfate and anhydrous ammonia gave lower yields for the Sebago variety. Anhydrous ammonia accounted for slightly lower specific gravity in the Russet Burbank variety. The nitrate sources (calcium nitrate and ammonium nitrate) had less effect on specific gravity of the Sebago variety than the ammonium sources.

The five year average shown in Table 11 indicates that calcium nitrate has been inferior for Russet Burbank. The fact that Russet Burbanks have a higher N requirement and that more N may have been leached from calcium nitrate plots than from the other N sources, may explain this interaction. Anhydrous ammonia has proven to be an excellent source of N fertilizer when applied preplant or sidedress. The five year average for specific gravity indicates that Russet Burbanks were not affected by the N sources while the nitrate sources reduced the specific gravity of the Sebago variety the most.

Fertilizer Materials Study

The fertilizer materials used in this study were liquid 10-34-0, an ammonium polyphosphate, 8-24-0, an ammonium ortho-phosphate, a 28% N solution, urea, ammonium nitrate, 15-62-0, a granulated ammonium polyphosphate, and 21-53-0, a granulated diammonium ortho-phosphate. Urea, ammonium nitrate and 28% N solution were mixed with the ortho- and polyphosphate materials to obtain a 1-2-0 ratio so that equal rates of N and P could be banded at planting time.

The yield, size and specific gravity data are given in Table 12. Total yield and specific gravity were not significantly affected by the treatments. The solid ortho-phosphate treatment had fewer medium size tubers (1 7/8 in. up to 10 oz.) and more off-type tubers compared to the other treatments. The treatments without P tended to yield less than those with P. No differences were observed when the liquid and solid or ortho and polyphosphate averages were compared. All materials were equally effective.

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				
Broad-cast	Band-ed	Side-dressed	Total	Total Yield	over 10 oz	1 7/8" to 10 oz	Less than 1 7/8"	Off Type	Sp. Gr.	Total Yield	over 3 1/4"	1 7/8" to 3 1/4"	Less than 1 7/8"	Sp. Gr.
- - - - - - lb N/A - - - - - - -				(cwt/A)	- - - - - - - - - - % - - - - - - -					(cwt/A)	- - - - - - - - - %- - - - - - -			
0	0	0	0	167	0	63	34	3	1.081	200	2	86	11	1.072
60 SCU	60 U	0	120	408	5	80	11	4	1.084	474	7	86	7	1.069
120 U	60 U	0	180	429	5	83	8	4	1.084	483	8	85	7	1.070
180 U	60 U	0	240	439	7	82	8	3	1.081	493	8	85	7	1.066
240 U	60 U	0	300	430	6	81	9	4	1.080	478	8	85	7	1.068
120 SCU	60 U	0	180	415	6	80	10	4	1.082	467	5	87	8	1.071
	60 U	120 U	180	435	5	81	8	5	1.082	472	8	85	7	1.068
0	60 U	180 U	240	449	9	78	8	5	1.082	514	9	84	6	1.068
0	60 U	240 U	300	448	7	81	7	5	1.080	497	10	83	6	1.066
180 SCU	60 U	0	240	465	8	80	8	4	1.080	503	10	83	6	1.066
LSD (.05) treatments within varieties				56	4	6	5	1	.004	56	4	NS	5	.004
LSD (.05) varieties within treatments				43	-	6	5	-	.003	43	-	6	5	.003

(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 16 prior to hilling.

Planted: May 9, 1972
Row spacing: 32 inches
Basic fertilizer: 0-150-200 banded at planting time
Irrigation: 5.0 inches
Soil test: pH = 6.6, P = 278, K = 198
Harvested: Sept. 27, 1972
Seed spacing: Russet Burbank = 14", Sebago = 10"
Previous crop: field corn
Harvest area: 266 sq. ft.

TABLE 2. Summary of yield and specific gravity data for the rate and time of nitrogen application study with potatoes -- 1970-72

N Application (a)				Russet Burbank			Sebago		
Broad-cast	Band-ed	Side-dressed	Total	Average Yield (cwt/A)	Relative Yield(b) (%)	Specific Gravity	Average Yield (cwt/A)	Relative Yield (5)	Specific Gravity
- - - - - - - lb N/A	- - - - - - -								
0	0	0	0	146	39	1.079	189	41	1.070
60 SCU	60 U	0	120	321	85	1.080	419	91	1.071
120 U	60 U	0	180	347	92	1.080	452	99	1.072
180 U	60 U	0	240	357	95	1.078	457	100	1.069
240 U	60 U	0	300	352	93	1.079	453	99	1.071
120 SCU	60 U	0	180	340	90	1.079	442	97	1.071
0	60 U	120 U	180	360	95	1.079	439	96	1.072
0	60 U	180 U	240	377	100	1.080	458	100	1.070
0	60 U	240 U	300	359	95	1.078	431	94	1.069
180 SCU	60 U	0	240	367	97	1.078	458	100	1.071

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

(b) Expressed as a percent of the maximum yield

TABLE 3. Effect of rate, source and time of nitrogen application on the elemental composition of potato petioles. (Russet Burbank and Sebago varieties sampled 7-14-72)

Treatment	Elements (b)										
No.(a)	N	P	K	Ca	Mg	Fe	Cu	Ba	Mn	Al	B
	------ % ------					------ ppm ------					
1	1.9	.45	17.67	.84	.40	91	26	87	58	175	26
2	2.7	.42	16.85	.70	.56	47	22	40	84	120	21
3	3.2	.36	14.51	.75	.77	25	20	34	77	120	17
4	3.3	.41	16.14	.88	.92	32	21	37	100	130	20
5	2.8	.38	16.02	.84	.78	46	20	42	117	135	20
6	2.7	.41	16.54	.75	.61	39	20	38	70	115	21
7	3.2	.37	15.41	.82	.74	57	20	38	71	115	19
8	2.8	.38	17.76	.90	.80	47	22	49	91	135	21
9	3.2	.36	14.53	.78	.74	29	20	38	95	120	18
10	3.2	.37	15.04	.82	.80	29	20	34	71	115	19
LSD (.05)	NS	NS	NS	NS	.22	32	2	10	23	30	3

(a) Treatments are the same as in the previous table.

(b) Other elements which were not significantly affected by the treatments in this experiment: Zn and Na.

TABLE 4. Effect of rate of potassium and magnesium on yield, size, and specific gravity of irrigated Russet Burbank and Sebago potatoes

Potassium-Magnesium (a) Application				Russet Burbank						Sebago				
Broad-cast	Band-ed	Broad-cast	Total	Total Yield	over 10 oz	1 7/8" to 10 oz	Less than 1 7/8"	Off Type	Sp. Gr.	Total Yield	over 3 1/4"	1 7/8" to 3 1/4"	Less than 1 7/8"	Sp. Gr.
--lb K_2O/A--		lb Mg/A	lb K_2O/A	(cwt/A)	- - - - - - - - % - - - - - - - - -					(cwt/A)	- - - - - - - - %- - - - - - -			
0	0	0	0	334	2	77	19	3	1.080	328	5	88	6	1.070
0	60	0	60	429	2	82	12	4	1.078	433	7	87	6	1.070
60	60	0	120	475	3	81	13	3	1.080	449	10	83	7	1.070
120	60	0	180	452	4	81	12	3	1.080	397	9	83	8	1.062
180	60	0	240	459	3	80	13	4	1.075	422	8	84	8	1.065
420	60	0	480	472	3	81	13	3	1.070	419	8	83	9	1.060
0	60	50	60	424	3	80	14	3	1.080	387	8	85	6	1.068
60	60	50	120	455	4	81	11	3	1.078	447	9	85	7	1.070
120	60	50	180	466	4	80	12	4	1.078	437	9	83	8	1.060
180	60	50	240	447	3	80	13	4	1.078	399	8	84	9	1.062
LSD (.05) treatments within varieties				51	NS	3	3	1	.005	51	3	3	3	.005
LSD (.05) varieties within treatments				39	2	3	2	-	.005	39	2	3	2	.005

(a) Potassium and magnesium sources were muriate of potash and epsom salts.

Planted: May 9, 1972
Row spacing: 32 inches
Basic fertilizer: 60-150-0, 180 lb N/A sidedressed June 17, 1972
Irrigation: 5.0 inches
Soil test: pH = 6.4, P = 276, K range = 124-214
Harvested: Sept. 28, 1972
Seed spacing: Russet Burbank = 10", Sebago = 10"
Previous crop: Sweet corn
Harvest area: 266 sq. ft.

TABLE 5. Summary of yield and specific gravity data for the potassium-magnesium study with potatoes 1971-72.

Potassium-Magnesium Application (a)				Russet Burbank			Sebago		
Broad-cast - -lb K_2O/A- -	Band-ed	Broad-cast lb Mg/A	Total lb K_2O/A	Average Yield cwt/A	Relative Yield(c) %	Specific Gravity	Average Yield cwt/A	Relative Yield(c) %	Specific Gravity
0	0	0	0	326	78	1.080	354	81	1.072
0	60	0	60	392	94	1.078	424	97	1.070
60	60	0	120	417	100	1.078	436	100	1.069
120	60	0	180	394	94	1.078	389	89	1.064
180	60	0	240	397	95	1.075	416	95	1.066
420	60	0	480	407	98	1.070	414	95	1.061
0	60	50	60	370	89	1.078	394	90	1.069
60	60	50	120	394	94	1.076	426	98	1.070
120	60	50	180	414	99	1.076	428	98	1.064
180	60	50	240	396	95	1.074	398	91	1.063
No Mg average (b)				400	100	1.077	416	100	1.067
Mg average (b)				394	98	1.076	411	99	1.066

(a) Potassium and magnesium sources were muriate of potash and epsom salts.

(b) Averages are of the four treatments with and without magnesium and having comparable rates of applied potassium.

(c) Expressed as a percent of the maximum yield.

TABLE 6. Effect of rate of potassium and magnesium on elemental composition of potato petioles. (Russet Burbank and Sebago varieties sampled 7-7-72)

Treatment No. (a)	Elements (b)							
	N	P	K	Ca	Mg	Al	Ba	B
	- - - - - -		%		- - - - - -	- - -	ppm	- - -
1	3.4	.48	7.10	.84	1.34	170	27	17
2	3.3	.49	13.11	.80	1.02	145	30	18
3	3.1	.42	13.95	.62	.66	120	28	16
4	2.8	.42	18.34	.72	.64	130	40	13
5	3.2	.42	20.08	.63	.53	110	39	15
6	3.1	.34	18.69	.54	.40	100	44	12
7	3.4	.46	13.63	.74	1.13	140	18	17
8	2.9	.40	13.29	.62	.81	125	22	15
9	3.2	.36	16.97	.58	.57	120	22	15
10	2.9	.41	22.56	.59	.54	110	26	16
LSD (.05)	NS	NS	3.6	.11	.19	22	9	3

(a) Treatments are the same as previous table.

(b) Other elements which were not significantly affected by the treatments in this experiment: Na, Cu, Zn, Fe, & Mn.

TABLE 7. Effects of different sources of potassium on yield, size, and specific gravity of irrigated Russet Burbank and Sebago potatoes

Source of Potassium (a)	Russet Burbank						Sebago				
	Total Yield (cwt/A)	over 10 oz	1 7/8" to 10 oz	Less than 1 7/8"	Off Type	Sp. Gr.	Total Yield (cwt/A)	over 3 1/4"	1 7/8" to 3 1/4"	Less than 1 7/8"	Sp. Gr.
		- - - - - - - -	%	- - - - - - - -				- - - - - - -	%	- - - - - -	
None	422	10	81	6	3	1.084	390	8	85	7	1.068
Potassium Chloride	451	9	81	6	3	1.080	469	9	84	6	1.062
Potassium Nitrate	465	11	80	5	3	1.080	474	9	85	6	1.064
Potassium Sulfate	471	12	79	7	3	1.078	488	10	85	6	1.066
Potassium Carbonate	462	13	78	6	3	1.080	459	8	84	7	1.065
LSD (.05) treatments within varieties	47	4	NS	2	NS	.002	47	NS	NS	NS	.002
LSD (.05) varieties within treatments	NS	3	4	1	-	.002	NS	3	4	1	.002

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

Planted: May 9, 1972
Row spacing: 32 inches
Basic fertilizer: 120-150-0, 93 lb N/A broadcast and plowed down prior to planting
Soil test: pH = 6.2, P = 394, K range = 214-252
Harvested: Oct. 3, 1972
Seed spacing: Burbank = 14", Sebago = 10"
Previous crop: Red clover
Harvest areas: 266 sq. ft.
Irrigation: 5.0 inches

TABLE 8. Summary of yield and specific gravity data for the potassium carrier study with potatoes 1967-68 and 1971-72

Source of potassium (a)	Russet Burbank Average Yield cwt/A	Russet Burbank Relative Yield(b) %	Russet Burbank Specific Gravity	Sebago Average Yield cwt/A	Sebago Relative Yield %	Sebago Specific Gravity
None	272	88	1.084	306	86	1.072
Potassium chloride	298	96	1.081	356	100	1.070
Potassium nitrate	303	98	1.082	356	100	1.071
Potassium sulfate	310	100	1.081	350	98	1.071
Potassium carbonate	302	97	1.081	348	98	1.070

(a) applied at rates of 150 lb K_2O/A in 1967-68 and 300 lb K_2O/A 1971-72

(b) expressed as a percent of the maximum yield

TABLE 9. Effect of potassium carriers on elemental composition of potato petioles (Russet Burbank and Sebago Varieties sampled 7-7-72)

Treatment No. (a)	N	P	K	Ca	Mg	Al	Ba	Mn
1	3.6	.29	7.80	1.03	1.50	165	63	112
2	3.4	.34	15.84	.78	.87	130	62	114
3	3.7	.30	13.93	.61	.68	110	46	51
4	3.3	.30	13.18	.73	.92	130	22	82
5	3.6	.30	14.44	.72	.82	125	54	67
LSD (.05)	NS	NS	3.53	.07	.14	11	24	39

Elements (b): N, P, K, Ca, Mg, Al, Ba, Mn

(a) Treatments are same as in previous table.

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

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				
	Total Yield (cwt/A)	over 10 oz	1 7/8" to 10 oz	Less than 1 7/8"	Off Type	Sp. Gr.	Total Yield (cwt/A)	over 3 1/4"	1 7/8" to 3 1/4"	Less than 1 7/8"	Sp. Gr.
		- - - - - - - -	%	- - - - - - - -				- - - - - - -	%	- - - - - - -	
Ammonium Sulfate (a)	440	6	81	8	5	1.078	452	8	86	6	1.064
Ammonium Nitrate (a)	444	4	82	9	5	1.079	506	7	87	6	1.067
Calcium Nitrate (a)	408	4	83	9	5	1.078	496	6	88	6	1.068
Urea (a)	441	5	81	9	6	1.080	483	5	88	7	1.065
Anhydrous Ammonia (b)	460	6	82	8	4	1.076	458	8	85	7	1.065
LSD (.05) treatments within varieties	40	NS	NS	NS	1	.003	40	3	3	NS	.003
LSD (.05) varieties within treatments	32	2	3	2	-	.002	32	2	3	2	.002

(a) 180 lb N/A was top dressed May 23, 1972 just prior to emergence
(b) 180 lb N/A was knifed in May 23, 1972 just prior to emergence

Planted: May 9, 1972
Row spacing: 32 inches
Basic fertilizer: 20-150-200, banded 2 inches to side and 2 inches below seed piece
Irrigation: 5.0 inches
Soil test: pH = 6.6, P = 292, K = 224
Harvested: Oct. 3, 1972
Seed spacing: Russet Burbank = 14", Sebago = 10"
Previous crop: Sweet corn
Harvest area: 266 sq. ft.

TABLE 11. Summary of yield and specific gravity data for the nitrogen carrier study with potatoes 1968-1972

Source of nitrogen (a)	Russet Burbank			Sebago		
	Average Yield cwt/A	Relative Yield(b) %	Specific Gravity	Average Yield cwt/A	Relative Yield %	Specific Gravity
Ammonium sulfate	325	98	1.077	367	93	1.069
Ammonium nitrate	321	96	1.077	379	96	1.071
Calcium nitrate	293	88	1.077	376	96	1.072
Urea	321	96	1.077	393	100	1.070
Anhydrous ammonia	333	100	1.077	383	97	1.070

(a) applied at a rate of 180 lb N/A

(b) expressed as a percent of the maximum yield

TABLE 12. The effect of liquid, solid, poly and ortho-phosphate fertilizers on yield, size and specific gravity of irrigated Russet Burbank potatoes (Montcalm Experimental Farm).

Treatment	Rate $N-P_2O_5-K_2O$	Total Yield	Over 10 oz	1 7/8" to 10 oz	Less than 1 7/8"	Off type	Specific Gravity
	---lb/A---	cwt/A	- - - - - - - - % - - - - - - - - -				
1 N (Liquid)	50-0-0	385	2	85	7	6	1.076
2 N (Solid)	50-0-0	383	5	83	6	6	1.080
3 N + Poly-P (Liquid)	50-100-0	409	3	85	7	5	1.080
4 N + Poly-P (Solid)	50-100-0	416	5	80	8	7	1.079
5 N + Ortho (Liquid)	50-100-0	420	4	83	7	5	1.080
6 N + Ortho (Solid)	50-100-0	405	5	79	7	9	1.081
LSD (.05) Treatments		NS	NS	4	NS	3	NS
Liquid average (a)		405	3	85	7	5	1.079
Dry average (a)		401	5	81	7	7	1.080
Polyphosphate average (b)		412	4	82	8	6	1.080
Orthophosphate average (b)		412	4	82	7	7	1.080

(a) These are the averages of the three liquid and solid fertilizer treatments.

(b) These are the averages of the two poly and ortho-phosphate treatments.

Planted: May 8, 1972
Row spacing: 34 inches
Broadcast fertilizer: 0-0-180
Sidedress N: 150 lb N/A June 17, 1972
Irrigation: 5.0 inches
Soil tests: pH = 5.7, P = 324, K = 228 lb/A
Harvested: October 2, 1972
Seed spacing: 14 inches
Harvest area: 283 sq. ft.

VARIETY STAGE OF GROWTH STUDY IN POTATOES WITH SENCOR-1972 (METRIBUZIN)

J. S. Ladlie, W. F. Meggitt and R. C. Bond
Department of Crop and Soil Sciences

Four varieties of potatoes (709, Onaway, Sebago, Russet Burbank) were planted May 11 on sand clay loam (organic matter 1.2%) Montcalm County, Michigan. The plots were 10 x 47 ft in a randomized complete block design with three replications. The study was divided into two ranges, with two varieties in each range. Two rows of each variety were planted in each plot in the range. 709, Onaway in the east range and Sebago and Russet Burbank in the west range. The study was designed to learn the effect of time of postemergence applications of metribuzin on: crop injury, flowering and row fill, lodging, degree of vine kill, yield, and weed control on four varieties of potatoes. Three stages of postemergence applications were used on all four varieties. The height of the potatoes at these stages of postemergence application were: A = 0-4", June 7; B = 4-10", June 16; and C = 14" , June 22. The same treatments were applied at A, B and C stages of growth. Preemergence treatments were all applied May 23. Preemergence, postemergence and split applications of preemergence and postemergence were compared in the study. Treatments were applied with a tractor mounted sprayer delivering 23 gpa. Rainfall was .03 inch 10 days after preemergence application.

The major weeds present were: pigweed, lambsquarter and barnyardgrass. Weed heights at the time of postemergence applications were: A = broadleaf 3", grass 3"; B = broadleaf 6-8", grass 5-7"; C = broadleaf 15-24", grass 8-12". Soil surface and air temperatures at the time of postemergence applications were: A = 120°F, 88°F; B = 60°F, 60°F; C = 77°F, 82°F respectively.

Crop injury was rated on June 23. Yellowing and necrosis of the leaf margin was evaluated on a 0-10 basis. Preemergence treatments of metribuzin gave only slight injury at the 2 lb/A rate. Onaway indicated the most injury with a rating of 13%. In the split applications and postemergence treatments alone only the A and B stages of application were rated. The C stage had been sprayed only the day before the rating and did not justify an evaluation. The B stage of postemergence application created more crop injury than the A stage of the same treatment. This was true for both split applications and the postemergence alone. Again Onaway received the high injury rating of the four potato varieties.

Flowering and degree of row fill was rated on July 6. The evaluation was on a 0 to 3 basis with 0 representing good blossoming and rows completely filled and 3 indicating no blossoms or row not completely filled. Preemergence treatments on all four varieties indicated good blossoming and row fill. The B stage of postemergence application again received the higher ratings. This was followed by C stage and then A stage indicated the least amount of flowering or row fill delay. Of the four varieties of potatoes the Onaway showed the most severe delay in blossoming and row fill. The oil concentrate added to the 1/2 lb/A postemergence treatments increased the ratings only slightly at the C stage of application. This is in comparison with the 1/2 lb/A postemergence without oil concentrate.

The degree of lodging and row fill was rated on July 27, 1972. Ratings were made on an 0-3 basis. 0 indicated no lodging and complete row fill and 3, lodging with rows not completely filled. The preemergence treatments of 1/2, 1, and 2 lb/A were about even in the ratings received for all four varieties in comparison to each other. A stage of postemergence application again received the lowest rating. C and B stages of application were close in their evaluations with B stage still indicating the high rating in most cases. The four potato varieties showed less difference in the ratings for any given treatment. The 709 or Onaway received the highest ratings for lodging and row fill.

The rating for degree of vine killing before the actual vine killing application was made on two separate dates, because of differences in maturity. The 709 and Onaways were rated August 28 and Sebago and Russet Burbanks, September 13. 0 indicated that the vines were all gree and a rating of 10 represented vines completely dead. The preemergence applications had a higher degree of vine kill than the split applications or postemergence applications alone. This would indicate a delay in the amount of vine kill received for postemergence applications at the same rate as preemergence. The A, B, C stages of application showed very little difference with no one stage or rate of herbicide indicating a high degree of vine kill over the other. Differences in varieties in percent of vine kill recorded may be due to the differences in maturity of the four varieties. The no treatment check had a large percentage of vine kill because of the weed pressure.

Weed control was rated July 12 on 0-10 basis. Ninety-six percent or more control was obtained on the broadleaf and grass species for all treatments, except the C stage of postemergence application. The potatoes provided a protective canopy from the postemergence spray for the weeds at the C stage of application. The weeds which were missed are the cause of lower ratings for the C stage. Generally split applications of metribuzin will give you better grass control. Although in this study preemergence treatment gave excellent control of broadleaf and grass species. Rating the stages of postemergence applications as to weed control: A, B and C stage, respectfully with A stage generally giving the best and C the least weed control. The oil concentrate added to the 1/2 lb/A postemergence application did not significantly increase the weed control compared to the treatment without the oil concentrate. For preemergence, postemergence split applications, there was little difference between the three stages in weed control. Split applications would be preferred over single preemergence or postemergence applications. This study brought out several factors to be considered when using metribuzin for weed control on potatoes. Varieties of potatoes do respond differently to applications of metribuzin. Split applications of metribuzin will give more complete and satisfactory weed control.

Postemergence applications should be made before the potatoes are 4 inches in height or after they reach a height of 14 inches or more. The B stage of postemergence applications (8 to 10") is at the time of bud formation. This seems to damage and set back the potatoes more at this critical bud formation stage. Postemergence alone at the C stage of application will miss some of the weeds due to the canopy cover at this stage of growth. Although split applications with the post-emergence application coming at the C stage of growth gave good weed control. The ideal application of metribuzin would be to apply the split application of 1/2 + 1/2 lb/A at the A and C stages. The first treatment would be a preemergence and postemergence application because the weeds would have grown to 1 inch height by this time, then if necessary come back at the C stage with another 1/2 lb/A postemergence.

Table 1. Variety Stage of Growth Study in Potatoes with Sencor. Montcalm Co., 1972

Planted: May 11, 1972
Treated: Pre - May 23, 1972
Rated: Stage A Post June 7, 1972
" B " June 16, 1972
" C " June 22, 1972

Variety: 709, Onaway, Sebago, Russet Burbank
Soil Type: Sand clay loam
Organic Matter: 1.2%

Harvest Date: 709 & Onaway, Sept. 6, 1972
Sebago & Russet Burbank, Sept. 21, 1972

Weeds present: pigweed, lambsquarter, barnyard grass

Pertinent information: Height of potatoes at the three stages of postemergence application:
A = 0-4.0"; B = 8.0 - 10.0"; C = 15.0">

			Crop Injury[1]				Flowering & Row Fill[2]				Lodging & Row Fill[3]			
Trmt.		Rate	6/23/72				7/6/72				7/27/72			
No.	Treatment	lb/A	709	Ona.	Seb.	R.B.	709	Ona.	Seb.	R.B.	709	Ona.	Seb.	R.B.
1	Sencor - Pre	1/2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.0	1.0	0.7
2	Sencor - Pre	1	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	1.7	1.3	1.0	0.7
3	Sencor - Pre	2	0.3	1.3	0.3	0.0	0.0	0.0	0.0	0.0	1.3	1.3	0.7	0.7
4	A Sencor - Pre & Post	1/2+1/2	0.0	2.0	1.3	1.0	0.0	0.0	0.0	0.0	0.7	0.3	0.3	0.7
5	B Sencor - Pre & Post	1/2+1/2	0.3	3.0	1.3	1.7	0.0	1.3	0.3	1.3	1.0	1.3	1.0	0.0
6	C Sencor - Pre & Post	1/2+1/2	--	--	--	--	0.0	0.3	0.0	0.7	0.7	1.0	0.3	0.3
7	A Sencor - Pre & Post	1+1	0.7	2.7	1.3	1.0	0.0	0.7	0.0	1.3	0.3	0.3	1.0	0.3
8	B Sencor - Pre & Post	1+1	2.7	5.7	3.7	4.0	0.7	2.7	1.0	2.3	0.7	1.0	0.7	0.0
9	C Sencor - Pre & Post	1+1	--	--	--	--	0.0	2.0	0.7	1.0	1.3	0.7	0.7	0.3
10	A Sencor - Post	1/2	1.0	2.7	1.3	1.0	0.0	0.0	0.0	0.0	1.0	0.7	0.7	0.3
11	B Sencor - Post	1/2	0.7	3.3	1.7	1.7	0.3	1.3	1.0	1.3	1.3	1.3	1.0	0.3
12	C Sencor - Post	1/2	--	--	--	--	0.7	1.3	0.0	1.0	0.7	0.3	1.0	1.3
13	A Sencor - Post	1	1.0	3.7	1.0	1.0	0.0	1.7	0.3	0.3	1.3	0.7	0.7	0.3
14	B Sencor - Post	1	2.3	5.0	3.7	2.7	0.3	3.0	1.7	2.3	1.7	1.7	0.7	0.3
15	C Sencor - Post	1	--	--	--	--	0.7	2.0	0.7	0.7	0.7	0.3	0.7	0.3

Table 1. Continued

Trmt. No.	Treatment	Rate lb/A	Crop Injury[1] 6/23/72 709	Ona.	Seb.	R.B.	Flowering & Row Fill[2] 7/6/72 709	Ona.	Seb.	R.B.	Lodging & Row Fill[3] 7/27/72 709	Ona.	Seb.	R.B.
16	A Sencor+Oil Conc.-Post	1/2+1 qt	1.3	3.7	0.7	0.7	0.0	0.0	0.0	0.0	0.7	0.3	0.7	0.3
17	B Sencor+Oil Conc.-Post	1/2+1 qt	1.7	4.0	1.3	1.3	0.3	1.3	1.0	1.3	0.3	0.3	1.0	0.7
18	C Sencor+Oil Conc.-Post	1/2+1 qt	--	--	--	--	0.7	2.0	1.3	1.3	1.7	1.7	0.7	0.3
19	Check - weed free	-	0.0	0.0	0.0	0.0	0.7	0.7	0.0	0.3	0.0	0.0	0.0	0.0
20	Check - no treatment	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

[1]Rated June 23, 1972 for crop injury and weed control - 0 - No injury; 10 - Complete kill/complete control

[2]Rated July 6, 1972 - 0 = good blossoming and rows filled; 3 = no blossoms and rows not filled

[3]Rated July 27, 1972 - Rated on: Degree of lodging and row fill
0 = no lodging and complete row fill; 3 = lodging and rows not complete filled

Table 1. Continued

Trmt. No.	Treatment	Rate lb/A	Degree of Vine Kill[4] 709	Ona.	Seb.	R.B.	Weed Control Evaluations[5] Bd. Lv.	Grass
1	Sencor - Pre	1/2	4.7	8.3	5.0	4.3	9.7	9.7
2	Sencor - Pre	1	3.7	7.3	5.7	5.0	10.0	10.0
3	Sencor - Pre	2	5.3	8.7	5.7	5.3	10.0	10.0
4	A Sencor - Pre & Post	1/2+1/2	3.7	6.0	6.3	5.0	10.0	9.7
5	B Sencor - Pre & Post	1/2+1/2	3.3	6.0	5.3	4.7	10.0	10.0
6	C Sencor - Pre & Post	1/2+1/2	2.7	6.0	5.0	4.3	10.0	9.8
7	A Sencor - Pre & Post	1+1	2.7	5.3	4.7	4.7	10.0	10.0
8	B Sencor - Pre & Post	1+1	2.7	4.7	3.7	3.7	10.0	10.0
9	C Sencor - Pre & Post	1+1	3.0	6.3	4.7	3.7	10.0	10.0
10	A Sencor - Post	1/2	3.7	6.3	4.0	3.7	10.0	9.6
11	B Sencor - Post	1/2	4.7	6.3	4.0	4.0	9.8	9.6
12	C Sencor - Post	1/2	3.7	7.0	4.0	3.3	8.0	9.6
13	A Sencor - Post	1	3.7	6.0	5.3	4.3	10.0	10.0
14	B Sencor - Post	1	2.7	4.0	4.7	3.0	9.8	10.0
15	C Sencor - Post	1	3.0	5.7	4.3	3.3	8.3	9.8
16	A Sencor+Oil Conc.-Post	1/2+1 qt	3.0	5.7	5.0	4.0	10.0	9.8
17	B Sencor+Oil Conc.-Post	1/2+1 qt	3.7	6.0	4.0	4.0	10.0	9.7
18	C Sencor+Oil Conc.-Post	1/2+1 qt	4.0	7.0	4.3	4.0	8.0	8.8
19	Check - weed free	-	6.3	7.0	4.0	4.0	10.0	10.0
20	Check - no treatment	-	9.7	9.7	7.3	7.7	0.0	0.0

[4]Rated for degree of vine killing before actual vine killing application.
Vine kill evaluation dates: 709 and Onaway, August 28; Sebago and Russet Burbanks, Sept. 13, 1972

0 - Vines all green; 10 - vines completely dead

[5]Rated July 12, 1972 -- 0 - No control; 10 - Complete control

Weed Control Evaluations in Potatoes on Mineral Soil

J. S. Ladlie, W. F. Meggitt and R. C. Bond

Russet Burbank potatoes were planted May 11 on a sandy clay loam (organic matter 1.2%), Montcalm County, Michigan. The plots were 10 x 50 ft in a randomized complete block design with three replications. The preemergence treatments were applied May 23 and the postemergence treatments June 7. Treatments were applied with a tractor mounted sprayer delivering 23 gpa. Rainfall was .03 inch on the sandy clay loam within 10 days after application. The surface temperature at the time of postemergence application was 120°F and the air temperature 88°F. The Russet Burbank potatoes were 4-6 inches with the broadleafs and grass being 3-4 inches in height at the time of postemergence application. The major weeds present were pigweed, lambsquarter, barnyard grass and crabgrass. The plots were visually rated on June 23.

The preemergence and postemergence herbicide treatments all gave 90% or more control of the broadleaf weeds except: U-27,267, 3 and 4 lb/A and Gulf S-6044, 2 lb/A. The control of grass was 80% or more for all treatments with the exception of these treatments: metribuzin 1/2 lb/A; U-27, 267, 3 and 4 lb/A and Gulf S-6044. The best overall preemergence treatments were linuron, 2 lb/A; chlorobromuran, 2 lb/A; alachlor + dinoseb, 2 + 4 1/2 lb/A; metribuzin, 1 lb/A and metribuzin + alachlor, 1/2 + 2 lb/A, all of which controlled 89-100% of both the broadleaf and grass species. Metribuzin gives satisfactory broadleaf weed control at 1/2 lb/A, but is weak on grass with only a preemergence application. Metribuzin as a split preemergence and postemergence treatment at 1/2, 3/4 lb/A preemergence and 1/2, 3/4 lb/A postemergence controlled 98-100% of the total weed population. Oil or oil concentrates added to the postemergence treatments of metribuzin did increase the grass control received. Crop injury was not at a high enough level on any of the treatment to cause concern.

Table 2. Preemergence and Postemergence Weed Control Evaluations in Potatoes on Mineral Soil, Montcalm Co., 1972.

Planted: May 11, 1972
Treated: Pre - May 23, 1972; Post - June 7, 1972
Rated: June 23, 1972

Variety: Burbanks
Soil Type: Sandy clay loam
Organic Matter: 1.21%

Weeds present: lambsquarter, pigweed, barnyard grass, crabgrass

Trmt. No.		PRE Treatment	Rate lb/A	PRE Trmt.	Rate lb/A	POST Trmt.	Rate lb/A	INJURY Burbanks	Weed Control Rating Bd. Lv.	Weed Control Rating Grasses
1		Lorox	2					0.0	10.0	9.8
2		Patoran	2					0.0	9.9	8.0
3		Maloran	2					0.7	10.0	9.0
4	X	Lasso	2	DNBP	4 1/2			0.7	9.7	9.0
5		Sencor	1/2					0.0	9.8	7.2
6		Sencor	1					0.0	9.8	8.9
7		Sencor	1/2			Sencor	1/2	1.0	10.0	9.8
8		Sencor	3/4			Sencor	1/4	0.3	10.0	9.0
9		Sencor	3/4			Sencor	3/4	1.3	10.0	9.9
10						Sencor	1/2	2.0	10.0	8.3
11						Sencor	1	2.0	10.0	9.2
12						Sencor+Oil Conc.	1/2+1 qt	1.7	9.8	8.3
13		Sencor	1/2			Sencor+Oil Conc.	1/2+1 qt	1.3	10.0	9.8
14						Sencor+Oil	1/2+1 gal	1.3	9.7	8.2
15		Sencor	1/2			Sencor+Oil	1/2+1 gal	0.7	10.0	10.0
16	X	Sencor	1/2	Lasso	2			0.0	10.0	8.9
17		U-27,267	3					0.0	0.7	0.0
18		"	4					0.0	0.0	0.0
19		Gulf S-6044	2					0.7	6.0	7.5
20		"	4					0.0	10.0	9.8

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

X = Tank mix

Vine Killing Evaluation in Potatoes in 1972

J. S. Ladlie, W. F. Meggitt, R. W. Chase and R.C. Bond

Postemergence vine killing treatments were applied to Russet Burbank potatoes in Montcalm County, Michigan. The potatoes were planted May 11, with the treatments being applied September 15. The treatments were evaluated on September 21. The plots were 10' by 30' in a randomized complete block design with three replications.

Treatments were applied with a tractor mounted sprayer using flood nozzels delivering 50 gpa. The air temperature at the time of application was 70°F.

Des-I-Cate, 1 1/2 gal and Des-I-Cate + oil, 1 1/2 + 1 gal/A gave 100% vine kill. Paraquat + X-77, 2 pts + 1 pt/A remained high on the list of effective vine killing compounds with 97% vine kill. The remaining treatments were below 90% with exception of Dinoseb, 2 pts with 90% vine kill. Dinoseb at 1 1/2 pts/A gave 73% vine kill with a slight increase in the amount of vine kill with one of these adjuvants. Oil, 1 gal; Agri-Oil Plus, 1 pt; Fomex, 1 qt; Fomark, 1 qt; and X-77, 1 pt. All of the adjuvants listed were about equal in increasing phytotoxicity of Dinoseb.

Table 3. Vine Killing Evaluations in Potatoes, Montcalm Co., 1972.

Planted: May 11, 1972
Treated: September 15, 1972
Rated: September 21, 1972

Variety: Russet Burbanks
Soil Type: Sandy clay loam
Organic Matter: 1.21%
Air Temp.: 70°F

Trmt. No.	Treatment	Rate lb/A	Vine Kill Sept. 21, 1972
1	Des-I-Cate	1 1/2 gal	10.0
2	Des-I-Cate + Oil	1 1/2 gal + 1 gal	10.0
3	Evik	2.4 lbs	8.0
4	Evik + Oil	2.4 lbs + 1 gal	7.7
5	Evik + Oil	2.0 lbs + 1 gal	7.0
6	Paraquat + X-77	2 pts + 1 pt	9.7
7	General	1 1/2 qt	7.3
8	General + Oil	1 1/2 qt + 1 gal	8.7
9	General + Agri-Oil Plus	1 1/2 qt + 1 qt	8.7
10	General + Fomex	1 1/2 qt + 1 qt	8.2
11	General + Fomark	1 1/2 qt + 1 qt	8.0
12	General + X-77	1 1/2 qt + 1 pt	8.3
13	General	2 qt	9.0
14	Premerge	4 qts	8.7
15	Check	---	5.0

0 - No vine killing; 10 - Complete vine killing

INSECTICIDE EVALUATION FOR PEST MANAGEMENT OF POTATOES

Arthur L. Wells,
Department of Entomology

The entomological research on potatoes at the Montcalm Experimental Farm consisted of the evaluation of several new insecticides for potential use in the management of foliar insects. These consisted of fifteen treatments using soil systemics and seven treatments using foliar applications compared to untreated check plots. An additional study was conducted at the Muck Experimental Farm to evaluate certain combinations of systemic and foliar insecticides of potatoes. A brief report on the demonstration plots at the Meyer farm in Bay County is also included.

A. Evaluation of Soil Systemic and Foliar Insecticides

Procedure

Six soil systemic insecticides applied alone or in combinations with other materials were evaluated for their effectiveness in potato insect control programs. These were applied in row with the seed or in a band each side and below the seed (Split Band) at the time of planting. Prior to hilling on June 15 certain treatments received an additional sidedressed application of three different materials. Russet Burbank and Norchip seed planted at 12 inch spacings were used in the study. The plots consisted of three replications of four 50 foot rows (two rows of each variety). Two replicated untreated plots were included in the study for comparison. A recommended fertilizer, herbicide and fungicide program was followed in all plots.

Seven foliar insecticides and an untreated check were compared on an adjacent range for their value against potato insects. The plot layout and agronomic practices were the same as in the systemic study except that these received foliar applications only. The applications were made with a CO_2

powered sprayer delivering 80 gallons per acre on June 26, July 21, August 10 and 22. Insect populations were evaluated on July 11, 21, August 10 and 30 by either sampling the leaves of each variety or with an insect net (10 sweeps per plot). The list of treatments and insect data from the plots are summarized in Table 1.

The inside row of each variety on all the plots were harvested on September 19-22 and yield and size distribution of the tubers were determined. Specific gravities of the tubers from each plot were taken approximately six weeks after harvest. These data are presented in Table 2.

Results

The cool temperatures and adequate rainfall during the early part of the growing season was ideal for activating the systemic insecticides. This is reflected by the almost complete protection from flea beetles and potato leaf-hopper populations. The same conditions which resulted in movement of the systemic treatments into the foliage acted as a deterrant for early aphid migration and establishment in the plots during the period of evaluation. The sidedressing applications did not increase the insecticidal protection afforded by the planting time treatments.

The foliar treatments were not adequately timed to evaluate against the second brood flea beetles (the last week of July) however the early treatments were effective against leafhoppers. It is very difficult to evaluate such low populations of aphids with a sweep net. Cutworm damage to the Norchip tubers were noted at harvest with less than one percent of the tubers (by weight) being damaged in any of the plots. The damage to the Burbanks was too low to evaluate.

All of the insecticide treatments gave higher yields than did the adjacent untreated plots. The differences were greater in the longer season Burbanks

Table 1. The effects of soil systemic and foliar insecticides on foliar insect populations

Material and Formulation	Lbs. Tox./A.	Placement*	Potato Flea Beetles			Potato Leafhopper: Nymphs/ 9 leaves		Potato Leafhopper: Adults/30 sweeps			Aphids			
			July		Aug			July		Aug	July		Aug	
			11	21	10	Burb	Norc	11	21	10	11	21	10	30
Soil Systemics														
Amer Cy 92100 15% Gran	3 lb	Split B	0	0	5	0	0	1	1	2	5	10	23	75
Amer Cy 92100 15% Gran	3 lb	Split B												
	+ 2 lb	Side Dr	0	0	1	0	0	1	1	1	6	16	21	73
Thimet 15% Gran	3 lb	Split B	0	0	0	0	0	0	4	1	8	10	11	64
Thimet 15% Gran	3 lb	Split B												
+ Am Cy 92100 15% Gran	2 lb	Side Dr	0	0	1	0	1	0	1	0	5	4	5	73
Di Sham 15647 10% Gran	1 1/2 lb	In-row	0	0	6	0	0	0	1	0	0	3	8	48
Di Sham 15647 10% Gran	3 lb	In-row	0	0	4	0	0	0	1	1	3	4	2	48
Temik 10% Gran	3 lb	In-row	0	1	4	0	0	1	0	0	3	6	5	17
Furadan 10% Gran	3 lb	In-row	0	0	5	0	0	2	8	0	26	52	9	27
Furadan 10% Gran	3 lb	In-row												
	+ 2 lb	Side Dr	0	1	3	0	0	0	4	1	30	51	30	48
Furadan 10% Gran	3 lb	In-row												
+ Disyston 15% Gran	2 lb	Side Dr	0	0	0	0	0	2	3	0	10	9	4	55
Furadan 4 Flow	3 lb	In-row	0	1	3	0	0	1	2	2	12	35	25	65
Disyston 15% Gran	3 lb	In-row	1	3	3	0	0	3	6	0	3	7	13	45
Disyston 15% Gran	3 lb	In-row												
	+ 2 lb	Side Dr	1	0	2	0	0	5	6	4	5	5	4	67
Disyston 15% Gran	3 lb	In-row												
	+ 3 lb	Side Dr	0	0	8	0	0	6	9	1	1	1	0	82
Untreated	--	--	3	40	170	65	56	29	402	13	32	80	26	82
Foliars														
Meta-Systox-R & SC	1/2 lb		0	10	142	0	0	2	4	1	2	17	3	48
Thiodan 2 EC	1/2 lb		0	5	301	1	0	8	56	10	0	26	24	29
Lannate 90 WDP	1/2 lb		0	4	306	4	5	5	84	9	4	49	27	44
Monitor 4 SC	1/2 lb		0	2	350	0	0	9	48	24	2	18	34	44
Furadan 4 Flow	1/2 lb		0	4	258	0	0	4	24	11	8	122	31	57
Azodrin 3.2 EC	.8 lb		0	10	245	0	0	4	18	14	3	6	17	63
Zolone 3 EC	3/4 lb		0	5	302	0	0	3	35	10	1	17	36	49
Untreated	--		0	10	278	53	36	14	359	16	7	162	15	73

* Soil treatments based on 34" rows (15,390 row-ft./A.); In-row--applied in 4" band on seed; Split band--applied in band below and each side of seed; Sidedress--applied on side of plant rows on June 15 prior to hilling; Foliars--applied in water with CO_2 sprayer at 80 gal/A. on June 26, July 21, Aug. 10 and 22, 1972.

** Numbers per 30 sweeps.

Table 2. The effects of soil systemic and foliar insecticides on potato yield, size and specific gravity.

Material & Formulation	Lbs. Tox./A.	Placement	Norchip					Russet Burbank					
				Size					Size				
			Cwt./A.	to 1 7/8"	1 7/8" to 3 1/4"	3 1/4"+	Sp. Gr.	Cwt./A.	to 1 7/8"	1 7/8" to 3 1/4"	+ 10 oz.	Off-type	Sp. Gr.
Soil Systemics													
Amer Cy 92100 15% Gran	3 lb	Split B	362	7%	87%	6%	1.076	504	7%	76%	11%	6%	1.082
Amer Cy 92100 15% Gran	3 lb	Split B											
	+ 2 lb	Side Dr	364	6	87	7	1.076	515	8	75	10	7	1.081
Thimet 15% Gran	3 lb	Split B	356	7	88	5	1.075	462	6	80	9	5	1.081
Thimet 15% Gran	3 lb	Split B											
+ Am Cy 92100 15% Gran	2 lb	Side Dr	329	6	89	5	1.076	421	7	74	9	10	1.082
Di Sham 15647 10% Gran	1 1/2 lb	In-row	355	7	86	7	1.077	460	9	74	10	6	1.082
Di Sham 15647 10% Gran	3 lb	In-row	338	6	86	8	1.075	428	8	78	8	6	1.082
Temik 10% Gran	3 lb	In-row	373	7	85	8	1.074	491	7	76	10	7	1.082
Furadan 10% Gran	3 lb	In-row	379	6	90	4	1.076	453	9	77	8	6	1.082
Furadan 10% Gran	3 lb	In-row											
	+ 2 lb	Side Dr	364	6	86	8	1.075	474	8	76	7	9	1.079
Furadan 10% Gran	3 lb	In-row											
+ Disyston 15% Gran	2 lb	Side Dr	353	6	89	5	1.077	463	9	74	9	8	1.081
Furadan 4 Flow	3 lb	In-row	364	6	89	5	1.077	495	8	72	10	10	1.079
Disyston 15% Gran	3 lb	In-row	345	8	87	5	1.076	456	8	80	9	3	1.083
Disyston 15% Gran	3 lb	In-row											
	+ 2 lb	Side Dr	350	6	89	5	1.077	457	6	80	10	4	1.085
Disyston 15% Gran	3 lb	In-row											
	+ 3 lb	Side Dr	338	6	90	4	1.078	437	6	82	8	4	1.085
Untreated	--	--	263	10	88	2	1.073	309	12	80	4	4	1.077
Foliars													
Meta-Syston-R 2SC	1/2 lb		352	9	88	3	1.075	440	11	70	10	9	1.079
Thiodan 2 EC	1/2 lb		349	9	89	2	1.077	448	10	71	12	7	1.080
Lannate 90 WDP	1/2 lb		361	8	89	3	1.074	436	9	71	8	12	1.078
Monitor 4 SC	1/2 lb		342	8	89	3	1.076	445	9	72	11	8	1.079
Furadan 4 Flow	1/2 lb		352	10	86	4	1.074	438	8	69	14	9	1.078
Azodrin 3.2 EC	.8 lb		321	9	88	3	1.077	436	9	72	10	9	1.080
Zolone 3EC	3/4 lb		340	7	90	3	1.075	435	10	74	7	9	1.077
Untreated	--		285	15	85	-	1.073	355	12	75	6	7	1.075

than in the Norchips. The high percentage of Size A tubers (1 7/8" and up) could be attributed to the excellent growing conditions through the growing season. The specific gravities of the tubers from the treated plots of both varieties appear higher than the untreated controls.

B. Insecticide Evaluation at the Muck Experimental Farm

Procedure

Eight treatments including a soil systemic alone or in combination with foliar insecticides were evaluated for the control of foliar feeding insects. The treatments were randomized in three replications of paired 25 foot rows using whole Sebago seed. The plots were plnated on May 19 with the soil systemic applied in the row with the seed and the foliars applied with a CO_2 powered sprayer. Two plots received a sidedress application of Disyston granules on June 27. Foliar applications were made on July 6, 20, August 10 and 29. Insect populations were sampled on July 6, 20, August 9, 17, 29, September 1 and 5 and are summarized in Table 3. Yields and size distribution of the tubers were determined at harvest on October 19. The data along with the specific gravities of each tuber sample are presented in Table 4.

Results

The heavy rainfall and cool temperatures early in the growing season resulted in excellent vine growth and thus made it difficult to evaluate insect numbers. The specificity of Dipel toward insects other than those evaluated is apparent. This bacterial insecticide is most effective against cabbage insects which were also studied in adjacent plots. Pirimor, which is specific on green peach aphids, also did not affect the other insects. The effectiveness of the double application of Disyston on muck soils is shown on aphids as well as potato beetles and would probably look better against the other insects if the plots had been larger and thus had less migration between centers of plots.

Table 3. Summary of Foliar Insects on Plots at Muck Experimental Farm.

Material and Formulation	Lb. Tox/A.	Place-ment	Total Insects/30 sweeps (July 5-Sept. 5)					
			Potato flea beetles	Potato leaf-hoppers	Col. potato beetles	Aphids	Lygus bugs	Parasites & predators
Dipel WP	1/2 lb	Fol	687	643	193	414	223	18
Disyston 15% Gran	3 lb	Band	586	367	111	80	240	36
Disyston 15% Gran	3 lb	Band	606	318	40	132	216	19
	+ 3 lb	Side						
Disyston 15% Gran	3 lb	Band						
	+ 3 lb	Side						
+ Meta-Systox-R 2 SC	1/2 lb	Fol	667	308	34	55	131	19
Pirimor 50% WP	1/4 lb	Fol	815	559	108	71	154	25
Thiodan 2 EC	1/2 lb	Fol	750	348	2	189	206	30
Thiodan 2 EC	1/2 lb	Fol						
+ Fomark	1 qt	Fol	500	363	4	164	128	32
Untreated	--	--	712	481	102	340	206	32

Table 4. Yield, Size and Specific Gravity from Plots at Muck Experimental Farm.

Material and Formulation			Yield/A. cwt.	Yield/A. bu.	% Size Distribution *	**	***	Specific Gravity
Dipel WP	1/2 lb	Fol	360	600	8%	68%	24%	1.060
Disyston 15% Gran	3 lb	Band	391	652	7	68	25	1.063
Disyston 15% Gran	3 lb	Band						
	+ 3 lb	Side	384	640	7	67	26	1.059
Disyston 15% Gran	3 lb	Band						
	+ 3 lb	Side						
+ Meta-Systox-R 2 SC	1/2 lb	Fol	385	642	7	68	25	1.061
Pirimor 50 WP	1/2 lb	Fol	399	665	8	70	22	1.059
Thiodan 2 EC	1/2 lb	Fol	400	667	8	62	30	1.063
Thiodan 2 EC	1/2 lb							
+ Fomark	1 qt	Fol	364	607	8	62	30	1.062
Untreated	--	--	342	570	8	67	25	1.062

* = up to 1 7/8

** = 1 7/8 - 3 1/4

*** = greater than 3 1/4

All of the effective materials provided higher yields than the untreated check. There appeared to be no differences between the specific gravities of any of the treatments.

C. Yields from the Demonstration Plots in Bay County

The results of the demonstration plots at the Meyer Farm in Bay County are summarized here. The four row plots using Norchip variety were planted on April 28 with either Thimet or Disyston banded with the fertilizer at 2.2 lbs. toxicant per acre. One of the Disyston treated plots received an additional application sidedressed at the time of hilling on June 7. One each of the Thimet and Disyston treated plots received foliar applications of insecticides as well as fungicides during the season. A four row untreated plot was left for comparison of yields which were taken on August 21. These are presented in Table 5. The plots receiving the foliar sprays were still green at the time of sampling and thus would have given a higher yield if left to mature and sampled at normal harvest.

Table 5. Yields and Size Distribution of Potatoes from the Bay County Plots

Treatment	Lb. Tox. /A.	Yield/A.		% Size Distribution	
		Cwt.	Bu.	to 1 7/8"	1 7/8" and up
Thimet 10% Gran.	2.2 lb.	354	590	5%	95%
Thimet 10% Gran. + Foliars*	2.2 lb.	349	582	4	96
Disyston 10% Gran.	2.2 lb.	384	640	7	93
Disyston 10% Gran. + Disyston 15% Gran.**	2.2 lb. 3.0 lb.	390	650	5	95
Disyston 10% Gran. ± Foliars*	2.2 lb.	378	630	5	95
Untreated	--	328	547	7	93

* Applied by grower with boom sprayer: June 30--Guthion & Manzate; July 10--MSR & Manzate; July 20--Parathion, Sevin & Bravo; July 31--MSR & Copper; August 12--Lannate & Copper; August 24--Copper

** Granules sidedressed on each side of row at hilling (June 7).

PHOSPHORUS-POTASSIUM SOIL TEST CORRELATION STUDY

D. R. Christenson, C. Bricker, F. Wedel
Department of Crop and Soil Sciences

This experiment is part of a three year study to evaluate present fertilizer recommendations based on soil test levels. Consequently this should be considered a preliminary report; a final report will be published elsewhere.

Methods

The soil test levels in this experimental area were: pH 6.0, lime index 6.6, extractable phosphorus 314 lb/acre and extractable potassium 210 lb/acre. A randomized complete block experiment with 12 treatments (Table 1) and 4 replications was planted on May 5. Russet Burbank potatoes were grown and all fertilizer treatments were banded. Nitrogen was applied in a split application with 50 lb N/acre banded and 120 lb N/acre sidedressed June 30. A herbicide, fungicide, insecticide and irrigation program was followed. The plots were harvested on October 2.

Results

The yield and specific gravity results are presented in Table 1. The percent medium sized tubers was not affected by either phosphate or potash, but the percent large tubers tended to be increased by applied potash. There were no general trends for the effect of applied nutrients on percent small tubers. Yields were increased over the check by the application of 100 pounds of phosphate and 400 pounds of potash. A response was also obtained with the application 200 or 400 pounds of potash in combination with 100 pounds of phosphate as compared to phosphate alone. Tuber specific gravity was suppressed by the application of potash, but not by the application of phosphate.

TABLE 1. Yield, percent small, medium, large and over 10 ounce, and specific gravity of Russet Burbank potatoes as affected by phosphorus and potassium applications.

Fertilizer P_2O_5	Application K_2O	Total Yield	Size* Small	Medium	Large	Specific Gravity
- lb/acre -		cwt/A	-	percent -		
50	100	396.6	6.6	82.7	4.1	1.080
50	200	417.1	6.6	83.3	3.4	1.076
50	400	391.2	6.1	84.2	5.7	1.074
100	100	392.7	7.4	86.9	2.2	1.080
100	200	407.6	6.8	81.6	4.4	1.076
100	400	494.0	4.9	83.8	4.0	1.072
200	100	393.6	7.6	82.0	3.8	1.080
200	200	412.0	6.8	80.9	4.4	1.077
200	400	393.4	6.3	78.6	8.1	1.072
100	0	316.2	9.3	83.8	1.9	1.082
0	200	379.0	2.2	87.0	3.8	1.076
0	0	351.3	7.1	82.8	2.8	1.083
	LSD (5%)	83.2	3.3	NS	2.8	0.003

*Small, less than 1 7/8 inches; large, over 10 oz.

WATER MANAGEMENT OF POTATOES

Ana Garay, R. J. Kunze, R. W. Chase and E. Kidder
Departments of Crop and Soil Sciences and Agricultural Engineering

As this is a two-year project dealing with various aspects of soil water management in potato production, some of the 1971 data are again referred to to permit a comparative interpretation with 1972 data. Inasmuch as the 1971 data showed that day versus night irrigation was not a factor in disease incidence or yield, other objectives thought to be more important were pursued in 1972.

Objectives

1. To determine the effect of time of initiation of irrigation on the quality and yield of tubers. In 1971 irrigation was started at 50 (treatment 1); at 60 (treatment 2); and at 70 (treatment 3) days after planting. In 1972, the initial irrigations were applied at 30, 50 and 70 days, respectively.

2. To measure the effect of two levels of irrigation cooling. Intermittent, low volume sprinkler irrigation was applied in 1971 whenever the temperature was higher than 75: (C-1) and 80F (C-2). In 1972 the temperature levels were changed to 80 and 85F, respectively.

3. To devise an accurate and simple scheme for determining the frequency and volume of crop irrigations. Precipitation gains, evaporative losses, soil type and crop stages are considered and programmed into this scheme.

4. Two objectives were added to the 1972 research project.

   a. Frequency and volume of the irrigations. A 1/2" water application was compared with a 1" application (this resulted in two 1/2" irrigations per week versus a 1" irrigation per week).

   b. Periodic nitrogen application through the irrigation system. These applications were:

      N_1 (check) - 120 lbs of N sidedressed at hilling time

      N_2 - 60 lbs of N sidedress at hilling time plus 60 lbs applied in 3 equal irrigation applications at 2 week intervals after hilling

      N_3 - 120 lbs of N applied at 6 weekly intervals of 20 lbs per irrigation.

   All plots had the same banded application of 800 lbs of 14-14-14 + 2% Mg at planting.

Procedure

The plots were irrigated with an elevated rotary sprinkler positioned at the center of each plot. Water volume meters were used to measure the water applied to each plot. Uniformity of distribution was adequate. A five-foot border was allowed between plots. Approximately 50 soil water sensing devices (tensionmeters and moisture blocks) were installed in the test area. Daily meteorological data were taken from a weather station adjacent to the experimental site.

Russet Burbank and Kennebec potatoes were planted on May 10, 1972. The fertilization program in pounds/acre was: 120K at plow-down; 110 N - 110 P - 110 K - 16 Mg banded at planting; and 120 N as described under objective 4b. All plots other than N1, N2, and N3 treatments were harvested September 15. The nitrogen treated plots were harvested October 5.

Results and Discussion

Table 1 shows that the average temperature for June 1971 was 11 degrees higher than for the same period in 1972. June is considered as the early tuberization period for most potatoes grown in Michigan.

Other climatic conditions, particularly rainfall, had an entirely different pattern in 1972 when compared with 1971. Table 1 shows that not only was precipitation low during the growing season in 1971, but the pan evaporation was higher. Hence, the water deficit was 13.72 inches higher in 1971. This is also shown by the amount of irrigation applied (Table 2) for the two years. In conclusion, the 1971 season was hot and dry with a low relative humidity; the 1972 season was cool and wet, with a high relative humidity. All of the meteorological data and some yield data reflect these two contrasting situations.

1) Initiation and Frequency of Irrigation

In 1971 the yield from Russet Burbank potatoes (Tr. 1 - Table 3) was 155 cwt/A larger or an 87% increase over that of the check plot. Likewise, the percentage of knobby tubers decreased from 43.4% (check plots) to 13.5%. The same treatment in 1972 produced a decrease rather than an increase in yield and no effect on the percentage of knobs was observed. A similar trend may be seen in the Kennebec variety in Table 4. It should be pointed out that irrigation applied at a frequency of 1/2 inch per irrigation gave a higher yield trend (not shown in tables) for both the Russet Burbank and Kennebec varieties. The fact that several 1" and 1/2" irrigation applications were followed by intensive rains suggest that yields were depressed by excessive water. Ample rainfall during the 1972 growing season eliminated any differential soil moisture stress and masked any differences due to the time of initiating the irrigation. As a consequence, a valid test for relating initiation and timing of irrigation to potato yields could not be made in 1972.

Table 1. Precipitation, Pan Evaporation and Temperature During the Potato Irrigation Period. Montcalm (1971 and 1972).

		Precipitation	Pan Evaporation		Daily Mean Temperature	Precipitation Minus Evapor.
		Inch	Total	Daily Ave.	ºF	(inch)
			(inch)			
1	June (15-30)	0.38	4.47	0.28	73.1	- 2.93
9	July	1.23	8.60	0.28	67.8	- 7.37
7	August	2.67	6.70	0.22	67.6	- 4.03
1	Total	4.28	19.77	0.25	69.5	-14.33
1	June (15-30)	1.88	2.88	0.18	62.0	- 1.00
9	July	3.83	6.66	0.21	68.2	- 2.83
7	August	7.29	4.07	0.13	67.0	3.22
2	Total	13.00	13.61	0.17	65.3	0.61

Table 2. Amount of irrigation applied according to treatments in 1971 and 1972 (in inches).

	Frequency of Irrigation and Timing of Initial Irrigation								Nitrogen			Irrigation Cooling*		
	1" frequency				1/2" frequency									
	1	2	3	Check	1	2	3	Check	1	2	Check	1	2	Check
1971	10.0	8.0	6.0	--				--				12.3	11.0	10.0
1972	3.75	2.75	1.0	--	3.0	2.5	0.5	--	3.75			6.35	4.45	3.75

* Sum of normal irrigations plus irrigation cooling

Table 3. Average yields, specific gravity and knobiness of Russet Burbank potatoes under one inch irrigation regime (1971 and 1972).

	1971			1972		
	Yield (cwt/A)	Specific Gravity	Knobs (%)	Yield (cwt/A)	Specific Gravity	Knobs (%)
Check*	178.9	1.0686	43.4	354.2	1.0715	12.8
Treatment 1	334.2	1.0756	13.5	324.1	1.0757	11.1
Treatment 2	302.0	1.0738	14.9	312.1	1.0725	12.6
Treatment 3	292.9	1.0711	21.6	316.7	1.0680	12.5

Table 4. Average yields and specific gravity of Kennebec potatoes under one inch irrigation regime (1971 and 1972).

	1971		1972	
	Yield (cwt/A)	Specific Gravity	Yield (cwt/A)	Specific Gravity
Check*	165.8	1.0628	345.9	1.0630
Treatment 1	328.9	1.0671	371.5	1.0667
Treatment 2	306.2	1.0633	429.7	1.0665
Treatment 3	285.8	1.0607	362.4	1.0637

*Check: no irrigation; Treatment 1, 2, 3 = different times of starting irrigation, Treatment 1 being the first irrigated.

2. Irrigation Cooling Experiment

In 1971 the irrigation cooling treatments consisted of a 5 minute irrigation every 30 minutes whenever the temperature exceeded 75F (C-1) and 80F (C-2). This resulted in 34 days of irrigation cooling and a total of 2.3 inches of water applied for C-1, and 14 days and 1 inch of water for C-2. In 1972 these figures were 30 days with 2.6 inches of water applied for C-1 and 10 days with 0.7 inch for C-2. Because of changes in method of application larger amounts of water would be applied for cooling in 1972. Hence, the temperature levels were raised to 80 and 85F, respectively. The equipment and operation for the irrigation cooling study was more accurately controlled in 1972. Unfortunately the potato plants were not stressed sufficiently to rigorously test the cooling effect in terms of yields. The data are presented in Table 5. The consistently higher yield in both 1971 and 1972 obtained with C-2 over C-1 is not easily explainable. Potatoes are considered a cool temperature plant and with the artificially imposed cooler environment one would expect a yield increase. However, the greater amount of water applied may again have depressed yields.

3. Scheme for Determining Time to Irrigate

The technique of deciding when and how much water to apply for irrigation of potatoes consisted of keeping a daily record of soil water gains and losses. The daily balance of water available in the root zone is obtained by subtracting the daily evapotransperation (ET) loss and adding any gain from precipitation. When the water balance approached a critical level, water was supplied by irrigation. An amount was added which was considered adequate but insufficient to fill the entire storage capacity of the soil.

Figure 1 shows the bookkeeping plan for potatoes irrigated with 1" of water per irrigation, starting 30 days after planting. The space between the two horizontal lines represents the soil storage for plant-available-water. The idea is to keep the daily soil water status between the two horizontal lines. This procedure differs in two ways with the procedure presented in 1971 Montcalm County Research Report.

a) The lines are not plotted on a diagonal; hence no accumulative loss of water is kept.

b) The daily loss of water varies with development of the plant canopy and with the daily or weekly pan evaporation. The straight diagonal line in 1971 assumed a constant loss for the entire growing season.

The daily evapotranspiration loss was estimated by multiplying the Class A weather pan evaporation data by a factor corresponding to the canopy development of a crop. The factor reaches its maximum of 0.8 when the crop canopy is fully developed. For the period 30-40 days after planting, 0.5 was used as the factor; for 40-50 days, 0.6; for 50-60 days, 0.7 and from then on 0.8. The pan loss multiplied by the appropriate factor was obtained for each day and was drawn on the graph as a solid line going downward indicating water loss. When rainfall occurred, it was drawn as a solid line directed upward indicating water gain. Irrigations are indicated by dashed lines drawn upward. The graph cannot exceed the upward boundary even if extensive rainfall occurs.

The U. S. Weather Bureau obtains pan evaporation data from six sites in Michigan. These sites are Dearborn, East Lansing, Germfask, Lake City, Lupton and South Haven. The climate most similar to the Montcalm Research Farm is that of Lake City. If one does not have access to these weekly pan losses then a loss of 0.2 inch per day is recommended. These data would be converted as follows:

a. 30-40 days after planting - 0.20" x 0.5 = 0.10"/day
b. 40-50 " " " - 0.20" x 0.6 = 0.12"/day
c. 50-60 " " " - 0.20" x 0.7 = 0.14"/day
d. 60- " " " - 0.20" x 0.8 = 0.16"/day

4. Nitrogen Applications with Irrigation Water

Table 6 depicts the yield response of Russet Burbank and Kennebec potatoes to periodic applications of nitrogen fertilizer through the irrigation system. There is a definite response to partitioning the nitrogen fertilizer but there is no clear indication suggesting that three 20 lb/A applications is superior to six 20 lb/A applications, or vice versa. Applying the nitrogen fertilizer at later times in the growing season increased the average yield about 70 cwt/A. The high rainfall during the latter part of the growing season may have leached the nitrogen and contributed to a reduced yield for the check plot.

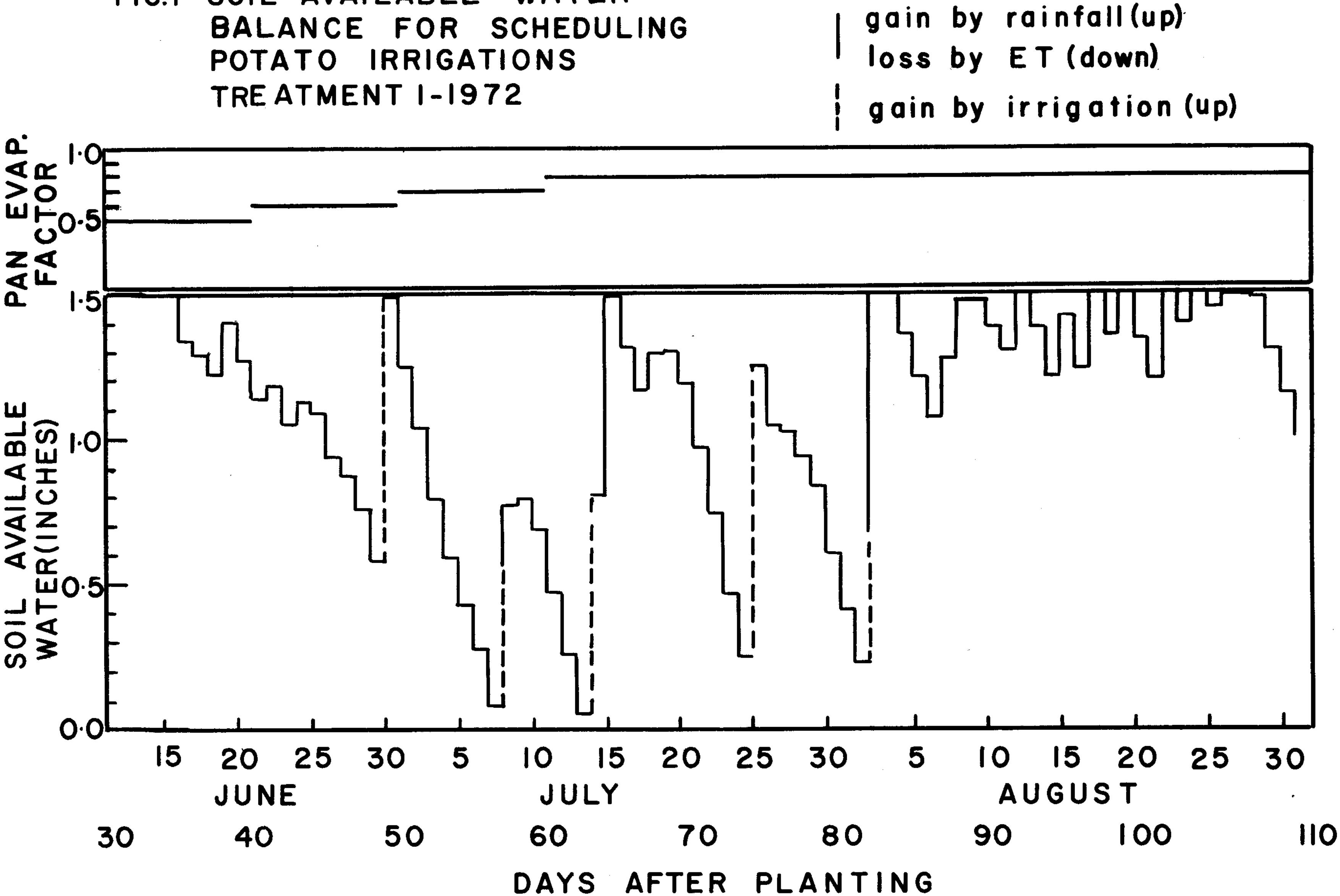
Table 5. Effect of sprinkler irrigation cooling on yield and specific gravity of Russet Burbank and Kennebec potatoes (1971 and 1972).

	Russet Burbank				Kennebec			
	1971		1972		1971		1972	
	Yield (cwt/A)	Specific Gravity	Yield (cwt/A)	Specific Gravity	Yield (cwt/A)	Specific Gravity	Yield (cwt/A)	Specific Gravity
Check	265.8	1.0727	343.3	1.0743	265.0	1.0607	392.0	1.0650
Treatment 1	315.9	1.0767	359.7	1.0763	315.0	1.0637	370.0	1.0673
Treatment 2	374.7	1.0752	378.9	1.0753	324.0	1.0650	392.7	1.0657

Table 6. Effect of the splitting of nitrogen fertilization on yield and specific gravity of Russet Burbank and Kennebec potatoes (1972).

	Russet Burbank		Kennebec	
	Yield (cwt/A)	Specific Gravity	Yield (cwt/A)	Specific Gravity
Check	343.3	1.0743	392.0	1.0650
Treatment 1	394.0	1.0676	480.0	1.0677
Treatment 2	427.3	1.0717	447.9	1.0647

FIG. 1 SOIL AVAILABLE WATER BALANCE FOR SCHEDULING POTATO IRRIGATIONS TREATMENT 1-1972



THE EFFECT OF HARVEST DATE AND STORAGE ON THE YIELD POTENTIAL OF ONAWAY AND SEBAGO SEED POTATOES

R. W. Chase
Department of Crop and Soil Sciences

Procedure

This is the third and final year of this study to evaluate the harvest and storage factors which may influence potential seed quality. Seed of the Onaway and Sebago varieties was harvested on several different harvest dates and placed in storage at East Lansing either at 40F or stored for 14 days at 65-70F and then transferred to a 40F storage. Approximately one week before planting the seed was warmed to 50-55F, cut and then hand planted at a uniform spacing (12 inches) and uniform number of seed pieces per plot (25).

Both varieties were planted on May 9. Fertilizer applied consisted of: plowdown, 200 lb/A 0-0-60; planting time, 800 lb/A 14-14-14 + 2% Mg; and sidedress, 115 lb N/A.

A summary of the 1971 harvest and storage conditions is as follows:

ONAWAY

Treatment No.	Topkill	Harvest Date	Storage Condition(F)	Days Growing	Days to Harvest
1	--	Aug. 3	40	91	91
2	--	Aug. 3	70-40	91	91
3	Aug. 3	Sept. 28	40	91	147
4	--	Aug. 20	40	108	108
5	--	Aug. 20	70-40	108	108
6	Aug. 20	Sept. 28	40	108	147
7	--	Sept. 28	40	147	147

SEBAGO

Treatment No.	Topkill	Harvest Date	Storage Condition(F)	Days Growing	Days to Harvest
1	--	Aug. 20	40	108	108
2	--	Aug. 20	70-40	108	108
3	Aug. 20	Oct. 7	40	108	156
4	--	Sept. 7	40	126	126
5	--	Sept. 7	70-40	126	126
6	Sept. 7	Oct. 7	40	126	156
7	--	Oct. 7	40	126	156

Results and Discussion

Table 1 summarizes the Onaway yield data. The lowest yields did occur with treatment numbers 1, 3, 6 and 7. The reduced yield of treatment 1 is due primarily to the physical condition of the seed at planting time. Seed harvested this early is too immature to be stored in adverse conditions. The only difference between treatments 1 and 2 is the storage environment of the tubers directly after harvest. The tubers from treatment 1 were held at 60-65F for approximately 3 days whereas those of treatment 2 were maintained at 60-65F for 14 days before being placed in the 40F storage. Obviously, 3 days is insufficient for proper curing and wound healing. Tubers harvested this year were very immature and very susceptible to skinning and bruising.

In contrast, the low yield of treatment 3 represents some internal change and is not a result of physical damage. These plots were top killed on the same day that treatments 1 and 2 were harvested, however, the tubers remained in the ground for an additional 56 days.

At the second harvest date there is little to no real difference between treatments 4 and 5. At this time the tubers were more mature so apparently the length of curing time was less critical. However, if the tubers were left in the ground for an additional 39 days as they were in treatment 6, the resulting yields decreased by 41 cwt/A below that of treatment 5 and were the same as treatment 7 which serves as the fully matured check.

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

Treatment No.	Total cwt/A	Percent Size Distribution -1 7/8	+3 1/4	1 7/8 to 3 1/4	Specific Gravity
1	356	6.3	9.8	83.9	1.064
2	458	4.4	17.8	77.8	1.064
3	311	4.9	13.6	81.5	1.067
4	424	6.9	10.1	83.0	1.065
5	433	5.3	15.4	79.3	1.065
6	392	8.0	14.7	77.3	1.064
7	395	6.8	14.4	78.8	1.065

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

Treatment No.	Total cwt/A	Percent Size Distribution -1 7/8	+3 1/4	1 7/8 to 3 1/4	Specific Gravity
1	424	5.4	18.1	76.5	1.065
2	422	6.0	12.5	81.5	1.066
3	301	3.8	24.7	71.5	1.064
4	362	5.7	12.1	82.2	1.063
5	401	5.0	9.6	85.4	1.066
6	359	4.5	14.1	81.4	1.064
7	358	3.9	16.1	80.0	1.061

Table 2 summarizes the Sebago yield data. The yield differences between treatments 1 and 2 did not exist here as they did with the Onaway, however, there is a difference between treatments 4 and 5. The reason for this difference at a later harvest date is uncertain. There is however, the same yield reduction with treatments 3, 6 and 7. The delay in the removal of the tubers from the ground does have some effect on the subsequent yield potential and this did occur with both varieties.

The effect on size distribution is less certain. Very little difference occurred with the Onaway and that of the Sebago is not consistent. The effect on specific gravity is similar.

Tables 3 and 4 summarize the combined three year results. The observations noted for yields from the 1972 results are the same as those noted in the combined 3 year data. The earlier harvested seed which is properly cured and stored does have the greatest yield potential compared to a seed crop which reaches full natural maturity or is top killed and the tubers allowed to remain in the ground too long. In terms of size distribution there is a slight trend toward a greater percentage of tubers over 3 1/4 inch in the later harvested seed (treatments 3, 6 and 7). This pattern, although not large, does exist in both varieties. There appears to be no difference in the effect on specific gravity.

TABLE 3. The combined 3 year summary of the effect of harvest date on the yield potential of Onaway seed potatoes.

					Percent Size Distrib.			
Treatment No.	No. Days Growing	No. Days to Harvest	Storage Temp.(F)	Cwt/A	-1 7/8	+3 1/4	1 7/8 to 3 1/4	Specific Gravity
1	86	86	40	365	4.7	19.0	76.3	1.067
2	86	86	70-40	424	3.6	22.5	73.9	1.068
3	86	132	40	339	4.1	26.5	69.4	1.069
4	105	105	40	405	4.1	24.1	71.8	1.065
5	105	105	70-40	426	4.0	19.8	76.2	1.067
6	105	132	40	392	5.0	26.6	68.4	1.066
7	132	132	40	377	4.2	26.4	69.4	1.067

TABLE 4. The combined 3 year summary of the effect of harvest date on the yield potential of Sebago seed potatoes.

Treatment No.	No. Days Growing	No. Days to Harvest	Storage Temp.(F)	Cwt/A	-1 7/8	+3 1/4	1 7/8 to 3 1/4	Specific Gravity
1	105	105	40	390	3.8	21.5	74.7	1.065
2	105	105	70-40	412	3.5	19.2	77.3	1.067
3	105	150	40	337	3.3	25.3	71.4	1.066
4	125	125	40	364	3.3	20.6	76.1	1.066
5	125	125	70-40	397	3.3	21.1	75.6	1.067
6	125	150	40	368	3.3	23.2	73.5	1.065
7	150	150	40	359	3.2	25.0	71.8	1.065

THE RELATIONSHIP OF PLANTING DATE, HARVEST DATE AND STORAGE TEMPERATURE ON THE YIELD POTENTIAL OF RUSSET BURBANK SEED POTATOES

R. W. Chase
Department of Crop and Soil Sciences

A three year study was initiated in 1972 to evaluate the effects of planting date, harvest date and storage temperature on the vigor and yield potential of the Russet Burbank. The objective is to relate the production management factors which may influence subsequent yield potential.

Procedure

Premier-Foundation Russet Burbank seed was planted on three different dates, May 9, May 18, and May 31, 1972. Within each planting, four harvest dates were included, August 15, September 1, September 15 and October 4, with each replicated three times. Plots were harvested and the yield, grade and specific gravity were determined. Two-one bushel samples from each plot were collected at harvest and placed in storage at 60F and 90% RH for two weeks. At the end of this curing time one sample was placed in storage at 40F and the second at 34-35F. These will be planted in 1973.

TABLE 1. The total yield, size distribution and specific gravity of Russet Burbank potatoes at several different planting and harvest dates.

Planting Date	Harvest Date	Days Growing	Total Yield	Percent Size Distribution Off Type	-1 7/8	+10 oz.	1 7/8 to 10 oz.	Specific Gravity
May 9	Aug. 15	98	289	9.2	14.8	3.3	72.7	1.074
	Sept. 1	115	335	15.6	8.7	7.8	67.9	1.075
	Sept. 15	130	376	13.4	7.3	17.7	61.7	1.076
	Oct. 4	149	368	12.7	7.0	17.1	63.2	1.073
	Aug. 15	89	244	3.5	19.6	0.1	76.8	1.075
	Sept. 1	106	313	10.5	13.8	2.5	73.2	1.076
	Sept. 15	121	365	10.7	10.8	13.4	65.1	1.079
	Oct. 4	140	370	12.8	14.3	8.4	64.5	1.073
	Aug. 15	76	97	0.5	56.8	0	42.7	1.065
	Sept. 1	93	169	18.9	21.7	0	59.4	1.070
	Sept. 15	108	277	7.3	14.0	9.3	69.4	1.077
	Oct. 4	127	289	8.4	19.5	9.0	63.1	1.073

Results and Discussion

Yield and quality are the only data available at this time and are summarized in Table 1. Regardless of planting date, there was no appreciable yield advantage in delaying the time of harvest from September 15 to October 4. None of the plots were topkilled. In fact the specific gravity readings show a very definite decrease with delay in the final harvest. This probably relates to the wet conditions which occurred late in the growing season.

SOIL FERTILITY RESEARCH WITH DENT CORN, SWEET CORN AND DARK RED KIDNEY BEANS

M. L. Vitosh
Department of Crop and Soil Sciences

In 1972 three soil fertility experiments were conducted with dent corn, two with sweet and two with dark red kidney beans. The experiments with dent and sweet corn were part of a rotation with potatoes. Growing conditions for corn were excellent and very little irrigation was required. Plot technique and general management practices are given at the bottom of each table.

Source, Rate, and Time of Nitrogen Application with Dent Corn:

In this experiment comparisons of broadcast vs sidedress N applications and urea vs sulfur-coated urea were made. The experimental design was a split plot with two corn hybrids (Mich 500-2X and Mich 396-3X) in each plot. Corn was planted to get a stand of 24,000 plants per acre and later thinned to 22,500. Grain and silage yields were taken for both hybrids.

Results of the study are repeated in Table 1. Average grain yields were more than tripled with 180 lbs of N/A. Sidedress applications of N especially at the higher rates resulted in a larger yield than broadcast N. In general sidedress applications of N resulted in more efficient use of N. Average silage yields were increased 5 tons/A with 60 lb N/A (SCU) and 8 to 10 tons with 120 or more lbs N/A. Sidedress N applications did not give better silage yields than broadcast applications.

Michigan 396-3X generally yielded more grain but less silage than Mich.500-2X Sulfur-coated urea in some plots tended to give better yields but the overall response indicated no difference between urea and sulfur-coated urea.

Potassium-Magnesium Study with Dent Corn:

This experiment contained 10 K treatments of varying rates at two plant populations. Four of the K treatments received 50 lbs Mg/A while four comparable K treatments did not. Mich. 500-2X was planted in one-half of each plot to obtain approximately 24,000 and 28,000 plants per acre. After emergence each plot was thinned to 22,500 and 26,200 plants per acre.

Results of the study are shown in Table 2. Grain and silage yields were not significantly affected by the K treatments but some trends exist. In many plots the lower plant population gave larger yields than the higher population. Both grain and silage yields showed a slight increase with the first 50 lbs of potash applied.

Nitrogen Residual Study with Dent Corn:

This study was conducted on the area which grew potatoes in 1971. The plots were fertilized with various rates of N up to 300 lb/A in 1971. Corn was planted in 1972 with no N. Similar studies with beans previously showed no carry-over effect of N fertilizers. The rotation was changed in 1972 to include corn to evaluate the residual N effect. The crop was irrigated and harvested for grain and silage.

Yields results are presented in Table 3. Residual effects were quite noticeable throughout the entire summer. The check plot showed signs of severe N deficiency but yielded very well. Plots which received 60 lbs N/A (sulfur-coated urea) in 1971 yielded an additional 27 bushel of grain and 2.8 tons of silage. Plots which received 120 to 180 lbs of sidedress N in 1971 resulted in larger grain and silage yields than plots receiving equivalent amounts of broadcast N. Plots receiving SCU also tended to yield better than corresponding urea treatments. Corn, which has a more extensive rooting system than beans resulted in more efficient recovery of N from the previous years application. It would appear the SCU does not release all of its N in one growing season and some additional N may be recovered by corn the following year.

Potassium-Magnesium Study with Sweet Corn:

Sweet corn yields in 1972 were not significantly affected by the K-Mg treatments in this experiment (Table 4). All K treatments however gave higher yields than the check plot indicating a slight response to K. The three year average also shows a slight response to K fertilizer. The overall average for the four K treatments with Mg and comparable K treatments without Mg indicates no significant difference in yield. The yield data are consistent with the soil test recommendation that this soil does not need Mg fertilizer.

Nitrogen Carrier Study with Sweet Corn:

Sweet corn yields in 1972 were not significantly affected by the five sources of N fertilizer (Table 5) but ammonium sulfate and anhydrous ammonia tended to out-yield the other N sources. The five year average shows that urea and anhydrous ammonia gave a slight yield advantage. Calcium nitrate continued to result in the lowest yields. These same trends have been observed with potatoes.

Nitrogen and Sulfur Studies with Dark Red Kidney Beans:

Two experiments with dark red kidney beans were conducted in 1972. Experiment A involved nine fertilizer treatments with varying rates of N and S. Experiment B had N and S treatments but at much higher N rates.

Results of these two experiments are reported in Tables 6 and 7. Bean yields were not significantly affected by any of the treatments, however, 80 lb S/A with N fertilizer tended to reduce yields in both experiments. Sulfur at rates of 1 and 4 lb/A with 40 lb N/A gave the largest yields in experiment A. Another investigator has reported that a N:S ratio of 16:1 is best for yields and protein synthesis on soils which are deficient in sulfur. Best yields in this experiment were obtained at N:S ratios of 40:1 and 10:1. The sulfate sulfur level in this soil is just above the critical level at which a yield response would be expected.

The percentage of non-protein N in experiment A was relatively constant for all treatments. Protein N for the same experiment was significantly increased with 40 lbs of N and no sulfur. Sulfur fertilizer had a tendency to increase the protein N but the increase was not statistically significant.

In experiment B both protein and non-protein N content was affected by the treatments. Nitrogen fertilizer at 100 lb N/A without sulfur increased both the percent protein and non-protein N over the check. When 200 lb N/A without S was applied only the protein N fraction was increased. The non-protein N content was the only fraction increased with 40 lb S/A and 100 lb N/A.

In summary sulfur fertilizer had little influence on the protein content of the dark red kidney bean at this location. Nitrogen fertilizer without S had the greatest effect in increasing the protein content and only in one instance was the non-protein fraction increased.

TABLE 1. Effect of rate, source and time of nitrogen application on grain and silage yields of two irrigated corn hybrids.

Nitrogen Application (a)				Mich. 396-3x		Mich. 500-2x		Average Effects	
Broad-cast	Band-ed	Side-dressed	Total N	Grain Yield (Bu/A)	Silage Yield (tons/acre)(b)	Grain Yield (Bu/A)	Silage Yield (tons/acre)(b)	Grain Yield (Bu/A)	Silage Yield (tons/acre)(b)
	lb N/A								
0	0	0	0	45	11.4	66	15.7	55	13.6
60 SCU	0	0	60	116	16.6	120	19.8	118	18.2
60 U	60 U	0	120	147	20.6	145	22.5	146	21.6
120 U	60 U	0	180	174	21.5	136	26.2	155	23.9
180 U	60 U	0	240	171	20.7	134	23.0	153	21.9
60 SCU	60 U	0	120	160	19.1	138	22.9	149	21.0
0	60 U	60 U	120	153	19.6	139	20.2	146	19.9
0	60 U	120 U	180	176	20.4	159	23.7	168	22.0
0	60 U	180 U	240	195	18.8	148	23.4	172	21.1
120 SCU	60 U	0	180	164	22.6	152	25.1	158	23.9
LSD (.05) treatments				-	-	-	-	12	2
LSD (.05) treatments within varieties				17	3	17	3	-	-
LSD (.05) varieties within treatments				17	3	17	3	-	-

(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 1 1/2 inches to side and 1 inch below the seed. Sidedressed urea was topdressed June 17, 1972.

(b) Fresh weight yield at 69% moisture.

Planted: May 4, 1972
Harvested:silage: September 21, 1972
Plant Population: 22,500
Harvest area: 116 sq. ft.

Row spacing: 28 inches
Basic fertilizer: 0-50-100 banded at planting time
Irrigation: 4.0 inches
Harvested grain: Oct. 9, 1972

TABLE 2. Effect of potassium and magnesium on grain and silage yields of Michigan 500-2X corn under irrigation.

Potassium-Magnesium Application (a)				22,500		26,200		Average Effects	
Broad-cast	Band-ed	Broad-cast	Total K20	Grain Yield (Bu/A)	Silage Yield(b) Tons/Acre	Grain Yield (Bu/A)	Silage Yield(b) Tons/Acre	Grain Yield (Bu/A)	Silage Yield(b) Tons/Acre
lb K_2O/A		lb Mg/A							
0	0	0	0	154	21.3	140	21.6	147	21.5
0	50	0	50	158	24.5	147	23.3	152	23.9
50	50	0	100	162	24.9	150	24.8	156	24.9
100	50	0	150	147	24.9	152	23.9	150	24.4
150	50	0	200	151	25.8	149	24.9	150	22.5
250	50	0	300	154	25.0	158	26.9	156	25.9
0	50	50	50	151	23.5	156	22.7	154	23.1
50	50	50	100	155	24.6	150	23.5	153	24.0
150	50	50	200	157	25.5	152	25.0	155	25.2
250	50	50	300	168	26.0	152	25.3	160	25.6
LSD (.05) treatments				NS	-	NS	-	NS	NS
LSD (.05) treatments within plant population				NS	NS	NS	NS	NS	NS
LSD (.05) plant population within treatment				NS	NS	NS	NS	NS	NS

(a) Broadcast potassium and magnesium were applied and plowed down 5 days prior to planting. Banded potassium was applied 1 1/2 inches to side and 1 inch below seed at planting time. Potassium and magnesium sources were KCl and $MgSo_4$.

(b) Fresh weight yield at 71% moisture.

Planting: May 4, 1972
Row spacing: 28 inches
Basic fertilizer: 50-50-0 banded, 180 N sidedressed June 17, 1972
Irrigation: 4.0 inches
Previous crop: potatoes
Harvest grain: Oct. 9, 1972

Harvest area: 116 sq. ft.

Soil test: pH = 6.4, P = 347, K range = 146-253, Mg = 210
Harvest silage: Sept. 21, 1972

TABLE 3. Effects of residual nitrogen on grain and silage yields of irrigated corn.

Nitrogen Application (a)				Mich. 500-2X	
Broad-cast	Band-ed	Side-dressed	Total	Grain Yield (Bu/A)	Silage Yield (Tons/A)
- - - - - - lb N/A	- - - - - -				
0	0	0	0	83	13.4
60 SCU	0	0	60	110	16.2
60 U	60 U	0	120	109	16.3
120 U	60 U	0	180	114	15.0
180 U	60 U	0	240	130	15.5
60 SCU	60 U	0	120	127	16.1
0	60 U	60 U	120	104	16.4
0	60 U	120 U	180	130	17.0
0	60 U	180 U	240	147	17.8
120 SCU	60 U	0	180	125	19.0
LSD (.05)				20	2

(a) All nitrogen applied in 1971

Planted: May 4, 1972
Plant population: 24,000
Basic fertilizer: 0-50-50 banded at planting time
Irrigation: 4.0
Harvest area: 233 sq. ft.
Soil tests: pH = 6.5, P = 274, K = 196
Harvested silage: Sept. 22, 1972
Harvested grain: Oct. 10, 1972
Row spacing: 28 inches
Previous crop: potatoes

TABLE 4. Effect of potassium and magnesium on yield of irrigated sweet corn.

Potassium-Magnesium Applications (a)				Sweet Corn Yield (cwt/A)	
Broad-cast	Band-ed	Broad-cast	Total K_2O	1972	1970-72
lb K_2O/A		lb Mg/A			
0	0	0	0	98	110
0	20	0	20	112	119
0	40	0	40	125	127
0	60	0	60	112	120
0	80	0	80	126	121
120	40	0	160	113	119
0	20	50	20	115	126
0	40	50	40	115	122
0	60	50	60	120	121
0	80	50	80	115	117
LSD (.05)				NS	-

(a) Banded potassium was placed 1 1/2 inches to side and 1 inch below seed at planting. Broadcast potassium and magnesium were applied and plowed down prior to planting. Potassium and magnesium sources were KCl and $MgSO_4$.

Planted: May 3, 1972
Row spacing: 28 inches
Basic fertilizer: 60-50-0 banded, 120 lb N/A sidedressed June 17, 1972
Harvest area: 116 sq. ft.
Soil tests: pH = 6.9, P = 210, K = 166
Harvested: July 31, 1972
Plant population: 18,000
Irrigation: 4.0 inches
Previous crop: corn

TABLE 5. Effect of source of nitrogen on yield of irrigated sweet corn.

Source of Nitrogen	Sweet Corn Yield (cwt/A)	
	1971	1968-72 Average
Ammonium Sulfate (a)	131	119
Ammonium Nitrate (a)	121	116
Calcium Nitrate (a)	122	112
Urea (a)	123	121
Anhydrous Ammonia (b)	139	127
LSD (.05)	NS	-

(a) 140 lb N/A topdressed May 25, 1972
(b) 140 lb N/A sidedressed May 25, 1972

Planted: May 2, 1972
Row spacing: 28 inches
Harvest area: 116 sq. ft.
Basic fertilizer: 10-50-100 banded at planting time
Soil tests: pH = 6.6, P = 289, K = 223
Harvested: August 9, 1972
Plant Population: 18,000
Irrigation: 4.0 inches
Previous crop: soybeans

TABLE 6. Effect of nitrogen and sulfur fertilizer on yield of grain and nitrogen content of Charlevoix dark red kidney beans (Experiment A).

Fertilizer Application		Red Kidney Bean			
Nitrogen	Sulfur	Yield (Bu/A)	Protein N (%)	Non Protein N (%)	Total N (%)
- - - -lb/A- - -					
0	0	44	2.54	.38	2.92
0	40 PD (a)	42	2.60	.41	3.01
0	80 PD (a)	42	2.59	.40	2.99
40 B	0	45	2.71	.38	3.09
40 B	1 (b)	46	2.65	.36	3.01
40 B	4 (b)	47	2.56	.43	2.99
40 B	8 (b)	44	2.59	.41	3.00
40 B	40 PD (a)	43	2.59	.43	3.02
40 B	80 PD (a)	37	2.62	.42	3.04
LSD (.05)		NS	.17	NS	--

(a) Sulfur applied as gypsum and plowed down May 23, 1972
(b) Sulfur applied as potassium sulfate and banded at planting

Planted: May 25, 1972
Plant Population: 58,500
Basic fertilizer: 0-50-50 banded at planting
Irrigation: 3.0 inches
Harvested: September 21, 1972
Row spacing: 28"
Harvest area: 373 sq. ft.

TABLE 7. Effect of nitrogen and sulfur fertilizer on yield of grain and nitrogen content of Charlevoix dark red kidney beans (Experiment B).

Fertilizer Applied			Red Kidney Bean			
Nitrogen	Sulfur	Source	Yield (Bu/A)	Protein N (%)	Non Protein N (%)	Total N (%)
---- lb/A ----						
0	0	KCL	41	2.59	.47	3.06
0	40	K_2SO_4	42	2.61	.49	3.10
100	0	KCL	44	2.78	.52	3.30
200	0	KCL	42	2.82	.44	3.26
100	40	K_2SO_4	44	2.67	.52	3.19
200	80	K_2SO_4 + Gypsum	38	2.68	.48	3.16
LSD (.05)			NS	.12	.05	-

N & S disced in May 23, 1972

Planted: May 25, 1972
Plant Population: 58,500
Basic fertilizer: 0-50-120 banded at planting
Irrigation: 3.0 inches
Harvested: September 21, 1972
Row spacing: 28"
Harvest area: 373 sq. ft.

INSECTICIDE EVALUATION FOR BEAN INSECT CONTROL

Arthur L. Wells,
Department of Entomology

The insecticide research on bean insects at the Montcalm Experimental Farm consisted of the evaluation of six soil systemic insecticide treatments banded below and to one side of the seed at the time of planting on June 16. The plots consisted of three replications of four 50 foot rows including two rows of Sanilac (white beans) and two rows of Charlevoix (dark red kidney) seed. The inside row of each variety in each plot was harvested on October 9 and yields determined. These data are presented below:

Material and Formulation	Rate/A.*		Yields/Acre			
			Whites		Dark Reds	
	Tox.	Form.	Bu.	Cwt.	Bu.	Cwt.
Amer Cyan 92100 15% Gran.	1 lb.	7 lb.	27.7	16.6	32.3	19.4
Thimet 15% Gran.	1 lb.	7 lb.	28.7	17.2	40.3	24.2
Disyston 15% Gran.	1 lb.	7 lb.	27.4	16.5	34.8	20.9
Diam Sham 15647 10% Gran.	1 lb.	10 lb.	29.7	17.8	32.6	19.6
Furadan 10% Gran.	1/2 lb.	5 lb.	27.1	16.3	30.0	18.0
Furadan 10% Gran.	1 lb.	10 lb.	35.5	21.3	46.1	27.7
Untreated (avg. of four)	--	--	28.4	17.0	36.6	22.0

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

A heavy population of Mexican bean beetles developed by late August in all of the untreated plots but the excellent start and rapid plant growth still resulted in yields comparable to most treatments. The insecticides provided almost complete protection from the beetles. The yield from the one pound application of Furadan appears higher than that from other treatments in both varieties.

Preplant Incorporated and Preemergence Herbicides for Weed Control in Field Beans at the Comden Farm, Montcalm Co., Michigan

D. L. Wyse, W. F. Meggitt and R. C. Bond
Department of Crop and Soil Sciences

Gratiot and Sanilac field beans were planted and treated June 16, 1972 on a McBride sandy loam soil (1.5% organic matter). The postemergence treatments we e applied July 20, 1972. Design of the experiment was a randomized block with three replications. Rainfall was .64 inches within 10 days after herbicide application. The weeds present were lambsquarter and pigweed. The plots were visually rated for injury and weed control July 26, 1972.

Preplant incorporated treatments. EPTC at 2 lb/A and 3 lb/A did not give satisfactory control of the pigweed population in this experiment. However, these treatments did give 87 and 90% control of the lambsquarter population. Trifluralin at 3/4 lb/A did not give good control of either the lambsquarter or pigweed population. EPTC + trifluralin at 2 + 1/2 lb/A controlled 87 and 80% of the lambsquarter and pigweed populations respectively. Alachlor at 2 lb/A did not give satisfactory control of lambsquarter and controlled 80% of the pigweed population. Alachlor + chloramben at 2 + 2 lb/A as a tank mix was the best preplant incorporated treatment resulting in 97% control of both broadleaf species. Dinitramine at 1/2 lb/A controlled 97% of the lambsquarter and 83% of the pigweed populations. This treatment resulted in 20% injury to the field bean plants.

Preplant incorporation-preemergence-and postemergence combinations. Two preplant incorporated herbicides, EPTC at 2 lb/A and trifluralin at 1/2 lb/A, were applied and incorporated twice with a disk. The following four preemergence herbicides were subsequently applied in combination with the two preplant incorporated treatments: chloramben at 2 lb/A; fluorodifen, 3 lb/A; dinoseb + chloramben (2:1) 1 gal/A and dinoseb at 4 1/2 lb/A.

BAS 3517-H at 1 1/2 lb/A was applied postemergence to the two preplant incorporated treatments. All EPTC at 2 lb/A preplant incorporated and preemergence combinations gave 97 to 100% control of the two broadleaf species. The preemergence-preplant incorporated combinations involving trifluralin controlled 90% or more of both broadleaf species. BAS 3517-H at 1 1/2 lb/A postemergence in combination with EPTC at 2 lb/A and trifluralin at 1/2 lb/A controlled 100% of the lambsquarter population and 90 to 97% of the pigweed population. BAS 3517-H at 1 1/2 lb/A alone as a postemergence treatment controlled 73 and 50% of the lambsquarter and pigweed population respectively and caused 12% injury to the field bean.

<u>Preemergence.</u> Three of the preemergence treatments - dinoseb, 4 1/2 lb/A; chloramben, 3 lb/A and alachlor + chloramben, 1 1/2 + 1 1/2 lb/A gave acceptable control of lambsquarter and pigweed. Fluorodifen at 3 lb/A and 4 1/2 lb/A controlled 97 to 100% of the pigweed population but was unacceptable in its control of lambsquarter. This experiment tends to show that for complete weed control in field beans a combination of preplant incorporated and preemergence herbicides should be considered. The preplant incorporated herbicides in general give better overall weed control than do the preemergence herbicides when applied alone.

Table 1. Preplant Incorporated and Preemergence Weed Control Evluations in Field Beans. Montcalm Co. Comden Farm

Planted: June 20, 1972
Treated: PPI+Pre - June 16, 1972
Post - July 20, 1972
Rated: August 26, 1972

Variety: Sanilac
Soil Type: McBride sandy loam
Organic Matter: 1.5%

Weeds present: lambsquarter, pigweed

Trmt. No.	PPI Treatments	PRE	POST	Rate lb/A	Injury	Weed Control Rating LQ	Weed Control Rating PW
1	EPTC			2	0.0	8.7	6.7
2	EPTC			3	0.0	9.0	7.7
3	Treflan			3/4	0.0	7.7	6.3
4	EPTC+Treflan			2+1/2	0.0	8.7	8.0
5	Lasso			2	0.0	7.0	8.0
6	Cobex			1/2	0.3	9.0	6.3
7	Cobex			1	2.0	9.7	8.3
8	Lasso+Amiben			2+2	0.0	9.7	9.7
9	Lasso+Amiben			1 1/2+1 1/2	0.0	9.0	8.0
10A	EPTC+Amiben			2+2	0.0	10.0	10.0
11A	EPTC+Preforan			2+3	0.0	10.0	10.0
12A	EPTC+Dynoram			2+1 gal	0.0	10.0	9.7
13A	EPTC+DNBP			2+4 1/2	0.0	10.0	10.0
14A	EPTC +		BAS 3517-H	2+1 1/2	1.8	10.0	9.3
10B	Treflan + Amiben			1/2+2	0.0	9.0	10.0
11B	Treflan + Preforan			1/2+3	0.3	9.0	9.7
12B	Treflan + Dynoram			1/2+1 gal	0.0	10.0	10.0
13B	Treflan + DNBP			1/2+4 1/2	0.0	10.0	9.7
14B	Treflan +		BAS 3517-H	1/2+1 1/2	1.2	9.7	9.0
10C		Amiben		2	0.0	5.7	8.3
11C		Preforan		3	0.0	3.7	9.7
12C		Dynoram		1 gal	0.0	8.7	7.0
13C		DNBP		4 1/2	0.0	10.0	9.0
14C			BAS 3517-H	1 1/2	1.2	7.3	5.0
15		Amiben		3	0.0	8.0	9.7
16		Lasso+Amiben		1 1/2+1 1/2	0.0	9.0	9.7
17		Lasso+Preforan		1 1/2+3	0.0	7.0	10.0
18		EL 119		1 1/2	0.0	6.0	7.7
19		Preforan		4 1/2	0.0	5.7	10.0
20	Check			--	0.0	0.0	0.0

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

REPORT OF RESULTS OF DRY BEAN VARIETY TEST

M. W. Adams
Department of Crop and Soil Sciences

The test in 1972 included 16 miscellaneous colored bean varieties or strains planted at the Montcalm Research Farm on June 13, in both 21 inch and 28 inch rows. The fertilizer used was 8-32-0, with 2% Mn and 2% Zn, applied at a rate of 250 pounds per acre at planting. A systemic insecticide, Thimet, was applied with the fertilizer at a 1.5 pound active per acre rate. The herbicide was Eptam. There were four replications per entry. Yield data are given in the accompanying table.

TABLE 1. Yield data in cwt/acre of clean beans for 16 varieties of colored beans grown on Comden Farm, 1972.

Variety or Strain	Cwts per Acre		
	21" rows	28" rows	Average
Light Red Kidney 01	22.04	21.53	21.79
" " " 02	23.01	24.19	23.60
" " " 03	24.87	24.73	24.80
" " " Manitou	20.98	23.59	22.29
" " " Redkote	23.90	26.03	24.96
Dark " " 021	24.57	23.75	24.16
" " " 023	26.09	22.76	24.43
" " " Charlevoix	24.45	26.98	25.72
California Dark Red Kidney	21.74	21.88	21.81
Expt. Cranberry 026 (Bush)	26.39	23.40	24.90
" " 027 "	24.23	23.94	24.09
" " 028 "	30.06	26.22	28.14
Mich. Improved Cran.(Vine)	22.97	27.04	25.00
Comm. Yellow Eye	21.32	24.10	22.71
Merithew Selection (Large White)	23.52	20.73	22.12
Swedish Brown (Bush)	30.78	31.17	30.98
General Averages	24.43	24.50	24.46

Discussion of Results

On the overall average there was no difference between beans in 21 and 28 inch rows. But among the 16 strains there was a comparison of particular interest, the bush-type cranberry bean selections all yielded better in the 21 inch rows, and exceeded the vine-type by up to 7 cwt. per acre. In the 28 inch row the vine-type slightly exceeded the better bush.

The most consistently good yielder was the Swedish Brown bean, not at present a commercial type. This bean is a bush type and is early in maturity. It yielded equally well in both row spacings.

As for the kidney strains, plans are underway to increase seed of LRK 03 and DRK 023, the better strains of their classes. These strains are resistant to the halo blight disease, whereas the standard varieties are susceptible.

1972 GRAIN AND FORAGE SORGHUM TRIALS

Stuart Hildebrand
Department of Crop and Soil Sciences

The basic reason for producing grain and forage (silage) sorghum in Michigan is as a substitute for corn on droughty soils where they are geographically adapted. In 1972, six grain and two silage-type forage sorghum hybrids were entered in a trial at the Montcalm Farm to determine their adaptation for maturity and production per acre. Selection of hybrids was based on previous performance in southwest Michigan trials, with the grain hybrids varying in bird resistance.

Seed was planted on May 31 in 28 inch rows, 20 feet long and each hybrid was replicated 4 times. Because of previous treatment no fertilizer was applied at planting but 100 pounds per acre of nitrogen was applied later as a sidedressing. Emergence was delayed by cold and dry weather. Silage harvest was made September 26. Frosts occurred on October 10 and 11 and grain harvest followed on October 16. Yield and other appropriate information follow:

Grain Sorghum

Hybrid	Yield in bu. per acre 14% M.	Remarks
MM-54 BR	69.5	Mature at harvest. Little bird damage.
Pride 500A	63.2	Immature at harvest. Slight bird damage.
Acco 920	52.2	Mature at harvest. Moderate bird damage.
Dorman 100	73.5	Immature at harvest. Little bird damage.
So. Dakota 506	55.9	Mature at harvest. Considerable bird damage.
NK 121	75.8	Mature at harvest. Little bird damage.

Forage Sorghum

Hybrid	Yield of silage in tons per acre 70% M	Remarks
NK 300	17.8	5-3/4 feet tall. 75,000 plant population. Has about 20 to 25 percent grain.
Pioneer 931	28.9	12 feet tall. 87,000 plant population. Very little grain. Hard to cut.

Both varieties had 72% moisture at harvest. Usually NK 300 contains less moisture. It appeared that Pioneer 931 was short of nitrogen near the end of the season. For information on feeding trials on the two sorghums refer to MSU Research Report 174, 1972 Report of Beef Cattle Research, August 1972.

CORN HYBRIDS, PLANT POPULATION AND IRRIGATION

E. C. Rossman and Bary M. Darling
Department of Crop and Soil Sciences

72 commercial and experimental corn hybrids were evaluated in 1972 with irrigation and without irrigation, Table 1. Six inches of irrigation water were applied (1 1/2" on July 7, 11, 24, 30). Buoyoucous soil moisture blocks were placed at 6, 12, 18, and 24-inch depths in both unirrigated and irrigated plot areas.

Soil moisture in the unirrigated plots was below 50% water holding capacity at 6-12" for only a short time in July and was 80-100% at 18-24" throughout the growing season. Nearly adequate rainfall during the growing season in 1972 contrasts with 1971 when soil moisture remained below 50% at 12-24" depths from July 5 to August 30 on unirrigated plots.

Irrigated yields in 1972 averaged 157.3 bushels and unirrigated yields average 136.6 bushels--a difference of 20.7 bushels for the 6" of irrigation applied in July. Comparable yields in 1971 were 162.5 irrigated and 28.2 not irrigated--a difference of 134.3 bushels for 12 1/2" of irrigation.

Hybrids ranged in yield from 98.5 to 206.3 irrigated and 90.5 to 179.1 not irrigated.

Five-Year Averages 1968-1972

Table 2 presents a five-year summary of yields and stalk lodging. Irrigated corn yields averaged 149.1 irrigated and 89.8 not irrigated for the five-year period--a difference of 59.3 bushels. The highest yielding hybrids averaged 79.4 bushels more when irrigated (195.5 vs 116.1) and the lowest yielding hybrids averaged 36.2 bushels more (94.7 vs 58.5). Irrigation response of the highest yielding hybrids was more than twice as great as the response of the lowest yielding hybrids, 79.4 vs 36.2 bushel increases from irrigation.

Stalk lodging. During the first three years, 1968-1970, there was more stalk lodging on unirrigated plots. Stalk lodging averaged higher on irrigated plots during the last two years, 1971-1972.

Plant Population x Irrigation

Five hybrids at five plant populations irrigated and not irrigated were grown in each of five years, 1968-1972. Yields and stalk lodging are summarized in Table 3.

Yields. Highest yields with irrigation were reached at a population of about 23,100 (181.3 bu.) and decreased at the highest plant population (27,200) to 163.8 bushels during the five years. Without irrigation, highest yields were attained at a population of 19,200 (108.9 bu.) and decreased at higher populations--23,100 = 93.1 bu. and 27,200 = 83.0 bu.

Highest yields were attained with about 4,000 more plants per acre when irrigated than when not irrigated--23,100 vs 19,200 plants per acre.

Stalk lodging. There tended to be slightly more lodging with irrigation than without irrigation in 1972 and in 1971. The reverse, more lodging when not irrigated, occurred during the previous three years, 1968-1970.

Moisture content of grain at harvest. The effect of either irrigation or plant population on grain moisture was small during the five years. Irrigated corn averaged 0.7% higher moisture. Population of 23,100 and 27,200 averaged about .7% higher moisture than population of 15,100 and 19,200.

Table 1

Zone 3

NORTH CENTRAL MICHIGAN

Montcalm County Trial-Irrigated vs Not Irrigated

One, Two, and Three Year Averages - 1972, 1971, 1970

Hybrid (Brand------Variety)	% Moisture 1972	% Moisture 2 Yrs	% Moisture 3 Yrs	Bushels per acre 1972 Irrig	Bushels per acre 1972 Not Irrig	Bushels per acre 2 Years Irrig	Bushels per acre 2 Years Not Irrig	Bushels per acre 3 Years Irrig	Bushels per acre 3 Years Not Irrig	% Stalk lodging 1972 Irrig	% Stalk lodging 1972 Not Irrig	% Stalk lodging 2 Years Irrig	% Stalk lodging 2 Years Not Irrig	% Stalk lodging 3 Years Irrig	% Stalk lodging 3 Years Not Irrig
Michigan 200 (4X)	23.9	23	21	98.5	90.5	101	62	109	71	14.1	3.2	14	2	10	3
Michigan 250 (4X)	25.7	25	24	108.3	98.2	123	61	128	77	13.7	12.3	13	8	12	8
Michigan 275-2X(2X)	26.2	25	24	126.3	99.9	137	65	138	76	15.5	1.5	11	1	9	3
Michigan 280 (4X)	26.2	25	24	136.6	123.4	145	75	145	82	12.7	12.4	10	7	9	8
Michigan 300 (4X)	26.4	25	24	138.4	126.9	145	76	142	84	17.0	3.1	11	5	9	6
Pioneer 3853 (4X)	27.5	--	--	153.4	128.5	--	--	--	--	15.8	2.2	--	--	--	--
Super Crost S14 (2X)	27.6	--	--	103.4	95.4	--	--	--	--	17.0	10.3	--	--	--	--
Acco UC1900 (2X)	27.8	26	--	112.1	99.5	136	68	--	--	24.4	14.5	14	7	--	--
Jacques JX863 (2X)	28.0	--	--	112.0	90.3	--	--	--	--	29.7	23.8	--	--	--	--
Michigan 333-3X (3X)	28.0	27	--	145.0	136.1	156	89	--	--	10.7	2.2	6	1	--	--
Northrup King PX476(3X)	28.2	--	--	144.2	124.0	--	--	--	--	12.5	2.1	--	--	--	--
Funk Bros. G4180 (3X)	28.2	26	--	130.4	120.3	135	77	--	--	20.0	6.9	15	5	--	--
Funk Bros. G4263 (3X)	28.3	26	--	158.1	145.6	157	90	--	--	11.1	3.6	8	2	--	--
Cowbell SX002 (2X)	28.5	27	--	147.7	123.9	144	79	--	--	11.6	4.3	7	3	--	--
Northrup King PX20 (2X)	28.6	27	25	157.1	134.8	158	78	154	90	10.1	7.5	6	4	6	3
Michigan 396-3X (3X)	28.6	27	26	153.0	146.9	167	83	166	96	5.8	4.3	6	3	5	2
Blaney B-302 (2X)	28.7	--	--	138.6	129.3	--	--	--	--	2.9	8.6	--	--	--	--
Funk Bros. G4252 (3X)	29.2	--	--	156.1	128.3	--	--	--	--	10.9	1.5	--	--	--	--
DeKalb XL304 (3X)	29.2	--	--	127.7	105.7	--	--	--	--	15.1	16.7	--	--	--	--
Cowbell SX102 (2X)	29.4	27	26	135.1	125.2	141	81	143	90	10.9	5.0	9	3	7	4
Michigan 400 (4X)	29.4	27	26	142.1	129.8	142	78	141	86	10.2	9.1	11	5	7	4
Mich.Exp. 70-21479-CB (2X)	29.6	--	--	132.7	126.1	--	--	--	--	9.0	8.0	--	--	--	--
Mich.Exp. 71-2001(2X)	29.8	--	--	156.2	134.4	--	--	--	--	0.8	1.5	--	--	--	--
Mich.Exp. 71-2001A(2X)	29.9	--	--	148.5	124.3	--	--	--	--	5.4	2.2	--	--	--	--
Mich.Exp. 69-2223 (2X)	30.0	--	--	137.1	128.1	--	--	--	--	8.6	0.0	--	--	--	--

Table 1 continued

Pioneer 3909 (2X)	30.1	28	27	136.8	127.1	143	80	148	87	5.8	3.7	5	2	4	3
DeKalb XL15A (2X)	30.3	28	--	135.5	122.7	154	76	--	--	20.9	12.5	14	6	--	--
Mich.Exp. 69-3399 (3X)	30.3	--	--	169.8	148.7	--	--	--	--	6.7	2.9	--	--	--	--
Pioneer 3784 (2X)	30.5	28	--	155.0	127.6	170	70	--	--	7.1	2.9	5	2	--	--
Michigan 410-2X (2X)	30.5	29	28	154.6	143.5	177	87	183	100	6.4	3.0	8	2	6	1
Acco UC2301 (2X)	30.5	28	--	162.7	146.2	171	83	--	--	12.9	5.8	10	3	--	--
Migro M-1101 (2X)	30.6	--	--	151.5	137.6	--	--	--	--	3.0	0.7	--	--	--	--
Pioneer 3937 (3X)	30.8	--	--	150.7	121.7	--	--	--	--	7.3	2.9	--	--	--	--
*Funk Bros. G4343 (2X)	30.8	--	--	175.0	142.3	--	--	--	--	8.8	1.5	--	--	--	--
Blaney B-55A (3X)	30.9	28	--	123.1	111.3	141	66	--	--	5.1	0.0	7	1	--	--
DeKalb XL24 (2X)	31.0	29	28	169.7	142.1	161	89	159	96	8.1	6.5	7	4	5	4
Northrup King PX519(Sp.)	31.0	--	--	144.4	136.2	--	--	--	--	2.2	6.1	--	--	--	--
Jacques JX162A (2X)	31.1	30	--	158.4	127.2	172	81	--	--	14.7	4.5	15	3	--	--
Cowbell SX112 (2X)	31.1	--	--	170.3	140.1	--	--	--	--	19.4	2.9	--	--	--	--
Super Crost 1712 (2X)	31.2	--	--	155.3	138.7	--	--	--	--	8.6	2.2	--	--	--	--
**Michigan 572-3X (3X)	31.2	29	--	186.3	156.5	184	91	--	--	10.0	4.5	7	3	--	--
Acco U334 (3X)	31.2	--	--	163.9	131.9	--	--	--	--	9.8	1.5	--	--	--	--
Northrup King PX529(3X)	31.2	--	--	159.1	131.5	--	--	--	--	11.6	4.3	--	--	--	--
**Pride R290 (2X)	31.4	29	28	178.4	164.4	182	92	180	101	10.4	8.9	10	5	7	4
Pride R501 (3X)	31.4	--	--	158.7	131.3	--	--	--	--	9.2	0.7	--	--	--	--
Northrup King PX556(3X)	31.5	--	--	149.6	120.8	--	--	--	--	6.4	5.9	--	--	--	--
**Mich.Exp. 71-2002(2X)	31.6	--	--	198.3	169.4	--	--	--	--	7.1	3.0	--	--	--	--
**Mich.Exp. 69-3097(3X)	31.7	30	--	191.6	166.7	190	102	--	--	8.0	0.0	7	0	--	--
*Mich.Exp. 69-3021 (3X)	31.8	--	--	172.8	146.0	--	--	--	--	14.3	5.4	--	--	--	--
Pioneer X8351 (2X)	31.9	--	--	141.2	117.2	--	--	--	--	9.4	2.2	--	--	--	--
Blaney B-501A (2X)	31.9	--	--	165.8	134.9	--	--	--	--	9.0	3.8	--	--	--	--
Blaney B-AA (2X)	32.0	29	27	156.6	146.2	171	90	156	94	9.6	7.2	6	5	5	5
Mich.Exp. 70-21259-CB (2X)	32.0	--	--	167.8	141.7	--	--	--	--	18.0	9.3	--	--	--	--
Pioneer 3773 (2X)	32.0	--	--	154.0	140.7	--	--	--	--	13.1	17.3	--	--	--	--
**Pioneer 3780 (2X)	32.3	--	--	181.9	156.9	--	--	--	--	11.7	1.4	--	--	--	--

Table 1 continued

**Blaney BX-AA (2X)	32.3	30	--	177.9	154.5	181	93	--	--	5.8	7.2	5	4	--	--
Renk RK9 (Sp.)	32.6	--	--	142.0	122.8	--	--	--	--	14.6	14.1	--	--	--	--
**Michigan 511-3X(3X)	32.6	31	--	188.5	172.8	199	101	--	--	5.8	4.3	4	2	--	--
**Funk Bros. G4444 (2X)	32.8	31	--	203.8	163.3	200	99	--	--	5.8	6.5	6	4	--	--
Pioneer 3729 (3X)	32.9	--	--	145.2	135.4	--	--	--	--	2.2	4.4	--	--	--	--
**Northrup King PX47E(2X)	33.0	--	--	187.2	159.3	--	--	--	--	3.0	2.2	--	--	--	--
Acco UC3300 (2X)	33.0	--	--	139.1	128.9	--	--	--	--	7.9	7.9	--	--	--	--
**Michigan 500-2X (2X)	33.0	30	29	178.2	159.3	181	94	177	105	6.6	0.7	7	0	5	1
*Mich.Exp. 67-1932 (2X)	33.4	31	--	178.5	142.0	183	87	--	--	3.6	3.1	4	3	--	--
**Acco UC3301 (2X)	33.4	--	--	182.7	149.8	--	--	--	--	3.6	2.9	--	--	--	--
**Michigan 560-2X(2X)	33.4	--	--	187.8	162.1	--	--	--	--	5.8	9.4	--	--	--	--
**Mich.Exp. 67-3124 (2X)	33.5	32	--	206.3	179.1	208	109	--	--	3.7	3.3	5	2	--	--
**Mich.Exp. 71-2003 (2X)	33.5	--	--	175.5	149.9	--	--	--	--	5.9	3.5	--	--	--	--
*Acco UC3201 (2X)	33.7	--	--	172.3	143.7	--	--	--	--	2.9	3.6	--	--	--	--
**Super Crost S27 (2X)	34.0	31	--	172.7	160.7	180	94	--	--	7.4	2.2	5	2	--	--
**P.A.G. SX69 (2X)	34.1	31	--	201.7	161.4	195	96	--	--	3.4	0.8	4	0	--	--
**Super Crost S25 (2X)	35.6	31	--	185.4	152.2	187	84	--	--	6.7	8.8	6	5	--	--
Average	30.6	28	26	157.3	136.6	163	84	151	89	9.7	5.6	8	3	7	4
Range	23.9 to 35.6	23 to 32	21 to 29	98.5 to 206.3	90.5 to 179.1	101 to 208	61 to 109	109 to 183	71 to 105	0.8 to 29.7	0.0 to 23.8	4 to 15	0 to 8	4 to 12	1 to 8
Least significant difference	1.1	0.7	0.5	14.4	12.5	7	6	5	5						

* Significantly better than average yield, irrigated, 1972

** Significantly better than average yield, not irrigated, 1972

Table 1 continued

		1972	1971	1970
Planted		May 5	May 6	May 8
Harvested		Oct. 25	Oct. 29	Oct. 16
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		20,100	20,300	19,900
Rows		30"	30"	30"
Fertilizer		258-145-145	160-140-140	213-160-160
Soil test:	pH	5.5	6.0	6.3
	P	420 (very high)	340 (very high)	246 (very high)
	K	178 (medium)	246 (high)	255 (high)
Irrigation		6"	12.5"	5.5"

Farm Cooperator: Theron Comden, Lakeview

County Extension Director: James Crosby, Stanton

Table 2. Average, highest, and lowest yields and percent stalk lodging for corn hybrids irrigated and not irrigated for five years, 1968-1972.

Year	No. of hybrids tested	Average		Highest		Lowest	
		Irrigated	Not irrigated	Irrigated	Not irrigated	Irrigated	Not irrigated
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		149.1	89.8	195.5	116.1	94.7	58.5
			% Stalk lodging				
1972	72	9.7	5.6	29.7	23.8	0.8	0.0
1971	56	7.4	0.9	23.4	3.1	1.5	0.0
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
Average		5.3	7.1	17.5	24.6	0.5	1.1

Irrigation:

1972 = 6"
July 7 = 1.5"
July 11 = 1.5"
July 24 = 1.5"
July 30 = 1.5"

1971 = 12.5"
June 23 = .75"
June 27 = 1.0"
July 3 = 1.0"
July 7 = .75"
July 12 = 1.0"
July 16 = 1.0"
July 23 = 1.0"
July 27 = 1.0"
Aug. 2 = 1.0"
Aug. 6 = 1.0"
Aug. 13 = 1.0"
Aug. 17 = 1.0"

1970 = 5.5"
July 20 = 1"
July 27 = 1"
July 30 = .5"
Aug. 4 = 1"
Aug. 11 = 1"
Aug. 13 = 1"

1969 = 6"
July 26 = 1.5"
Aug. 8 = 1.5"
Aug. 14 = 1.5"
Aug. 27 = 1.5"

1968 = 7.5"
July 16 = 1.5"
Aug. 2 = 1.5"
Aug. 12 = 1.5"
Aug. 20 = 1.5"
Sept. 7 = 1.5"

Table 3. Average yield and percent stalk lodging at four plant populations irrigated and not irrigated for five years, 1968-1972.

Year	15,100		19,200		23,100		27,200	
	Irrigated	Not irrigated	Irrigated	Not irrigated	Irrigated	Not irrigated	Irrigated	Not irrigated
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	143.2	92.9	169.3	108.9	181.3	93.1	163.8	83.0
				% Stalk lodging				
1972	10.3	7.6	12.3	9.1	18.1	16.2	23.1	19.8
1971	6.4	1.0	7.8	0.6	10.7	0.9	10.1	1.5
1970	2.9	8.0	5.8	9.1	8.4	10.6	9.4	11.5
1969	2.4	18.5	2.7	23.4	3.4	28.0	5.2	34.4
1968	0.6	3.3	0.4	5.1	2.7	12.1	3.4	20.4
Average	4.5	7.7	5.8	9.5	8.7	13.6	10.2	17.5