Chase File

1979 Research Report

MONTCALM EXPERIMENT STATION

Michigan State University
Agricultural Experiment Station

ACKNOWLEDGMENTS

Research personnel working at the Montcalm Branch Experiment Station have received much assistance in various ways. A special thanks is due each of these individuals, the Michigan Potato Industry Commission, private companies and government agencies who have made this research possible. Many valuable contributions in the way of fertilizers, chemicals, seed, equipment, technical assistance, personal services, and monetary grants were received and are hereby gratefully acknowledged.

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

TABLE OF CONTENTS

MONTCALM BRANCH EXPERIMENT STATION RESEARCH REPORT

R.W. Chase and M.H. Erdmann, Coordinators
Department of Crop and Soil Sciences

INTRODUCTION

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

This report is designed to coordinate all of the research obtained at this facility during 1979. Much of the data herein reported represents projects in various stages of progress; so 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

Tables 1 and 2 summarize the twelve year temperature and rainfall data. Temperatures during 1979 were not too much different than the 12 year average. August was somewhat cooler and there were many cloudy and high humidity days. During the entire growing season there were only four days that the temperature reached 90°. September was unseasonably warm with the average maximum temperature some five degrees above the 12 year average.

Of particular interest is the rainfall record. Total rainfall during the growing season was the second lowest since 1967 and 6.1 inches below the 12 year average. Only 0.04 inches were recorded in September which is the lowest recorded for any month during our tenure at this facility. It allowed for continuous plot harvest without interuption.

Irrigation applications of slightly less than one inch each were made fourteen times (June 6, July 10, 13, 17, 20, 23, 27, 31, August 3, 7, 14, 21, 28, September 3, 8).

SOIL TESTS

Soil test results for the general plot area were:

	Pounds per Acre				
pH	P	K	Ca	Mg	Percent organic matter
6.3	601	253	960	137	2.6

Table 1. The 12 year summary of average maximum and minimum temperatures during the growing season at the Montcalm Branch Experiment Station.

	April		May		June		July		August		September		6-month average	
Year	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
1968	61	37	62	41	74	53	80	55	81	58	74	50	73	50
1969	56	35	67	43	70	50	80	59	82	56	73	49	74	49
1970	54	35	65	47	72	55	80	60	80	57	70	51	73	45
1971	53	31	65	39	81	56	82	55	80	53	73	54	76	48
1972	47	30	70	47	72	50	79	57	76	57	69	49	73	48
1973	54	36	63	42	77	58	79	60	80	60	73	48	74	51
1974	57	36	62	41	73	52	81	57	77	56	68	45	70	48
1975	48	28	73	48	75	56	80	57	79	58	65	44	70	49
1976	58	35	63	41	79	57	81	58	80	53	70	46	71	48
1977	62	37	80	47	76	50	85	61	77	52	70	53	75	50
1978	50	31	67	45	78	50	81	56	82	57	75	52	72	49
1979	50	33	66	44	74	55	82	57	77	55	76	47	71	49
12-year average	54	34	67	44	75	54	81	58	79	56	71	49		

Table 2. The 12-year summary of precipitation (inches per month) recorded during the growing season at the Montcalm Station.

Year	April	May	June	July	August	September	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
1973	3.25	3.91	4.34	2.36	3.94	1.33	19.13
1974	4.07	4.83	4.69	2.39	6.18	1.81	23.97
1975	1.81	2.05	4.98	2.71	11.25	3.07	25.87
1976	3.27	4.03	4.22	1.50	1.44	1.40	15.86
1977	1.65	0.46	1.66	2.39	2.61	8.62	17.39
1978	2.34	1.35	2.55	1.89	5.90	2.77	16.80
1979	2.58	1.68	3.77	1.09	3.69	0.04	12.85
12-year average	2.54	2.82	3.73	2.24	4.55	3.06	18.94

FERTILIZERS USED

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

Plow down	- 0-0-60	- 200 lbs/A
Banded at planting	- 20-10-10	- 600 lbs/A
Sidedressed at hilling	- 46-0-0	- 300 lbs/A

Alfalfa cover crop plowed down.

HERBICIDES

Preplant incorporated EPTC (Eptam) at 3 lbs/A followed by delayed preemergence of metribuzin (Sencor) at 1/2 lb/A.

DISEASE & INSECT CONTROL

Systemic insecticide Temik was applied at 3 lbs/A.

Foliar fungicide and insecticide sprays were as follows:

July 13	Bravo
July 20	Monitor + Bravo
July 28	Monitor + Bravo
August 3	Thiodan + Bravo
August 11	Thiodan + Bravo
August 20	Thiodan + Bravo
August 28	Thiodan + Bravo
Sept. 7	Thiodan + Bravo

Top killed prior to harvest with Dinoseb (Dow General) two quart/A plus crop oil concentrate (Herbimax) at one quart/A.

THE INFLUENCE OF SELECTED PRODUCTION MANAGEMENT INPUTS ON THE YIELD, QUALITY AND STORABILITY OF POTATOES

G.W. Bird and J. Noling
Department of Entomology

The objective of this study was to examine varying phosphorus levels and their interaction with selected insect and nematode control programs and to monitor growth and development and yield. Seedpieces were planted on May 16-17, 1979 for all experiments at the Montcalm Potato Research Farm in Entrican, Michigan. Each plot consisted of four rows 50 ft. (15.24m) in length and 34 in. (.86m) apart, with 8 to 12 in. (20.5-30.5cm) spacings between plants. Plant growth and development was monitored at various intervals throughout the season. This was accomplished by randomly selecting two plants from the outside rows of each plot and then returning them to the laboratory for analysis. In the laboratory, root weight, foliage weight and tuber weight and number were recorded at each sampling date. Soil and root populations of nematodes were estimated from samples taken at these times. Soil samples (centrifugation-flotation technique) for nematode analysis were taken by core sampling the two outside rows of each plot. Root samples (shaker technique) were derived from plants returned to the laboratory for plant growth analysis. At harvest, the center two rows of each plot were harvested, graded and weighed. During the season plants were maintained under normal commercial irrigation and insect and disease control practices. A complete random block- two factorial design was used to analyze the data, with each treatment replicated five times.

Experiment I

Seedpieces (cv Superior) were planted in plots treated with two levels of phosphorus (50, 150 lb/acre) and two nematicides (Temik 15G 3.0 a.i./acre, Vorlex 10 gal/acre). Temik 15G was applied in the seed piece furrow at planting and Vorlex was injected to a 6-8 in. (15-20cm) soil depth on May 1, 1979. Those plots to receive phosphorus were applied with either 50 lbs/acre or 150 lbs/acre P_2O_5 at planting. All plots also received a uniform application of 500 lbs/acre NPK(20-0-0) at planting. The plots were hilled and sidedressed at an application rate of 145 lbs/acre Urea(45%) on June 20, 1979.

Phosphorus application rate and nematicide treatment contributed significantly to final yield. Irrespective of the pesticide used, yields were higher at the higher phosphorus application rate (Table 1). Within each phosphorus level, total yields increased consistantly from the controls, to the Temik and Vorlex treated plots, respectively. The total yield of plots treated with Vorlex were significantly higher ($P = 0.05$) than the controls at the 0 lb/acre and 50 lb/acre phosphorus rates. Highest total yields were observed in the 150 lb/acre phosphorus plots with Temik 15G and Vorlex. Yields of A grade potatoes showed similar results to that of total yield (Table 1). No significant differences in yields of B grade potatoes were observed. Yields of the oversized 'Jumbo' grade potatoes increased with increasing phosphorus application rate in the controls and Temik treated plots. Both Temik 15G at the 150 lb/acre phosphorus rate and Vorlex at the 50 lb/acre and 150 lb/acre phosphorus rates, significantly increased yields over the controls and the 0 lb/acre phosphorus plots. The control at the 150 lb/acre phosphorus rate and Vorlex at the two highest phosphorus rates significantly (P = 0.05) increased the specific gravity of potatoes over the Temik 15G plots at the 50 lb/acre phosphorus rate (Table 11). There were no significant differences in soil population densities of Pratylenchus penetrans among the plots except for the sample of June 26, 1979 (Table 2). Temik 15G significantly reduced the soil population density of P. penetrans over the control and Vorlex treatments in the 0 lb/acre phosphorus plots. There were no significant differences in root population densities of P. penetrans among the plots season long (Table 3). Based on P. penetrans recovered from root tissue in this test, Temik 15G resulted in the best nematode control. There were no significant differences in root weight, tuber weight, plant weight or tuber number among the treatments season long, (Tables 5, 8, 9, 10, respectively). The effect of varing phosphorus levels and nematicide treatment on stem weight and foliage weight is reported in Tables Six and Seven.

Experiment II

Seedpieces (cv Russet Burbank) were planted in plots treated with two levels of phosphorus (50-150 lbs/acre) and two nematicide treatments (Temik 15G 3.0 a.i./acre, Vorlex 10 gal/acre). Temik 15G was applied in the seed piece furrow at planting and Vorlex was injected to a 6-8 in. (15-20cm) soil depth on May 1, 1979. Those plots to receive phosphorus were applied with either 50 lbs/acre or 150 lbs/acre P_2O_5 at planting. All plots also received a uniform application of 500 lbs/acre NPK(20-0-0) at planting. The plots were hilled and sidedressed at an application rate of 145 lbs/acre Urea(45%) on June 20, 1979.

Phosphorus application rate and nematicide treatment contributed significantly (P = 0.05) to the final yield (Table 12). Irrespective of the pesticide used, yields were generally higher at the higher phosphorus rate. Vorlex at the two highest phosphorus rates significantly (P = 0.05) increased total yield when compared to the controls at the 0 lb/acre and 50 lb/acre phosphorus rate and the 0 lb/acre Temik 15G plots. Yield of Jumbo grade potatoes increased with increasing phosphorus, and was highest in the Vorlex treated plots (Table 12). Within each phosphorus level, yields increased consistantly from the controls to the Temik and Vorlex treated plots, respectively. Vorlex at the 150 lb/acre phosphorus level significantly(P = 0.05) increased the yield of Jumbo grade potatoes. The yield of B grade potatoes was significantly (P = 0.05) greater in the 50 lb/acre phosphorus control plots than in the control plots at the lower phosphorus level (Table 12). Irrespective of the phosphorus application rate, yield of A grade potatoes were highest in the Vorlex treated plots (Table 12). Yield of A grade potatoes was significantly (P = 0.05) increased with Vorlex at phosphorus rates above 50 lb/acre over the control and Temik 15G plots at 0 lb/acre. The yield of Knob grade potatoes generally increased with increasing phosphorus and were highest in the Temik 15G and Vorlex treated plots (Table 12). Yields of Knob grade potatoes were significantly (P = 0.05) increased by Temik 15G, at the 150 lb/acre phosphorus rate. Vorlex at the 150 lb/acre phosphorus rate significantly (P = 0.05) increased the specific gravity of cv Russet Burbank potatoes (Table 11). Irrespective of the phosphorus level, soil population levels of P. penetrans were consistantly lower in the Temik 15G plots season long (Table 13). During the June 26, 1979 sample, Temik 15G significantly (P = 0.05) reduced soil population densities of P. penetrans at all phosphorus rates when compared to the control plot at the 150 lb/acre phosphorus rate. Based on P. penetrans recovered from root tissue in this test, Temik 15G resulted in the best nematode control. There were no significant (P = 0.05) differences in root weight, tuber weight or tuber number season long (Table 16, Table 19, Table 20, respectively). From June 26, 1979 plant weight were higher in all nematicide treatments (Table 21). Stem weight and foliage weight were generally higher at the higher phosphorus rate and in all the nematicide treatments (Table 17, Table 18, respectively).

TABLE 1

Influence of selected management inputs on the yield and grade of potatoes (cv Superior)

TREATMENT	A Grade	B Grade	Jumbo Grade	Total
	YIELD (CTW/ACRE)			
0P[2] Check	215.0a[1]	10.9a	10.5a	236.7a
0P Temik 15G 3 lb a.i./acre	247.5ab	13.2a	20.0ab	280.7ab
0P Vorlex 10 gal/acre	277.5bc	14.9a	22.6abc	314.9bc
50P Check	247.7ab	10.5a	15.0ab	273.3ab
50P Temik 15G 3 lb a.i./acre	276.8bc	11.2a	28.7bcd	316.7bc
50P Vorlex 10 gal/acre	298.1c	12.7a	38.1d	348.9c
150P Check	282.7bc	11.6a	19.4ab	313.7bc
150P Temik 15G 3 lb a.i./acre	315.7c	11.9a	36.4cd	364.1c
150P Vorlex 10 gal/acre	324.6c	12.3a	29.9bcd	366.7c

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newmans-Keuls Multiple Range Test.

2 0P = 0 lb. phosphorous per acre

TABLE 2

Influence of selected management inputs on population ddensity of *P. penetrans* on potatoes (cv Superior)

TREATMENT		5/01/79	5/16/79	6/04/79	6/26/79	7/23/79	8/21/79
		P. penetrans per 100 cm^3 soil					
0P[2]	Check	28a[1]	41a	20a	19b	78a	39a
0P	Temik 15G 3 lb a.i./acre	30a	36a	17a	2a	85a	2a
0P	Vorlex 10 gal/acre	35a	30a	16a	15b	79a	39a
50P	Check	42a	39a	20a	12ab	120a	55a
50P	Temik 15G 3 lb a.i./acre	23a	24a	9a	3a	23a	4a
50P	Vorlex 10 gal/acre	30a	16a	18a	8ab	12a	53a
150P	Check	55a	50a	19a	20b	80a	40a
150P	Temik 15G 3 lb a.i./acre	42a	37a	12a	2a	25a	8a
150P	Vorlex 10 gal/acre	32a	14a	14a	10ab	119a	41a

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newman-Keuls Multiple Range Test.

2 0P = 0 lb. phosphorous per acre

TABLE 3

Influence of selected management inputs on population density of *P. penetrans* on potatoes (cv Superior)

TREATMENT			P. penetrans per gram root tissue			
			6/04/79	6/26/79	7/23/79	8/21/79
0P[2]	Check		19a[1]	56a	178a	95a
0P	Temik 15G	3 lb a.i./acre	3a	11a	6a	6a
0P	Vorlex	10 gal/acre	15a	20a	206a	74a
50P	Check		19a	24a	205a	182a
50P	Temik 15G	3 lb a.i./acre	7a	14a	6a	25a
50P	Vorlex	10 gal/acre	16a	17a	149a	151a
150P	Check		25a	36a	175a	214a
150P	Temik 15G	3 lb a.i./acre	3a	11a	9a	6a
150P	Vorlex	10 gal/acre	9a	19a	173a	148a

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newman-Keuls Multiple Range Test.

2 0P = 0 lb. phosphorous per acre

TABLE 4

Influence of selected management inputs on population density of *P. penetrans* on potatoes (cv Superior)

TREATMENT	*P. penetrans* per 100 cm^3 soil and per gram root tissue combined 6/04/79	6/26/79	7/23/79	8/21/79
0P[2] Check	40a	76b	256bc	134a
0P Temik 15G 3 lb a.i./acre	20a	13a	91ab	9a
0P Vorlex 10 gal/acre	32a	36ab	285bc	113a
50P Check	39a	37ab	326c	237a
50P Temik 15G 3 lb a.i./acre	17a	17a	92ab	29a
50P Vorlex 10 gal/acre	35a	25ab	162abc	204a
150P Check	44a	57ab	255bc	254a
150P Temik 15G 3 lb a.i./acre	15a	14a	35a	14a
150P Vorlex 10 gal/acre	24a	30ab	293bc	189a

[1] Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newman-Keuls Multiple Range Test.

[2] 0P = 0 lb. phosphorous per acre

TABLE 5

Influence of selected management inputs on root weight of potatoes (cv Superior)

TREATMENT	ROOT WEIGHT (GRAMS) 6/04/79	6/26/79	7/23/79	8/21/79
0P[2] Check	3.6a[1]	13.7a	12.5a	9.3a
0P Temik 15G 3 lb a.i./acre	3.8a	13.6a	11.8a	11.0a
0P Vorlex 10 gal/acre	3.4a	15.0a	10.6a	8.9a
50P Check	4.3a	13.6a	13.4a	14.7a
50P Temik 15G 3 lb a.i./acre	3.0a	12.2a	14.4a	7.7a
50P Vorlex 10 gal/acre	3.2a	15.4a	12.3a	6.9a
150P Check	3.6a	14.2a	11.0a	8.5a
150P Temik 15G 3 lb a.i./acre	4.2a	15.8a	13.4a	5.5a
150P Vorlex 10 gal/acre	3.3a	13.7a	13.0a	7.6a

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newmans-Keuls Multiple Range Test.

2 0P = 0 lb. phosphorous per acre

TABLE 6

Influence of selected management inputs on stem weight of potatoes (cv Superior)

TREATMENT			STEM WEIGHT (GRAMS) 6/04/79	6/26/79	7/23/79	8/21/79
OP[2]	Check		0[1]	45.5a	28.9ab	8.1a
OP	Temik 15G	3 lb a.i./acre	0	43.7a	22.9a	11.4a
OP	Vorlex	10 gal/acre	0	47.3a	27.9ab	10.2a
50P	Check		0	36.9a	39.1b	8.6a
50P	Temik 15G	3 lb a.i./acre	0	43.0a	37.2ab	6.9a
50P	Vorlex	10 gal/acre	0	35.4a	31.5ab	8.2a
150P	Check		0	46.0a	26.5ab	10.8a
150P	Temik 15G	3 lb a.i./acre	0	48.0a	33.9ab	12.0a
150P	Vorlex	10 gal/acre	0	38.8a	32.9ab	12.5a

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newmans-Keuls Multiple Range Test.

2 OP = 0 lb. phosphorous per acre

TABLE 7

Influence of selected management inputs on foliage weight of potatoes (cv Superior)

	FOLIAGE WEIGHT	(GRAMS)	
TREATMENT	6/04/79	6/26/79	8/21/79
0P[2] Check	23.4a[1]	216.1a	22.4a
0P Temik 15G 3 lb a.i./acre	26.8a	249.9a	65.6a
0P Vorlex 10 gal/acre	20.8a	278.3ab	39.8a
50P Check	23.9a	274.2ab	42.2a
50P Temik 15G 3 lb a.i./acre	20.0a	263.8ab	34.2a
50P Vorlex 10 gal/acre	20.5a	400.1b	40.7a
150P Check	23.1a	297.2ab	49.3a
150P Temik 15G 3 lb a.i./acre	22.8a	397.6b	74.0a
150P Vorlex 10 gal/acre	23.4a	383.0b	76.0a

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newmans-Keuls Multiple Range Test.

2 0P = 0 lb. phosphorous per acre

TABLE 8

Influence of selected management inputs on tuber weight of potatoes (cv Superior)

TREATMENT			TUBER WEIGHT/PLANT (GRAMS)		
			6/26/79	7/23/79	8/21/79
0P[2]	Check		45.71a[1]	524.11a	651.87a
0P	Temik 15G	3 lb a.i./acre	24.07a	532.21a	822.17a
0P	Vorlex	10 gal/acre	22.22a	757.92a	690.80a
50P	Check		21.04a	501.91a	796.36a
50P	Temik 15G	3 lb a.i./acre	21.56a	772.13a	734.07a
50P	Vorlex	10 gal/acre	21.15a	803.25a	822.95a
150P	Check		25.47a	588.47a	818.77a
150P	Temik 15G	3 lb a.i./acre	21.77a	742.75a	837.25a
150P	Vorlex	10 gal/acre	24.33a	813.26a	934.57a

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newmans-Keuls Multiple Range Test.

2 0P = 0 lb. phosphorous per acre

TABLE 9

Influence of selected management inputs on
tuber number of potatoes (cv Superior)

TREATMENT		TUBER NUMBER/PLANT (GRAMS)			
		6/04/79	6/26/79	7/23/79	8/21/79
0P[2]	Check	0[1]	13.4a	11.2a	7.0a
0P	Temik 15G 3 lb a.i./acre	0	10.6a	8.0a	9.2a
0P	Vorlex 10 gal/acre	0	14.8a	11.2a	7.8a
50P	Check	0	9.2a	12.0a	9.4a
50P	Temik 15G 3 lb a.i./acre	0	11.2a	13.4a	7.4a
50P	Vorlex 10 gal/acre	0	13.4a	14.0a	9.0a
150P	Check	0	9.8a	9.2a	8.6a
150P	Temik 15G 3 lb a.i./acre	0	14.0a	12.4a	7.8a
150P	Vorlex 10 gal/acre	0	7.8a	12.8a	8.0a

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newmans-Keuls Multiple Range Test.

2 OP = 0 lb. phosphorous per acre

TABLE 10

Influence of selected management inputs on
plant weight of potatoes (cv Superior)

TREATMENT	PLANT WEIGHT (GRAMS) 6/04/79	6/26/79	7/23/79	8/21/79
0P[2] Check	27.0a[1]	321.0a	613.5a	691.7a
0P Temik 15G 3 lb a.i./acre	30.5a	331.3a	655.2a	910.2a
0P Vorlex 10 gal/acre	24.2a	362.8a	796.4a	749.7a
50P Check	28.2a	345.8a	554.4a	861.7a
50P Temik 15G 3 lb a.i./acre	23.0a	340.5a	823.8a	782.8a
50P Vorlex 10 gal/acre	23.8a	472.0a	847.0a	878.8a
150P Check	26.7a	382.8a	625.9a	887.3a
150P Temik 15G 3 lb a.i./acre	27.0a	483.1a	790.1a	928.8a
150P Vorlex 10 gal/acre	26.7a	459.8a	859.2a	1030.7a

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newmans-Keuls Multiple Range Test.

2. 0P = 0 lb. phosphorous per acre

TABLE 11

Influence of selected management inputs on specific gravity of potatoes

TREATMENT		SPECIFIC GRAVITY Russet Burbank	SPECIFIC GRAVITY Superior
0P[2]	Check	1.068a[1]	1.066ab
0P	Temik 15G 3 lb a.i./acre	1.070a	1.066ab
0P	Vorlex 10 gal/acre	1.072a	1.067ab
50P	Check	1.069a	1.066ab
50P	Temik 15G 3 lb a.i./acre	1.070a	1.065a
50P	Vorlex 10 gal/acre	1.072a	1.068b
150P	Check	1.072a	1.068b
150P	Temik 15G 3 lb a.i./acre	1.072a	1.066ab
150P	Vorlex 10 gal/acre	1.077b	1.068b

[1] Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newmans-Keuls Multiple Range Test.

[2] 0P = 0 lb. phosphorous per acre

TABLE 12

Influence of selected management inputs on the yield and grade of potatoes (cv Russet Burbank)

	YIELD (CTW/ACRE)				
TREATMENT	A Grade	B Grade	Jumbo Grade	Knobs	Total
0P[2] Check	182.9a[1]	22.5a	2.2a	24.3a	231.9a
0P Temik 15G 3 lb a.i./acre	196.2ab	24.5ab	3.4ab	44.3bc	268.5ab
0P Vorlex 10 gal/acre	248.8bc	24.2ab	5.6ab	31.2ab	309.7bc
50P Check	214.5abc	31.3b	7.4ab	26.7ab	279.9b
50P Temik 15G 3 lb a.i./acre	217.9abc	23.3ab	7.6ab	52.2c	301.0bc
50P Vorlex 10 gal/acre	270.3c	26.8ab	11.6b	38.0abc	346.7c
150P Check	253.6bc	29.8ab	8.4ab	30.9ab	322.6bc
150P Temik 15G 3 lb a.i./acre	209.7ab	25.3ab	10.4ab	64.8d	310.2bc
150P Vorlex 10 gal/acre	267.4c	25.3ab	18.9c	30.9ab	342.4c

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newmans-Keuls Multiple Range Test.

2 0P = 0 lb. phosphorous per acre

TABLE 13

Influence of selected management inputs on population density of *P. penetrans* on potatoes (cv Russet Burbank)

TREATMENT			*P. penetrans* per 100 cm^3 soil 6/04/79	6/26/79	7/23/79	9/05/79
0P[2]	Check		14.6a[1]	15.6ab	40.2a	57.0bc
0P	Temik 15G	3 lb a.i./acre	5.4a	5.8a	6.0a	2.0a
0P	Vorlex	10 gal/acre	12.8a	11.4ab	37.6a	45.2abc
50P	Check		12.0a	13.4ab	37.0a	32.8abc
50P	Temik 15G	3 lb a.i./acre	4.2a	5.0a	23.8a	1.6a
50P	Vorlex	10 gal/acre	9.8a	12.6ab	11.8a	32.8abc
150P	Check		11.2a	19.8b	20.4a	75.4c
150P	Temik 15G	3 lb a.i./acre	5.8a	4.8a	10.8a	9.8ab
150P	Vorlex	10 gal/acre	14.0a	12.8ab	15.4a	43.2abc

[1] Column followed by the same letter are not significantly different ($P = 0.05$) according to the Student-Newman-Keuls Multiple Range Test.

[2] 0P = 0 lb. phosphorous per acre

TABLE 14

Influence of selected management inputs on population density of *P. penetrans* on potatoes (cv Russet Burbank)

TREATMENT			P. penetrans per gram root tissue 6/04/79	6/26/79	7/23/79	9/05/79
OP[2]	Check		16.6a[1]	47.0ab	59.0a	96.4ab
OP	Temik 15G	3 lb a.i./acre	2.2a	10.6a	3.0a	5.0a
OP	Vorlex	10 gal/acre	38.0a	40.4ab	64.8a	134.8b
50P	Check		12.6a	65.4b	54.4a	67.0ab
50P	Temik 15G	3 lb a.i./acre	4.2a	2.8a	0.8a	1.6a
50P	Vorlex	10 gal/acre	22.8a	29.0ab	49.0a	94.6ab
150P	Check		18.2a	22.0ab	49.6a	85.4ab
150P	Temik 15G	3 lb a.i./acre	2.8a	8.6a	8.4a	4.0a
150P	Vorlex	10 gal/acre	15.0a	43.8ab	58.0a	109.0b

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newman-Keuls Multiple Range Test.

2 OP = 0 lb. phosphorous per acre

TABLE 15

Influence of selected management inputs on population density of *P. penetrans* on potatoes (cv Russet Burbank)

TREATMENT	*P. penetrans* per 100 cm^3 soil and per gram root tissue combined			
	6/04/79	6/26/79	7/23/79	9/05/79
0P[2] Check	31.2ab[1]	62.6ab	99.2a	153.4b
0P Temik 15G 3 lb a.i./acre	7.6a	16.4a	9.0a	7.0a
0P Vorlex 10 gal/acre	50.8a	51.8ab	102.4a	176.0b
50P Check	24.6ab	78.8b	91.4a	99.8b
50P Temik 15G 3 lb a.i./acre	8.4a	7.8a	24.6a	3.2a
50P Vorlex 10 gal/acre	32.6ab	41.6ab	60.8a	127.4b
150P Check	29.4ab	43.4ab	70.0a	160.8b
150P Temik 15G 3 lb a.i./acre	8.6a	13.4a	19.2a	13.8a
150P Vorlex 10 gal/acre	29.0ab	56.6ab	73.4a	152.2b

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newman-Keuls Multiple Range Test.

2 0P = 0 lb. phosphorous per acre

TABLE 16

Influence of selected management inputs on root weight of potatoes (cv Russet Burbank)

	ROOT WEIGHT (GRAMS)			
TREATMENT	6/04/79	6/26/79	7/23/79	9/05/79
0P[2] Check	2.6a[1]	14.8a	18.4a	16.7a
0P Temik 15G 3 lb a.i./acre	2.1a	19.6a	19.2a	15.7a
0P Vorlex 10 gal/acre	2.0a	18.6a	19.0a	17.4a
50P Check	1.8a	18.8a	20.6a	13.7a
50P Temik 15G 3 lb a.i./acre	1.6a	17.3a	20.6a	21.0a
50P Vorlex 10 gal/acre	2.1a	20.5a	18.0a	20.2a
150P Check	1.7a	18.5a	18.3a	16.6a
150P Temik 15G 3 lb a.i./acre	2.4a	16.5a	20.7a	21.2a
150P Vorlex 10 gal/acre	2.2a	19.4a	23.3a	20.4a

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newmans-Keuls Multiple Range Test.

2 0P = 0 lb. phosphorous per acre

TABLE 17

Influence of selected management inputs on stem weight of potatoes (cv Russet Burbank)

		STEM WEIGHT (GRAMS)		
TREATMENT	6/04/79	6/26/79	7/23/79	9/05/79
0P[2] Check	0[1]	39.3a	28.9a	16.5a
0P Temik 15G 3 lb a.i./acre	0	34.6a	33.2a	21.4ab
0P Vorlex 10 gal/acre	0	43.2a	32.2a	23.7ab
50P Check	0	32.9a	32.2a	23.1ab
50P Temik 15G 3 lb a.i./acre	0	33.4a	33.6a	27.0ab
50P Vorlex 10 gal/acre	0	46.2a	36.1a	34.1b
150P Check	0	34.5a	35.4a	25.4ab
150P Temik 15G 3 lb a.i./acre	0	27.3a	37.6a	27.0ab
150P Vorlex 10 gal/acre	0	43.8a	44.9a	35.6b

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newmans-Keuls Multiple Range Test.

2 0P = 0 lb. phosphorous per acre

TABLE 18

Influence of selected management inputs on
foliage weight of potatoes (cv Russet Burbank)

TREATMENT		FOLIAGE WEIGHT (GRAMS) 6/04/79	6/26/79	7/23/79	9/05/79
0P[2]	Check	8.8a[1]	185.5a	588.3a	91.4a
0P	Temik 15G 3 lb a.i./acre	7.3a	239.8ab	653.7ab	205.8ab
0P	Vorlex 10 gal/acre	8.5a	258.2ab	779.0ab	289.1abc
50P	Check	7.3a	239.5ab	668.6ab	222.8ab
50P	Temik 15G 3 lb a.i./acre	4.9a	249.4ab	803.2ab	408.3abcd
50P	Vorlex 10 gal/acre	6.8a	330.4c	980.8ab	561.1cd
150P	Check	7.8a	250.1ab	780.7ab	512.6bcd
150P	Temik 15G 3 lb a.i./acre	7.7a	259.7ab	889.1ab	489.1bcd
150P	Vorlex 10 gal/acre	6.6a	300.4bc	1059.1b	677.3d

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newmans-Keuls Multiple Range Test.

2 0P = 0 lb. phosphorous per acre

TABLE 19

Influence of selected management inputs on
tuber weight of potatoes (cv Russet Burbank)

TREATMENT	TUBER WEIGHT/PLANT (GRAMS)			
	6/04/79	6/26/79	7/23/79	9/05/79
0P[2] Check	0[1]	1.5a	400.9a	822.1a
0P Temik 15G 3 lb a.i./acre	0	0.7a	453.7a	968.3a
0P Vorlex 10 gal/acre	0	2.7a	497.5a	1156.4a
50P Check	0	1.4a	400.7a	1025.2a
50P Temik 15G 3 lb a.i./acre	0	1.7a	416.9a	1035.2a
50P Vorlex 10 gal/acre	0	2.5a	548.3a	1385.6a
150P Check	0	0.3a	424.7a	1092.7a
150P Temik 15G 3 lb a.i./acre	0	0.9a	464.8a	1076.5a
150P Vorlex 10 gal/acre	0	0.7a	583.2a	1282.0a

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newmans-Keuls Multiple Range Test.

2 0P = 0 lb. phosphorous per acre

TABLE 20

Influence of selected management inputs on
tuber number of potatoes (cv Russet Burbank)

TREATMENT	TUBER NUMBER/PLANT (GRAMS) 6/04/79	6/26/79	7/23/79	9/05/79
0P[2] Check	0[1]	8.8a	14.0a	12.0a
0P Temik 15G 3 lb a.i./acre	0	4.8a	17.0a	9.2a
0P Vorlex 10 gal/acre	0	11.0a	18.6a	14.0a
50P Check	0	6.4a	20.0a	12.6a
50P Temik 15G 3 lb a.i./acre	0	4.6a	17.0a	11.0a
50P Vorlex 10 gal/acre	0	6.2a	24.0a	17.2a
150P Check	0	2.6a	22.0a	11.0a
150P Temik 15G 3 lb a.i./acre	0	3.2a	19.8a	11.8a
150P Vorlex 10 gal/acre	0	5.2a	24.8a	15.4a

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newmans-Keuls Multiple Range Test.

2 0P = 0 lb. phosphorous per acre

TABLE 21

Influence of selected management inputs on plant weight of potatoes (cv Russet Burbank)

	PLANT WEIGHT (GRAMS)			
TREATMENT	6/04/79	6/26/79	7/23/79	9/05/79
0P[2] Check	11.5a[1]	241.0a	1036.5a	946.6a
0P Temik 15G 3 lb a.i./acre	9.4a	294.7ab	1159.8a	1211.1ab
0P Vorlex 10 gal/acre	10.5a	322.7ab	1327.7a	1486.6ab
50P Check	9.1a	292.6ab	1122.1a	1284.8ab
50P Temik 15G 3 lb a.i./acre	6.5a	301.9ab	1274.4a	1491.5ab
50P Vorlex 10 gal/acre	8.9a	399.6c	1583.2a	2001.0b
150P Check	9.5a	303.3ab	1259.1a	1647.3ab
150P Temik 15G 3 lb a.i./acre	10.1a	304.3ab	1412.2a	1613.7ab
150P Vorlex 10 gal/acre	8.8a	364.3bc	1710.5a	2015.2b

1 Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newmans-Keuls Multiple Range Test.

2 0P = 0 lb. phosphorous per acre

THE INFLUENCE OF SELECTED MANAGEMENT INPUTS ON NUTRIENT COMPOSITION OF POTATO PETIOLES

M.L. Vitosh
Department of Crop and Soil Sciences

The effect of phosphorus fertilizer and two nematicides on yield, quality and storability of potatoes was reported on by G. W. Bird, J. Noling, B. Cargill and H. S. Potter. The results here only include plant and soil analysis of the integrated project.

The experiment was conducted at the Montcalm Research Farm with Russet Burbank and Superior. Phosphorus was applied at rates of 0, 50 and 150 lb. P_2O_5 per acre banded two inches to either side and two inches below the seed. Temik 15G was applied with the banded fertilizer at a rate of three lb active ingredient per acre. Vorlex was applied two weeks prior to planting in a band 6-8 inches beneath the intended row at a rate of 10 gal. per acre. All plots received a uniform application of nitrogen and potassium.

In the previous report both rates of P and the nematicides significantly increased the total yield of both varieties. Soil test values from the treated plots are shown in Tables 1 and 2. Good uniformity was observed for all treatments as indicated by the non-significant (NS) LSD tests. Soil P levels for the Research Farm are extremely high and potassium values are considered to be medium.

Potato petiole samples were taken on July 5th and then two weeks later on July 19. Analysis for the first sampling are shown in Tables 3 and 4. Only P and Manganese (Mn) were significantly affected by the treatments for the Russet Burbank variety. Phosphorus in petioles was directly related to rate of P application. Manganese was significantly reduced by Vorlex at all P rates. Temik also tended to reduce the Mn content but the reduction was not significant. Similar reductions in Mn content have been observed for the past three years. We are still unable to explain the change in Mn uptake or how it might be related to yield increases from Temik or Vorlex. Similar results for P and Mn are observed for Superior (Table 4). In addition calcium (Ca) and sodium (Na) were significantly affected by the treatments for this variety. The differences however were not consistent and can not be explained at this time.

For the second sampling on July 19, similar results for P and Mn were observed. In addition several other elements for Superior (Table 6) were significantly affected by the treatments. The differences again were not always consistent, however K, Ca, Fe, Cu and Zn values appeared to be lower with the higher rates of P.

Many of the elements (P, K, Fe, Cu, Zn and Al) were found in smaller quantities with the second sampling. Only Ca, Mg, Na and Mn were found to increase with the later sampling.

Normal or sufficient ranges for petioles from recently matured leaves sampled in mid-season have been reported as follows:

P	.18 - .22
K	6.0 - 9.0
Ca	.36 - .50
Mg	.17 - .22
Mn	30 - 200
Fe	30+
B	14 - 40
Cu	7 - 30
Zn	30 - 100

From these sufficiency ranges it would appear that all elements were in sufficient supply at the time of the July 5th sampling even in the OP check treatment. On July 19, P levels had dropped below the .18 critical level for nearly all treatments on Superior but only the OP, check treatment on Russet Burbank. I conclude that July 19 was too late for the Superior variety in order to utilize the established sufficiency ranges. Copper (Cu) and zinc (Zn) also appeared to be below the sufficiency range on July 19.

In summary it appears that for samples taken 30-40 days after emergence, the petiole P content should be above .3% for Superior and .4% for Russet Burbank. Phosphorus values below these levels at this stage of growth will result in less than optimum yield. In regard to manganese it appears that Vorlex and to a lesser extent Temik, do alter the uptake of Mn while increasing yield. This cannot be explained by the dilution effect due to more growth because none of the other elements changed. Manganese is known to affect certain enzyme reactions. It may be that a reduction in Mn allows for more production of some growth regulator which results in greater growth and yield. Some very basic biochemistry research will be necessary to prove this theory.

The soil tests for P indicates extremely high levels (above 400 lb/A) and yet very significant increases in yield occurred. This data leaves much doubt in the reliability of the Bray P_1 phosphorus test to predict P requirements for potatoes. For corn, 50 to 60 lb P/A soil test is generally adequate for maximum production. Why the potato plant cannot adequately utilize soil P measured by the Bray P_1 test is a mystery at this time. Additional basic research will be needed to answer this question.

Table 1. Soil Test values on samples taken from treated plots in June 1979. (Range 4).

Treatment	Soil Tests				
	pH	P	K	Ca	Mn
		- - - - -lb/A- - - - - -			
OP Check	5.3	473	395	768	124
OP Temik	5.4	462	398	768	124
OP Vorlex	5.4	456	362	789	132
50P Check	5.4	487	389	725	107
50P Temik	5.4	457	419	811	128
50P Vorlex	5.4	461	373	725	113
150P Check	5.2	499	395	747	107
150P Temik	5.3	480	386	725	98
150P Vorlex	5.3	484	376	853	111
LSD (.05)	(NS)	(NS)	(NS)	(NS)	(NS)

Table 2. Soil test values on samples taken from treated plots in June 1979. (Range 5).

Treatment	Soil Tests				
	pH	P	K	Ca	Mn
		- - - - -lb/A- - - - - -			
OP Check	5.8	456	341	1006	158
OP Temik	5.8	431	323	960	136
OP Vorlex	5.9	470	378	1143	162
50P Check	5.6	453	348	937	131
50P Temik	6.1	460	345	1051	169
50P Vorlex	6.0	448	310	1052	167
150P Check	6.0	468	343	1028	159
150P Temik	5.7	481	353	960	136
150P Vorlex	6.0	497	375	1157	187
LSD (.05)	(NS)	(NS)	(NS)	(NS)	(NS)

Table 3. Elemental composition of Russet Burbank petioles sampled July 5, 1979 as affected by phosphorus and nematicide treatments.

Treatments	Elements										
	P	K	Ca	Mg	Na	Mn	Fe	B	Cu	Zn	Al
	%				ppm						
0P Check	.25	10.6	.61	.39	74	119	77	25	9	46	61
0P Temik	.27	10.5	.59	.38	91	103	96	24	10	46	72
0P Vorlex	.28	10.5	.55	.38	84	63	83	23	9	49	59
50P Check	.38	10.4	.47	.31	128	135	93	25	9	48	63
50P Temik	.39	10.2	.48	.33	95	119	92	22	9	48	65
50P Vorlex	.39	10.5	.50	.37	70	79	69	23	9	46	45
150P Check	.45	10.3	.54	.32	79	151	77	21	8	44	58
150P Temik	.43	10.7	.58	.34	60	143	77	22	9	44	56
150P Vorlex	.47	10.5	.53	.37	80	84	84	23	9	47	51
LSD (.05)	(.04)	(NS)	(NS)	(NS)	(NS)	(24)	(NS)	(NS)	(NS)	(NS)	(NS)

Table 4. Elemental composition of Superior potato petioles sampled July 5, 1979 as affected by phosphorus and nematicide treatments.

Treatments	Elements										
	P	K	Ca	Mg	Na	Mn	Fe	B	Cu	Zn	Al
	%				ppm						
OP Check	.19	11.2	.80	.42	39	116	98	28	10	32	82
OP Temik	.25	11.8	.65	.34	63	101	84	27	10	38	62
OP Vorlex	.22	11.9	.76	.40	49	76	104	27	12	43	68
50P Check	.32	11.3	.61	.32	74	133	92	26	10	35	71
50P Temik	.27	12.1	.73	.42	52	120	79	26	10	37	56
50P Vorlex	.34	12.2	.64	.39	112	70	90	26	11	39	61
150P Check	.39	11.7	.71	.36	82	120	92	25	9	34	57
150P Temik	.45	11.7	.69	.36	67	123	81	25	10	41	54
150P Vorlex	.39	11.8	.72	.44	57	83	90	26	10	33	56
LSD (.05)	(.04)	(NS)	(.11)	(NS)	(41)	(31)	(NS)	(NS)	(NS)	(NS)	(NS)

Table 5. Elemental composition of Russet Burbank petioles sampled July 19, 1979 as affected by phosphorus and nematicide treatments.

Treatments	Elements										
	P	K	Ca	Mg	Na	Mn	Fe	B	Cu	Zn	Al
	-%-				-ppm-						
0P Check	.18	10.0	.78	.55	111	148	48	27	6	35	20
0P Temik	.20	10.0	.76	.56	117	125	38	26	7	36	17
0P Vorlex	.21	9.5	.70	.56	104	96	40	25	7	31	16
50P Check	.21	10.4	.78	.54	93	277	39	27	5	39	18
50P Temik	.24	10.2	.72	.53	71	206	39	26	6	35	15
50P Vorlex	.25	9.9	.66	.55	104	125	56	26	6	34	17
150P Check	.27	10.1	.79	.53	64	284	37	26	5	32	15
150P Temik	.25	10.1	.86	.56	64	249	39	26	5	32	15
150P Vorlex	.32	9.8	.70	.52	90	147	40	25	6	35	14
LSD (.05)	(.06)	(NS)	(NS)	(NS)	(NS)	(59)	(NS)	(NS)	(NS)	(NS)	(NS)

Table 6. Elemental composition of Superior potato petioles sampled July 19, 1979 as affected by phosphorus and nematicide treatments.

Treatment	Elements										
	P	K	Ca	Mg	Na	Mn	Fe	B	Cu	Zn	Al
	------ % -------				--------------ppm---------------						
OP Check	.12	9.9	1.07	.75	129	209	53	30	6	32	53
OP Temik	.13	10.2	.99	.59	106	184	50	29	7	31	42
OP Vorlex	.13	10.0	1.06	.77	95	129	60	29	7	31	46
50P Check	.14	9.8	.92	.50	105	281	47	30	4	25	45
50P Temik	.13	9.4	.91	.67	70	201	47	27	5	25	50
50P Vorlex	.13	9.2	.91	.66	86	155	51	28	5	23	41
150P Check	.14	9.7	1.02	.64	88	244	49	29	3	19	42
150P Temik	.18	9.3	.89	.52	105	214	49	28	6	23	39
150P Vorlex	.16	8.8	.95	.68	90	162	49	29	4	22	42
LSD (.05)	(.02)	(.8)	(.13)	(NS)	(NS)	(53)	(6)	(NS)	(2)	(9)	(NS)

INFLUENCE OF PRE-STORAGE TREATMENTS ON OUT-OF-STORAGE QUALITY

*B.F. Cargill**
Department of Agricultural Engineering

INTRODUCTION

This report includes the results of two 1978 potato storage projects. The 1979 potatoes are still in storage and will be reported in the 1980 report.

OBJECTIVES

The 1978 Integrated Project
(storage phase)

1. To study the influence of selected production management inputs on storability by determining weight loss, tuber quality and seed viability after extended storage.

The 1978 Harvesting & Storage Project (#8)

1. To study the influence of post harvest pre-storage mechanical and chemical treatments on storability by determining tuber quality, chip quality, and weight loss.
2. To compare the storability of equivalent pre-storage treated Monona potatoes stored in MSU cubicles and a commercial bulk storage.

OVERALL PROCEDURE

This report includes: 1) the Storage Phase of the 1978 MSU Integrated Project; it involves storage of Superior potatoes grown using various levels of nitrogen and different insecticides. Respective bagged lots of Superior potatoes were stored in the MSU cubicles to evaluate the effects of production practices and storage: on seed viability; weight loss in storage; tuber quality after storage; and chip quality after storage; & 2) the 1978 MSU Harvesting and Storage Project #8; this project involved an evaluation of post harvest pre-storage treatments (mechanical and chemical) on the out-of-storage quality of Monona potatoes.

Specific Procedure for 1978 Superior Potatoes

Superior potatoes (1978) were planted for the Integrated Project at the Montcalm Potato Research Farm, Superior potatoes were planted in two ranges (Range 7 & 8) and subjected to three levels of nitrogen and two insecticides in Range 7 and two levels of nitrogen and four insecticides in Range 8.

These Superior potatoes were mechanically harvested using the MSU plot harvester; placed in mesh bags; and stored at two environments (40° & 50°F & 95% RH).

At prearranged times during the storage period bagged lots of these Superior potatoes were removed from storage and evaluated for weight loss, tuber quality and chip quality. At planting time in May 1979 one bagged lot (nine treatments and five replications and ten treatments and five replications - 95 bags) was removed and 65 tubers were planted from each bag to study seed viability due to production practices and storage.

*Other Investigators on this storage project:
Dr. H.S. Potter, Botany & Plant Pathology
Dr. J.N. Cash, Food Science & Human Nutrition
Dr. Richard Chase, Crop & Soil Sciences

Specific Procedure for 1978 Monona

One range (area) at the Montcalm Potato Research Farm was used for Monona potatoes specifically grown for the MSU Storage Research Project. These potatoes were grown using one of the recommended production practices of the Integrated Project (Range 7 150 lb N & Temik). This same practice was used for 1977 potatoes and will also be repeated for 1979 potatoes. This production/storage project will be repeated for four years to exclude the production environment variable and its potential influence on storability.

These Monona potatoes were mechanically harvested with the MSU plot harvester. Some lots were subjected to additional controlled bruising and prestorage treated with bactericide and fungicide chemicals.

Bagged lots of bruised and nonbruised, treated and non-treated potatoes were stored in cubicles at MSU and in the center of a bulk bin in a commercial potato storage.

The potatoes in the MSU cubicles were examined at a predetermined schedule for tuber quality, weight loss, and chip quality. Potatoes stored in the bulk bin were examined when the bin was emptied.

Results & Discussion (Superior Potatoes)

The 1978 Integrated Project

Experiment I Range 7 (nine treatments)

Superior potatoes were planted in plots treated with three levels of nitrogen (75-150-300 lb/acre) and three insecticide/nematicides (Temik 3.0 lb a.i./acre, Vorlex 10 gal/acre and a check). Each treatment was replicated five times. All plots received a uniform application of NPK at planting and the added nitrogen variables were side dressed later. Vorlex was applied two weeks before planting, and Temik was applied at planting. All plots were sprayed (as needed) with foliar insecticides. The potatoes were machine harvested with the MSU plot harvester and stored in the MSU cubicles to evaluate weight loss, tuber quality, chip quality, and seed viability.

Experiment II Range 8 (ten treatments)

Superior potatoes were planted to evaluate the interaction of two levels of nitrogen (75 and 150 lbs/acre) with five nematicide/insecticide treatments. (Temik 3.0 lb a.i./acre, Furadan 3.0 lb a.i./acre, Dacamox 3.0 lb/acre, Vorlex 10 gal/acre and an untreated check). The treatments were replicated five times. The potatoes were machine harvested with the MSU plot harvester and stored in the MSU cubicles to evaluate weight loss, tuber and chip quality and seed viability.

Table I. Total weight loss of 1978 Superior potatoes* grown using nine different production treatments and stored for 9 months at 40°F and 95% RH.

Treatment		Replications and Average						Rank due to Weight Loss
		I	II	III Weight Loss %	IV	V	Ave.	
1	75 N Check	5.73	6.07	6.81	6.67	5.33	6.06	1**
2	75 N Temik	7.54	6.77	6.49	5.73	7.23	6.75	6
3	75 N Vorlex	5.21	7.01	7.14	5.98	7.34	6.54	4**
4	150 N Check	6.05	6.43	6.91	5.34	5.02	6.23	2**
5	150 N Temik	6.48	6.55	7.45	5.84	5.69	6.40	3**
6	150 N Vorlex	7.39	6.36	6.61	6.95	6.08	6.68	5
7	300 N Check	11.18	6.55	5.92	5.43	6.23	7.06	9
8	300 N Temik	5.61	8.87	7.18	6.23	7.09	6.99	8
9	300 N Vorlex	7.24	6.28	6.56	5.86	8.28	6.84	7
Average							6.62	

*Weighed at harvest August 22, 1978 and May 14, 1979

**Top four (4) in rank of least weight loss in storage

Table II. Total weight loss of 1978 Superior potatoes* grown using ten different production treatments and stored for 9 months at 40°F and 95% RH.

Treatment		Replications and Average						Rank due to Weight Loss
		I	II	III	IV	V	Ave.	
		Weight Loss %						
1	75 N Check	5.09	6.03	3.90	5.13	7.35	5.50	4**
2	75 N Temik	3.80	6.16	5.08	6.78	6.28	5.62	5
3	75 N Vorlex	5.19	5.21	5.58	7.30	6.41	5.94	8
4	75 N Furadan	5.31	5.43	4.76	5.93	5.26	5.34	2**
5	75 N Dacamox	4.41	7.02	5.38	6.06	5.78	5.73	6
6	150 N Check	9.09	5.11	6.19	5.93	6.76	6.62	10
7	150 N Temik	3.92	6.09	6.88	5.36	6.69	5.79	7
8	150 N Vorlex	6.67	8.06	4.43	5.91	6.67	6.35	9
9	150 N Furadan	4.14	4.66	5.24	5.42	7.33	5.36	3**
10	150 N Dacamox	5.64	6.18	4.19	4.27	5.21	5.10	1**
Average							5.73	

*Harvested August 22, 1978 and weighed May 14, 1979.

**Top four (4) in rank of least weight loss in storage.

Table III. Total weight loss of 1978 Superior potatoes grown using: two levels of nitrogen, two chemical treatments, and stored for 9 months at 40°F & 95% RH.

Production Treatments		Storage Weight Loss, %			
Nitrogen level, lbs/A	Chemical	Range 7	Range 8	Average	Rank due to Weight Loss
75 N	Temik	6.75	5.62	6.18	3
	Vorlex	6.54	5.94	6.24	4
	Check	6.06	5.50	5.75	1
150 N	Temik	6.40	5.79	6.10	2
	Vorlex	6.68	6.35	6.52	6
	Check	6.23	6.62	6.42	5

Table IV. Total weight loss of 1978 Superior potatoes: using three (3) levels of nitrogen and stored for 9 months at 40°F & 95% RH.

	Storage Weight Loss, %			
Nitrogen level, lbs/A	Range 7	Range 8	Average	Rank due to Weight Loss
75	6.45	5.63	6.04	1
150	6.44	5.84	6.14	2
300	6.96	---	6.96	3

Table V. Tuber quality* of 1978 Superior potatoes grown using different production treatments and stored for 9 months at 40°F and 95% RH.

Production Treatments		Good Potatoes, % Replications and Average I	II	III	IV	V	Ave.	Rank based on Tuber Quality
1	75 N Check	95.9	95.4	98.0	96.2	97.7	96.6	1**
2	75 N Temik	96.2	95.6	97.1	95.8	94.4	95.8	4**
3	75 N Vorlex	96.2	97.3	97.0	98.7	90.0	95.8	3**
4	150 N Check	96.0	99.1	95.7	94.3	92.5	95.5	5
5	150 N Temik	93.6	95.6	96.3	97.2	97.2	96.0	2**
6	150 N Vorlex	90.1	91.9	95.1	91.0	89.2	91.5	8
7	300 N Check	96.9	84.5	92.9	96.0	97.3	93.5	6
8	300 N Temik	86.1	88.0	93.2	96.1	90.6	90.8	9
9	300 N Vorlex	89.9	93.9	93.6	94.1	89.0	92.1	7
Average		93.4	93.5	95.4	95.5	93.1	94.2	
1	75 N Check	96.3	96.2	94.2	95.9	95.9	95.7	1**
2	75 N Temik	92.2	89.5	94.7	95.7	96.9	93.8	4**
3	75 N Vorlex	95.3	88.1	95.1	95.7	91.4	93.1	7
4	75 N Furadan	93.4	90.5	96.2	85.2	94.9	92.0	9
5	75 N Decamox	93.5	95.6	95.6	91.1	96.5	94.5	2**
6	150 N Check	93.8	96.4	96.1	94.3	91.3	94.4	3**
7	150 N Temik	92.0	93.8	91.2	93.5	96.2	93.3	5
8	150 N Vorlex	94.4	86.2	94.0	95.2	93.5	92.7	8
9	150 N Furadan	96.8	93.4	95.8	92.1	81.5	91.9	10
10	150 N Dacamox	94.2	92.1	91.4	89.9	98.3	93.2	6
Average		94.2	92.2	94.4	92.9	93.6	93.5	

*Marketable quality potatoes harvested August 22, 1978 with MSU plot harvester

**Top four (4) in rank of best tuber quality out-of-storage

Table VI. Comparison of yields of 1978 Superior potatoes grown using three (3) levels of nitrogen and two (2) chemical; stored for 9 months at 40°F and 95% RH; and planted as seed in 1979.

1978 Production Treatment and Yields				1979 Seed Yields		
Lot	Nitrogen Level	Chemical	1978 Total Yield cwt/A	Total cwt/A	Yield Difference* 1979 vs. 1978	Marketable Potatoes cwt/A
1	75 lbs N	Control	255	303	+48	271
2	75 lbs N	Temik	300	295	-5	265
3	75 lbs N	Vorlex	312	306	-6	278
4	150 lbs N	Control	277	300	+23	279
5	150 lbs N	Temik	341	250	-91	232
6	150 lbs N	Vorlex	356	296	-60	271
7	300 lbs N	Control	268	290	+22	262
8	300 lbs N	Temik	372	298	-74	273
9	300 lbs N	Vorlex	366	289	-77	261

*Difference in total yield in cwt/A between the 1978 production and the 1979 seed. These 1978 stored potatoes were planted May 6, 1979 and harvested August 22, 1979.

Table VII. Comparison of total yield and marketable yield distribution of 1978 Superior potatoes grown using different production treatments; stored for 9 months at 40° and 98% RH; planted as seed May 6, 1979; and harvested August 22, 1979.

1978 Production Treatments		Total cwt/A	Mktb cwt/A	% Under 2"	% Over 3¼"	No. of Plants*	Percent Virus	Rank of seed storability based on marketable production
1	75 lb. Check	303	271	10.3	4.1	10.0	7.5	5
2	75 lb. Temik	295	265	10.1	11.1	10.0	12.5	6
3	75 lb. Vorlex	306	278	9.2	7.7	10.0	4.9	2**
4	150 lb. Check	300	279	6.8	2.1	10.1	11.1	1**
5	150 lb. Temik	250	232	6.9	9.4	10.8	14.0	9
6	150 lb. Vorlex	296	271	8.4	5.8	10.3	9.8	4**
7	300 lb. Check	290	262	9.7	7.0	10.3	19.5	7
8	300 lb. Temik	298	273	8.4	5.2	10.7	4.8	3**
9	300 lb. Vorlex	289	261	9.7	14.1	10.7	4.8	8

*Number of plants per plot from 12 seed pieces

**Top four (4) in rank of seed quality

Table VIII. Comparison of yields of 1978 Superior potatoes grown using two (2) levels of nitrogen and four (4) chemicals; stored for 9 months at 40° and 95% RH; and planted as seed in 1979.

1978 Production Treatments & Yields				1979 Seed Yields		
Treatment Number	Nitrogen Level	Chemical	Total Yield 1978 cwt/A	Total cwt/A	Yield Difference* 1978 vs. 1979	Marketable Potatoes cwt/A
1	75 lb N	Control	297	379	+82	359
2	75 lb N	Temik	350	340	-10	310
3	75 lb N	Vorlex	367	337	-30	312
4	75 lb N	Furadan	317	337	+20	317
5	75 lb N	Dacamox	334	371	+37	356
6	150 lb N	Control	308	314	+6	290
7	150 lb N	Temik	372	225	-147	207
8	150 lb N	Vorlex	376	329	-47	307
9	150 lb N	Furadan	327	301	-26	271
10	150 lb N	Dacamox	346	337	-9	312

*Difference in total yield in cwt/A between the 1978 production and the 1979 seed. These 1978 stored potatoed were planted May 6, 1979 and harvested August 22, 1979.

Table IX. Comparison of total yield and marketable yield distribution of 1978 Superior potatoes grown using different production treatments, stored for 9 months at 40°F and 95% RH; planted as seed May 6, 1979; and harvested August 22, 1979.

1978 Production Treatments			1979 Yield Data						
No.	N Level	Chemical	Total Yield cwt/A	Mktb. Yield cwt/A	Under 2" %	Over 3¼" %	Specific Gravity	No. of Plants*	Rank Seed Storability Based on Marketable Production
1	75 lb.	Check	379	359	5.3	18.1	1.070	11.0	1**
2	75 lb.	Temik	340	310	8.7	13.3	1.069	10.3	6
3	75 lb.	Vorlex	337	312	7.4	11.1	1.073	11.5	4**
4	75 lb.	Furadan	337	317	6.0	4.6	1.069	11.5	3**
5	75 lb.	Dacamox	371	356	4.2	18.5	1.071	11.5	2**
6	150 lb.	Check	314	290	7.5	15.4	1.070	10.8	8
7	150 lb.	Temik	225	207	7.6	26.4	1.068	9.0	10
8	150 lb.	Vorlex	329	307	6.6	7.6	1.069	11.0	7
9	150 lb.	Furadan	301	271	9.8	9.3	1.070	10.8	9
10	150 lb.	Dacamox	337	312	7.4	5.1	1.069	11.5	5

*Number of plants per plot from 12 seed pieces.

**Top four (4) in rank of 1978 seed viability in 1979 based on marketable production in 1979.

Table X. Tuber quality of prestorage treated Monona potatoes stored in center of a bulk pile in a commercial potato storage for 9 months at approximately 45°F.

Treatment		Potato Quality, % Good Bulk Storage
Non Bruised*	No Chemical	87.0
	TBZ + Chl	86.6
	TBZ only	86.3
Bruised (3x)*	No Chemical	59.7
	TBZ + Chl	71.6
	TBZ only	68.0

*Non bruised average 91.3% B.F. and bruised averaged 45.8% B.F. (bruise free) as evaluated by Ore-Ida, Greenville, Michigan.

Table XI. Tuber quality after 9 months storage at 45°F of 1978 bruised and non-bruised Monona potatoes pre-storage treated with TBZ and/or Chlorine*.

	Replications & Potato Quality, Good Potatoes %												
Treatment	1	2	3	4	5	6	7	8	9	10	11	12	Average
Bruised - no chemical	---	69.8	73.0	59.5	60.0	45.6	58.5	57.1	48.4	53.2	71.2	60.9	59.7
Bruised - TBZ	75.7	59.5	66.7	70.0	77.2	72.5	78.9	68.1	47.0	75.4	59.7	65.5	68.0
Bruised - TBZ + Chl	81.4	76.5	67.2	77.8	70.8	87.5	72.9	67.1	73.8	61.7	64.9	57.4	71.6
Bruised - TBZ+Chl+Spr Ih	74.6	74.6	73.5	76.1	74.0	71.4	87.5	60.8	66.2	66.0	71.4	80.9	73.1
Non Bruised - no chem.	87.5	92.2	85.2	83.1	83.6	94.9	92.5	87.9	80.6	88.9	89.8	77.5	87.0
Non Bruised - TBZ	87.5	86.0	95.9	89.8	93.6	90.4	95.7	91.7	62.2	83.1	79.2	80.7	86.3
Non Bruised - TBZ+Chl	87.1	70.8	89.0	91.0	85.2	86.9	90.1	87.9	90.9	83.8	93.4	83.6	86.6
Non Bruised - TBZ+Chl+ Spr Ih	92.6	87.2	85.3	77.5	87.5	87.5	78.1	88.1	91.3	93.2	98.6	93.2	88.3

Average of all bruised lots (45.8% B.F.) 68.1% good potatoes

Average of all non-bruised lots (91.3% B.F.) = 87.1% good potatoes

Average quality difference between bruised and non-bruised lots 19%

*Monona potatoes were hand picked out of a windrow (non-bruised) and rerun over a windrower three (3) times for a 3x bruise (bruised).

Table XII. Weight loss after 9 months storage at 45°F 1978 bruised and non-bruised Monona potatoes pre-storage treated with TBZ and/or Chlorine*.

	Replication and Weight Loss %												
Treatment	1	2	3	4	5	6	7	8	9	10	11	12	Average
Bruised - no chemical	---	11.11	15.96	13.44	13.25	15.31	11.85	11.65	14.57	12.69	11.84	12.40	13.09
Bruised - TBZ	8.60	11.22	12.87	10.53	12.97	13.43	15.89	11.15	11.87	13.42	13.57	12.07	12.30
Bruised - TBZ+Chl	8.91	10.22	10.17	11.72	----	13.93	11.94	13.40	13.37	11.47	13.18	14.38	12.06
Bruised - TBZ+Chl+ Spr Ih	10.56	12.66	14.89	14.78	14.68	13.78	15.31	12.73	12.54	12.56	14.16	11.62	13.36
Non-Bruised - no chem.	10.70	7.83	10.32	10.14	11.32	9.04	11.31	10.57	11.89	10.39	11.50	12.21	10.60
Non-Bruised - TBZ	13.69	10.00	9.66	9.10	9.73	11.27	11.40	10.34	10.50	9.04	-----	-----	10.47
Non-Bruised - TBZ+Chl	-----	9.41	10.75	10.41	10.69	-----	11.85	11.45	11.57	9.67	11.16	11.10	10.81
Non-Bruised - TBZ+Chl+ Spr Ih	9.49	12.49	14.84	12.17	13.51	14.04	12.19	13.03	14.38	13.22	14.27	11.92	12.96

*Monona potatoes were hand picked up from a windrow of potatoes (non-bruised 91.3% B.F.) and rerun over a windrower three (3) times for a 3x bruise (bruised 45.8% B.F.).

Table XIII. Dry rot infection and sprout inhibition after seven months storage at 40° and 50°F of Monona potatoes* prestorage treated with Ronilan.

	Storage Temperature			
	40°F		50°F	
Treatment	Dry Rot, %	S.I**	Dry rot,%	S.I**
Water	12.4	3	19.1	5
Ronilan 0.5 oz.a.i	3.8	1	7.0	3
1.0 oz.a.i	4.4	1	5.8	3
2.0 oz.a.i	3.4	1	7.1	3

**S.I. (sprout index)

1 = 0 to less than ½" sprout
2 = ½ to 1"
3 = 1 to 2"
4 = 2 to 4"
5 = over 4"

*mechanically bruised (3x)

Publication

Cargill, B.F. The Potato Storage proceedings of the 1980 Potato Growers Short Course, January 7-10, 1980.

NEW VARIETY EVALUATION

R.W. Chase, R.B. Kitchen, R.K. Peterson
Dept. of Crop and Soil Sciences, Michigan State University

Purpose: To determine the adaptation of new and existing potato cultivars to Michigan conditions.

A. <u>DATES of HARVEST</u> (Montcalm Experimental Farm)

Three blocks containing 104 ten foot plots were planted on May 2. Each block contained 26 cultivars and advanced selections planted in a randomized complete block design with four replications. One block was harvested on each of three dates: August 9; August 30; and September 24. At each date of harvest (D of H), economic yields of marketable tubers (over 2 inches diameter), specific gravities, chip scores and internal evaluations (per 20 cut tubers) were determined for each of the 26 entries, Table 1.

During the course of the growing season all plots received standard cultural practices. These included: 200 lbs./A 0-0-60 plow down, 3 lbs./A Eptam preplant incorporate; 600 lbs./A 20-10-10 and 20 lbs./A 15G Temik at time of planting; 0.5 lbs./A Sencor delayed preemerge; 300 lbs./A 46% urea sidedress; supplemental irrigation and application of Bravo 500, Monitor, and Thiodan as needed.

Notes on each of the 26 entries appear below.

<u>Atlantic</u>: USDA, Beltsville (1976); medium-late maturity; high (1.085-1.090) specific gravity; chips well; has above average yield potential; has low (10%) incidence of vascular discoloration, hollow heart and internal necrosis are major limitations.

<u>Belchip</u>: USDA,Beltsville (1978); medium-late maturity; tubers flattened and somewhat rough; medium (1.075-1.080) specific gravity; chips well; average to above average yields; medium (20-30%) incidence of vascular discoloration this year.

<u>Belrus</u>: USDA, Beltsville (1978); early dark russet type; medium specific gravity; acceptable chips; below average yields, did not bulk after first D of H; no internal defects. Very uniform type, appears best suited to early russet fresh market.

<u>Buckskin:</u> Pennsylvania; medium-late maturity; medium specific gravity; acceptable chips; slightly below to below average yields in second and third D of H, significant bulking between first and second D of H; high (40%) incidence of vascular discoloration, some hollow heart and internal necrosis.

Butte: USDA, Idaho (1977); late maturity russet; high specific gravity; average yields, tremendous bulking between first and second D of H; medium incidence of vascular discoloration. Appears to be later maturity in Michigan than is Russet Burbank.

Croatan: North Carolina; medium maturity; low (1.060-1.065) specific gravity; acceptable chips; early bulking leads to significantly above average yields in first D of H, average to above average yields in later harvests; low incidence of vascular discoloration.

Denali: Alaska, USDA (1979); medium-late maturity; very high (1.090-1.095) specific gravity; chips well; average to above average yields; high incidence of vascular discoloration.

Kennebec: Medium-late maturity; medium-low specific gravity; significantly above average yields in second and third D of H, significant bulking between first and second D of H; high incidence of vascular discoloration, some internal necrosis; large tubers tend to be rough.

Michibonne: Michigan; medium-late maturity; medium-low specific gravity; significantly above average yields; low incidence of vascular discoloration; good smooth type, best suited for fresh pack.

Michimac: Michigan; medium-late maturity; medium-low specific gravity; average to above average yields; high incidence of vascular discoloration, some internal necrosis, some scab observed.

Oceania (B6969-2): USDA, Beltsville (1980); early-medium maturity, low specific gravity; acceptable chips; significantly above average yields first D of H, not much further bulking; free of internal defects; tuber type very acceptable.

Onaway: Early maturity; low specific gravity; does not chip; significantly above average yields first D of H, some bulking after contributes to above average yields; low incidence of vascular discoloration.

Oneida: Wisconsin (1977); medium maturity; medium specific gravity; acceptable chips; above average to average yields first and second D of H; low incidence of vascular discoloration.

Russet Burbank: Late maturity; high specific gravity; above average yields second and third D of H; low incidence of vascular discoloration, some internal necrosis, and hollow heart.

Superior: Early maturity; medium specific gravity; above average yield first D of H, although it continued to bulk it did not keep pace with later cultivars; low incidence of vascular discoloration.

Tobique: New Brunswick, Canada (1977); white skin with red splashes; medium maturity; medium specific gravity; above average to average yields; high incidence of vascular discoloration.

<u>B7583-6</u>: USDA, Beltsville; blocky russet type; medium-late maturity; medium specific gravity; slightly below average yields; low incidence of vascular discoloration, hollow heart.

<u>MS 2-152</u>: Michigan; medium maturity; medium to high specific gravity; acceptable chips; above average yields second and third D of H; medium incidence of vascular discoloration. Will be DISCONTINUED.

<u>MS 4-169</u>: Michigan; medium maturity; medium to high specific gravity; acceptable chips; average yields, significant bulking between first and second D of H; medium incidence of vascular discoloration. Will be DISCONTINUED.

<u>MS 4-377</u>: Michigan; yellow flesh; medium-late maturity; high specific gravity; acceptable chips; above average yields; low incidence of vascular discoloration, some scab observed.

<u>MS 4-408</u>: Michigan; yellow flesh; medium-late maturity; medium to high specific gravity; chips well; above average yields; low incidence of vascular discoloration. Will be DISCONTINUED.

<u>MS 4-439</u>: Michigan; medium-late maturity; high specific gravity; chips well; slightly above average yield first D of H, no further bulking leads to significantly below average yields later dates of harvest; medium incidence of vascular discoloration.

<u>MS 108-5</u>: Michigan; medium-late maturity; medium specific gravity; acceptable chips; above average to average yields; medium incidence of vascular discoloration.

<u>MS 305-19</u>: Michigan; yellow flesh; late maturity; high specific gravity; chips well; slightly above average to average yields; low incidence of vascular discoloration, some hollow heart. Will be DISCONTINUED.

<u>MS 402-1</u>: Michigan; medium maturity; low specific gravity; chips well, average to significantly below average yields; no internal defects.

<u>MS 403-2</u>: Michigan; early maturity; medium specific gravity; acceptable chips; average to significantly below average yields; (no internal data).

COMMENTS:

Yields did not significantly increase between the second and third dates of harvest and, for the most part, actually decreased. This generalized decrease was only statistically significant (P=.05) for two entries, Oneida and MS 108-5, however. The fact that yields did not significantly increase can be attributed to the absence of further bulking after August 30 or to differences between the blocks. The decrease in percent B's for all entries over the three dates of harvest indicates that bulking continued past the second date of harvest. There very possibly could have been differences between the blocks such as soil, stand, and tuber initiation which could have contributed to the results obtained. Plant emergence was very slow due to wet soil conditions after planting. It becomes necessary, therefore, to primarily consider differences within each of the dates of harvest rather than differences between the dates of harvest especially for the latter two harvest dates.

Many selections had higher incidences of and more severe vascular and/or internal disorders than in past years. This may be a result of this year's environmental growing conditions.

Onaway was the only cultivar not to produce at least marginal chips from the second date of harvest. Chips were made three days after harvest for the first two dates and two weeks after harvest for the third date. All chip samples were kept at room temperature until chipping.

B. 10 HILL OBSERVATIONAL TRIAL (Montcalm Experimental Farm)

Thirty-six advanced selections and new releases were planted on May 7 in unreplicated 10 foot observation plots. All plots received the standard cultural practices mentioned in the Dates of Harvest Trial and were harvested August 27. Data was collected on total yield, maturity, appearance, specific gravity, chip score after harvest, and internal defects (per 20 cut tubers), for each of the entries, Table 2.

Several selections deserve notation and/or further testing.

Dakchip: (ND8888-2): North Dakota, (1979); early maturity; chips well; had above average yields but had severe sprouting and vascular discoloration. Tuber shape and smoothness were not uniform.

ND8891-3: North Dakota; medium maturity; acceptable chips; had above average yields but had a medium incidence of vascular discoloration and some internal necrosis.

Rideau: Canada; medium maturity; attractive red color; medium specific gravity; had a medium incidence of vascular problems. May have a place in red market (high specific gravity for a red).

Yukon: Medium maturity; yellow flesh; attractive type; medium to high specific gravity; chips well; low incidence of vascular discoloration.

B6987-184: USDA, Beltsville; late maturity; very high specific gravity; chips well; above average yields; very attractive but did have considerable vascular discoloration and sprouting.

COMMENTS:

As in the dates of harvest study, it was noted that vascular disorders were common. Further tests will be necessary to determine its relationship to the growing season. The Campbell selections were obtained from the breeding program of the Campbell Soup Co. and of these Campbell 13 performed the best, however internal disorders were more prevalent.

There are several promising selections from the Beltsville breeding program which are worthy of further testing. The environment under which these selections have been made and tested may be more like that of Michigan which improves their chances of adaptability to Michigan conditions.

There are several selections within the 400 series of the Michigan program which are very smooth, well shaped and attractive. Those with the higher levels of specific gravity will be more vigorously tested in the future.

Table 1: YIELDS, SPECIFIC GRAVITIES AND CHIP RATINGS OF SEVERAL CULTIVARS AT THREE DATES OF HARVEST (M.E.F.)

	August 9, 1979			August 30, 1979			September 24, 1979			
Cultivar	US No.1's cwt/A	Specific Gravity	Chip Score[1/]	US No.1's cwt/A	Specific Gravity	Chip Score	US No.1's cwt/A	Specific Gravity	Chip Score	Maturity[2/] 8/27
Atlantic	232	1.080	1	312	1.086	1	309	1.084	2	2
Belchip	269	1.071	1	344	1.074	1	363	1.079	2	3
Belrus	220	1.073	2	235	1.074	1	212	1.071	2	1
Buckskin	186	1.070	2	390	1.078	1	390	1.079	3	3
Butte	77	1.072	4	375	1.082	2	361	1.085	4	4
Croatan	304	1.062	3	343	1.064	2	397	1.064	2	2
Denali	281	1.084	1	358	1.090	1	390	1.094	3	3
Kennebec	247	1.068	3	513	1.072	3	509	1.070	3	3
Michibonne	300	1.069	3	516	1.071	1	478	1.069	3	3
Michimac	237	1.064	4	398	1.071	2	412	1.071	3	3
Oceania	350	1.069	2	384	1.062	2	335	1.062	2	2
Onaway	329	1.059	5	407	1.066	4	386	1.066	5	1
Oneida	263	1.072	2	352	1.075	2	278	1.073	2	2
Russet Burbank	224	1.070	3	390	1.081	2	413	1.080	3	3
Superior	266	1.071	4	343	1.068	2	315	1.066	3	1
Tobique	266	1.067	4	327	1.073	2	352	1.072	2	2
B7583-6	229	1.075	3	350	1.079	2	346	1.077	4	3
MS 2-152	151	1.075	3	390	1.087	1	337	1.082	2	2
MS 4-169	171	1.074	3	358	1.081	1	378	1.083	2	2
MS 4-377 (Y)	255	1.074	2	383	1.084	1	406	1.084	3	3
MS 4-408 (Y)	251	1.074	2	407	1.080	1	420	1.082	2	3
MS 4-439	258	1.080	2	298	1.088	1	275	1.081	1	3
MS 108-5	277	1.074	2	370	1.079	1	317	1.078	3	3
MS 305-19 (Y)	206	1.074	3	384	1.086	1	360	1.085	1	4
MS 402-1	247	1.064	2	243	1.064	1	283	1.063	3	2
MS 403-2	244	1.073	2	324	1.073	2	271	1.070	2	1
Average	242	1.074		365	1.076		357	1.076		
LSD .05	61	.004		68	.004		70	.005		

[1/] Chip Scores based on PC/SFA chart: 1=light; 5=dark. [2/] Maturity: 1=mature, vines dead; 3=vines spread green; 5=vines up, vigorous, flowering.

TABLE 2: 10 HILL OBSERVATION PLOT SUMMARY, M.E.F. (1979)

SELECTIONS	YIELD (CWT./A)	MATURITY 8/26 1/	APPEARANCE 2/	SPECIFIC GRAVITY	CHIP SCORE 3/	INTERNAL DEFECTS (%) (20 CUT) HOLLOW HEART	INTERNAL NECROSIS	VASCULAR	% FREE INTERNAL	COMMENTS
BK-73	438	2	-	1.070	5	-	20	40	55	
Campbell 11	177	3	-	1.068	1	-	5	5	90	
Campbell 12	277	3	A-	1.072	4	-	-	25	75	
Campbell 13	315	3	A+	1.080	2	-	5	40	65	
Dakchip	369	1	A	1.070	1	-	-	75	25	sprouted (severe), vascular (severe)
ND8891-3	377	2	A	1.073	2	-	10	25	65	
Neb 1.72-1	330	2	-	1.066	1	-	-	25	75	10% knobs
Neb A 102.72-2	292	1	A	1.062	3	-	-	-	100	
Neb A 129.69-1	423	3	A	1.073	4	-	5	-	95	
Rideau	369	2	A	1.077	4	-	-	25	75	red
Yukon	284	2	+	1.080	1	-	5	15	80	yellow flesh
USDA -Idaho										
A68678-1	269	1	A-	1.079	3	5	5	50	40	russet
USDA-Beltsville										
B6987-184 5/	354	3	A	1.100	1	-	-	40	60	sprouted (slight)
B6987-184 5/	469	3	A-	1.098	1	-	-	35	65	sprouted (slight)
B7516-7	246	1	-	1.063	1	10	-	30	55	10% sungreen, 10% growth crack
B7516-9	407	1	A	1.069	2	-	5	25	70	
B7802-2	284	1	-	1.068	2	-	5	-	95	
B7805-1	354	1	A	1.070	3	-	25	25	60	15% growth cracks
B7859-3	300	3	A-	1.086	1	-	-	20	80	
B8528-3	192	2	A	1.066	2	-	-	-	100	dark russet, sprouted
B8822-9	277	1	A-	1.065	4	-	50	35	20	russet, pointed
B8972-1	223	1	+	1.070	1	-	-	20	80	russet, 15% sungreen
MSU (white) 4/										
4-439	307	1	-	1.087	1	-	5	10	85	
401-2	169	2	-	1.071	1	-	-	-	100	
402-4	200	1	A-	1.073	1	-	-	5	95	
402-6	200	1	A	1.069	1	-	-	-	100	small, sprouted (slight)
407	215	1	+	1.061	1	-	10	5	90	
MSU (off-white) 4/										
4-198	284	1	A-	1.071	1	-	-	15	85	
402-1	269	2	A	1.058	1	-	5	-	95	

TABLE 2: Con't.

SELECTIONS	YIELD (CWT./A)	MATURITY 8/26 [1]	APPEARANCE [2]	SPECIFIC GRAVITY	CHIP SCORE [3]	INTERNAL DEFECTS (%) (20 CUT) HOLLOW HEART	INTERNAL NECROSIS	VASCULAR	% FREE INTERNAL	COMMENTS
MSU (yellow)[4]										
2-171	315	1	A	1.069	1	-	-	-	100	
2-302	323	3	A-	1.081	2	-	-	20	80	
3-69	246	3	A	1.079	1	-	-	10	90	
4-377	300	1	A	1.081	1	-	-	25	75	sprouted
4-408	400	2	A-	1.087	1	-	-	35	65	sprouted (slight)
305-15	423	3	A-	1.082	4	NO	DATA			
402-5	238	1	A	1.073	2	-	-	5	95	
MEAN, $S_{\bar{x}}$	303	, 13								

1/ Maturity notes taken on 8/26
- 1 - plants dead - early - Norland maturity
- 2 - - Norchip maturity
- 3 - plants spread but still green - Russet Burbank maturity

2/ Appearance - tuber type
- \- rough, deep eyed
- A average
- \+ smooth, attractive

3/ Chip Score based on Potato Chip/Snack Food Association Chart
- 1 light ≥ 65 (Agtron) acceptable
- 3 45-54 (Agtron) marginal
- 5 dark 25-34 (Agtron) unacceptable

4/ MSU flesh color: white, off-white, yellow

5/ B6987-184 had 2 seed sources

*TO EVALUATE SEVERAL SELECTIONS FOR THEIR YIELD AND PROCESSING POTENTIAL UNDER MICHIGAN CONDITIONS**

R.W. Chase, R.B. Kitchen, R.K. Peterson
Dept. of Crop and Soil Sciences, Michigan State University

MATERIALS AND METHODS:

Thirteen cultivars and advanced selections were tested for their yield potential, size distribution and their processability. Two randomized complete block designs, one containing 6 early and one containing 7 late selections, were planted on May 7. Each entry in both designs consisted of 23 foot plots that were replicated 4 times.

All plots received standard cultural procedures which included:

200 lbs/A 0-0-60 plow down, 3 lbs/A Eptam preplant incorporate; 600 lbs/A 20-10-10 and 20 lbs/A 15G Temik at planting; 0.5 lbs/A Sencor delayed preemerge; 300 lbs/A 46% urea sidedress; supplimental irrigation and applications of Bravo 500, Monitor and Thiodan as needed. Specific gravity, yield and size distrubution, internal defects, and fry color data were taken after harvest and data summarys appear below.

EARLY HARVEST

Tables 1 and 2 summarize the data from the early harvest design which was harvested on August 27. Specific gravity, total yield, yield over 10 oz., yield 4-10 oz. and yield under 4 oz. were all significant at the (P=.05) level. Specific gravities ranged from 1.064 to 1.074 with A68599-1 having the highest specific gravity of the early entries. Total yield varied from a low of 266 cwt/A for ALR22-2 to a high of 456 cwt/A for A68710-5. Size over 10 oz. ranged from 33 cwt/A to 211 cwt/A or from 12-47% of the total yields. A68710-5 and Pioneer had the highest cwt/A in this class. The ranges of variation in the 4-10 oz. and under 4 oz. classes were more restricted. It is interesting to note that the percent of total yield in the 6-10 oz., 4-6 oz. and under 4 oz. classes was lowest for A68710-5 but this selection gave a high (12.5) percent of number 2's.

Center slab and internal data are presented in Table 2. Virtually all of the early entries gave acceptable to good fry scores. The one exception was A66107-12 which had a higher incidence of center slabs in the 2-3 category. A72687-11 had a medium incidence of vascular discoloration.

Of the six early entries tested, Pioneer and A68710-5 have good yields, acceptable to good fry color, and above average specific gravities. The high incidence of sugar ends and 12% number 2's in A68710-5 makes Pioneer the more attractive selection in our trials.

---

* Projected supported by Ore-Ida Foods, Inc.

TABLE 1: ORE-IDA EARLY HARVEST 8/27/79 (M.E.F.)

CULTIVAR	AVERAGE NO. PLANTS/PLOT	MATURITY (8/27)[1]	SPECIFIC GRAVITY (coded)[2]	TOTAL YIELD (cwt/A)	YIELD OVER 10 OZ. (cwt/A)	YIELD 4-10 OZ. (cwt/A)	YIELD < 4 OZ. (cwt/A)	OVER 10 OZ. (%)	6-10 OZ. (%)	4-6 OZ. (%)	CULLS < 4 OZ. (%)	NO. 2's (%)
A66107-12	23	1.5	68.0	358	79	202	74	22.0	30.8	25.7	20.5	0.9
A68599-1	23	1	73.5	354	54	216	79	15.3	33.0	28.1	22.3	1.3
A68710-5	23	3	72.3	456	211	155	33	46.3	22.1	11.7	7.2	12.5
A72687-11	22	2.5	69.8	333	94	193	31	28.5	38.1	20.0	9.4	4.2
ALR22-2	20	1	63.8	266	33	162	61	12.3	29.6	31.4	22.9	3.8
Pioneer	23	1	71.5	398	185	178	31	46.5	28.4	16.3	7.7	1.2
Average			69.8	360.6	122.2	171.9	51.4					
CV (%)			4.1	9.0	17.4	17.7	19.5					
LSD .05			4.3	48.7	32.0	45.8	15.1					

[1]Maturity: 1= mature, vines dead; 3= vines spread, green; 5= vines up, vigorous, flower

[2]S.G. coded = (S.G. - 1.000) 1000

TABLE 2: CENTER SLAB FRY DATA[3] - ORE-IDA (EARLY)

CULTIVAR	TOTAL NO. TUBERS/ 10 LBS.	FRY COLOR (0-1)[4]	FRY COLOR (2-3)	FRY COLOR (4+)	HOLLOW HEART	VASCULAR DISCOLORATION	INTERNAL NECROSIS	JELLY END/ SUGAR ENDS
A66107-12	21	15	6					
A68599-1	19	19				1		
A68710-5	19	18		1				13
A72687-11	20	20				4		
ALR22-2	21	18	3					
PIONEER	18	17	1					

3 3/8" center slabs from a 10 lb. tuber sample were fried at 365°F for 3 minutes

4 Fry color is based on the USDA Color Standards for Frozen French Fried Potatoes Chart: 0-1 = light; 4+ = dark

LATE HARVEST

Tables 3 and 4 summarize the data from the late harvest design which was harvested on September 26th. Specific gravity, total yield, yield over 10 oz., yield of 4-10 oz., and yield under 4 oz. were all significant at the (P=.05) level.

Specific gravities ranged from 1.074 to 1.091 with A72685-2 having the highest specific gravity. Total yields ranged from a low of 347 cwt/A to a high of 467 cwt/A with A67142-1, A70758-3 and A72685-2 having yields of 450 cwt/A or higher, well above the average and that for Russet Burbank. Yields over 10 oz. were 130 cwt/A or higher for A67142-1, A70758-3, and A72685-2 which represents 28-32% of the total yields for these three selections. Ranges in yields for the 4-10 oz. and under 4 oz. categories w were more restricted. A69327-5 and Russet Burbank gave the highest percent of total yields in the under 4 oz. and number 2's categories respectively.

Table 4 summarizes the center slab fry data and internal defects for the late harvest design. Only A67142-1, A68678-1 and Russet Burbank gave good fry color results. A68678-1 had a medium to high incidence of internal problems with vascular discoloration and sugar ends. Russet Burbank also had a medium incidence of sugar ends.

Of the seven late entries tested, A67142-1 appears to be the most promising with its above average yields, good specific gravity, good fry color and freedom from internal defects. A72685-2 had an above average yield and high specific gravity but did not have as good fry color. A70758-3 had an above average yield but below average specific gravity and only fair to poor fry coloration.

TABLE 3: ORE-IDA LATE HARVEST 9/26/79 (M.E.F.)

CULTIVAR	AVERAGE NO. PLANTS/PLOT	MATURITY (8/27)[1]	SPECIFIC GRAVITY (coded)[2]	TOTAL YIELD (cwt/A)	YIELD OVER 10 OZ. (cwt/A)	YIELD 4-10 OZ. (cwt/A)	YIELD < 4 OZ. (cwt/A)	OVER 10 OZ. (%)	6-10 OZ. (%)	4-6 OZ. (%)	< 4 OZ. (%)	NO. 2's (%)	CULLS (%)
A67142-1	23	4	84.3	450	143	233	33	31.8	32.4	19.3	7.3	6.1	3.1
A68678-1	22	4	79.3	347	68	234	45	19.4	37.7	26.7	13.1	3.1	
A69327-5	23	3.5	84.0	361	33	227	88	9.2	28.8	33.8	24.2	3.9	
A70758-3	23	4.5	74.3	467	130	243	61	27.9	30.6	21.5	13.0	7.0	
A72545-7	23	4	79.0	348	63	225	41	18.0	37.2	27.4	11.7	5.7	
A72685-2	22	4	91.0	454	143	246	52	31.4	32.2	21.9	11.5	3.1	
Russet Burbank	23	3.5	77.0	389	57	233	44	14.6	34.0	25.7	11.3	14.4	
Average			81.3	402.3	90.9	232.5	51.9						
CV (%)			4.1	9.9	35.6	12.2	23.3						
LSD .05			5.0	58.9	48.0	42.1	18.0						

[1]Maturity: 1 = mature, vines dead; 3 = vines spread, green; 5 = vines up, vigorous, flower

[2]S.G. coded = (S.G. - 1.000) 1000

TABLE 4: CENTER SLAB FRY DATA[3] - ORE-IDA (LATE)

CULTIVAR	TOTAL NO. TUBERS/ 10 LBS.	FRY COLOR (0-1)[4]	FRY COLOR (2-3)	FRY COLOR (4+)	HOLLOW HEART	VASCULAR DISCOLOR-ATION	INTERNAL NECROSIS	JELLY END/ SUGAR ENDS
A67142-1	18	18						
A68678-1	18	18				3		5
A69327-5	15	11	4					
A70758-3	19	1	12	6				
A72545-7	18	2	16			2		
A72685-2	15	10	5		1			
Russet Burbank	19	19						4

[3] 3/8" center slabs from a 10 lb. tuber sample were fried at 365°F for 3 minutes

[4] Fry color is based on the USDA Color Standards for Frozen French Fried Potatoes Chart: 0-1 = light; 4+ = dark

THE EVALUATION OF PIX, A PLANT GROWTH REGULATOR, FOR ITS EFFECT ON POTATO PLANT GROWTH, TUBER NUMBER, AND TUBER QUALITY

R.K. Peterson, R.W. Chase, R.B. Kitchen
Department of Crop and Soil Sciences

MATERIALS AND METHODS:

Two cultivars, Superior and Russet Burbank, were planted in two separate randomized complete block designs on May 7, each design consisted of 28 ten foot plots of 7 treatments replicated 4 times. The seven treatments included 1 check and 3 rates of PIX (0.044, 0.1 and 0.5 a.i./A) by 2 dates of application (prebloom and 2 weeks after prebloom). All PIX treatments were applied using a standard 3 gallon Hudson sprayer. PIX is a plant growth regulator obtained from BASF Wandotte Corp.

All plots received standard cultural practices during the growing season. These included: 200 lbs/A 0-0-60 plowdown, 3 lbs/A Eptam preplant incorporate; 600 lbs/A 20-10-10 and 20 lbs/A 15G Temik at time of planting; 0.5 lbs/A Sencor delayed preemerge; 300 lbs/A 46% urea sidedress; supplemental irrigation and applications of Bravo 500, Monitor, and Thiodan as needed.

Height measurements were taken on both cultivars on July 26. Tuber yield (weight, number and size) and specific gravity measurements were taken at the time of harvest and are summarized under each cultivar below.

SUPERIOR EXPERIMENT:

Plots of Superior received the prebloom spray applications on June 18. At the time of application Superior plots were in 10% flower, stolons were 6-10 inches long and tubers were 1/2 to 1" in diameter. The 2 week after prebloom spray was applied on July 5 (17 days after the prebloom spray). Plots were in full flower with 3-6 tubers per plant and tubers were 1 1/2 - 2" in diameter. All the Superior plots were harvested on August 23.

Table 1 summarizes the results of the Superior experiment of all the categories studied, only the total number of tubers and the number of tubers between 2 and 3 1/4" were significant. In both cases signficiance was at the P - .10 level and no trends were noted.

From these results it appears that the timing of and the rates of PIX applied did not appreciably affect the height, yield, size distribution or quality of tubers in the Superior experiment.

RUSSET BURBANK EXPERIMENT:

Plots of Russet Burbank received the prebloom spray applications on June 22. At that time the plots were in 90% bud, stolons were 4-6 inches long and tubers were 1/2 inch in diameter. The 2 week after prebloom spray was applied on July 5 (13 days after the prebloom spray). Plots were in full flower, with 5-7 tubers per plant and tubers were 1/2 to 1" in diameter. All Russet Burbank plots were harvested September 26.

Table 2 summarizes the results of the Russet Burbank experiment. Significance at the P = .10 level was obtained for yield of number 2's, total tuber number, and number of number 2's. There appears to be an increase in total tuber number with an increase on the rate of PIX applied. This can be attributed to the increase in the number of tubers under 4 ounces although this category gave no significant differences.

From these results it appears that the application of PIX has a variable effect on tuber yield and tuber size. PIX tends to increase tuber numbers in the smaller size categories and as a result increases tuber yields in these categories as well. PIX has the opposite effect on larger size categories. Few of these trends were significant at the P = .10 level, however, PIX has a tendency to increase both the number and weight of tubers in the number 2 category which may be an undesirable feature.

TABLE 1: PLOT MEANS FOR HEIGHT, SPECIFIC GRAVITY, YIELD AND TUBER NUMBER IN THE SUPERIOR EXPERIMENT

	HEIGHT (7/26) (inches)	SPECIFIC GRAVITY	TOTAL YIELD cwt/A	YIELD UNDER 2" cwt/A	YIELD 2-3¼" cwt/A	YIELD OVER 3¼" cwt/A	TOTAL # TUBERS	# TUBERS < 2"	# TUBERS 2-3¼"	# TUBERS > 3¼"	$\bar{X}$ WEIGHT/ $\bar{X}$ TUBER # Lbs.
CHECK	18.8	1.067	458	9	306	142	67	7	49	11	.44
.044 PRE	20.5	1.066	455	12	306	138	63	8	45	10	.47
.1 PRE	20.3	1.067	455	14	352	88	70	8	55	7	.42
.5 PRE	17.5	1.066	420	14	281	125	64	9	45	10	.43
.044 POST	20.0	1.067	461	9	350	103	67	7	53	8	.45
.1 POST	20.5	1.068	452	12	336	105	72	9	55	8	.41
.5 POST	20.3	1.066	453	6	321	127	64	5	49	10	.46
Average	19.7	1.0664	450	11	321	118	67	7	50	9	.44
CV (%)	19.5	4.3	8.7	59.0	11.7	37.3	6.6	46.4	10.5	38.6	
LSD .1							5.4		6.4		

TABLE 2: PLOT MEANS FOR HEIGHT, SPECIFIC GRAVITY, YIELD AND TUBER NUMBER IN THE RUSSET BURBANK EXPERIMENT

	HEIGHT (7/26) INCHES	SPECIFIC GRAVITY	TOTAL YIELD cwt/A	YIELD UNDER 4 OZ. cwt/A	YIELD 4-10 OZ. cwt/A	YIELD OVER 10 OZ. cwt/A	YIELD #2's cwt/A	TOTAL NO. TUBERS	NO. TUBERS UNDER 4 OZ.	NO. TUBERS 4-10 OZ.	NO. TUBERS OVER 10 OZ.	NO. TUBERS #2's	X TOTAL WT./ X TOTAL #
CHECK	27.5	1.078	433	60	165	81	128	69	22	27	7	14	.41
.044 PRE	27.3	1.075	404	84	183	52	87	69	28	28	4	8	.38
.1 PRE	27.0	1.078	463	88	243	56	76	82	30	38	4	10	.37
.5 PRE	27.8	1.081	474	79	158	67	170	76	26	24	5	21	.41
.044 POST	27.3	1.078	438	78	208	83	69	76	29	33	7	8	.38
.1 POST	26.3	1.077	440	80	178	56	127	74	27	26	5	16	.39
.5 POST	26.3	1.078	426	89	183	60	94	82	33	28	5	16	.34
Average	27.0	1.0778	440	80	188	65	107	75	28	29	5	13	.38
CV (%)	4.9	4.6	10.0	31.8	27.4	38.6	43.2	10.7	26.7	24.0	36.5	48.2	
LSD .1							57	9.9				7.9	

CORRELATION OF THE SUCROSE-RATING SYSTEM TO VARIETY, HARVEST & STORAGE

Dr. Jerry Cash & Dr. Richard Chase
Dept. of Food Science & Human Nutrition & Dept. of Crop & Soil Science

Five varieties, Atlantic, Belchip, Denali, Monona & Norchip were grown at three nitrogen levels of 120, 200 & 280 lbs of nitrogen per acre. Norchip was planted at a 12" spacing whereas the others were spaced at 8". Plantings were made on May 7.

The fertilizer applied was 200 lbs/A of 0-0-60 plowdown and 600 lbs/A of 20-10-10 banded at planting. The additional nitrogen for the 200 pound level was applied as a single side-dressing of uread on May 30. The additional nitrogen for the 280 pound level was applied in two applications, May 30 & June 12.

Weekly harvests were made July 16,23, 30, Aug 6, 13, 20 & 27. At each harvest, 5 consecutive hills were harvested so that yield, size distribution, set, specific gravity, chip quality, carbohydrates and fat absorption could be determined.

Results

Table 1 summarizes the yield, size distribution and specific gravity when the main plot was harvested on Sept. 13. These plots were top killed approx. 2 weeks prior to harvest. It is apparent there was no yield response with any variety with increasing nitrogen levels. The residual nitrogen at this location must have been adequate. There was an increase with higher nitrogen in the percent over 3¼ inch in Atlantic, Belchip, Denali, Monona, however the response was not always consistent. Similarily there was a decrease in specific gravity of Belchip, Denali & Monona with the highest levels of nitrogen.

Table 2 summarizes the weekly observations made for each variety. Generally yields showed a continued increase without much difference among varieties. There was some difference in the percentage of tubers under 2 inch with Monona showing the smallest amount, whereas Denali had the highest percentage at the early harvest. This is likely related to numbers and time of tuber set. Tubers over 3¼ inch were recorded for Atlantic and Belchip on July 30 whereas Monona and Norchip were not noted until Aug 6 and Denali at Aug 13.

Specific gravity patterns started at a much higher level than anticipated. The fluctuations were significant and may be related to weather patterns, particularly rainfall.

Tuber quality will again be monitored in 1980 in an effort to determine the relationship between management inputs, variety, weather and optimiun levels of specific gravity.

TABLE 1 THE YIELD, SIZE, DISTRIBUTION & SPECIFIC GRAVITY OF FIVE POTATO VARITIES GROWN AT THREE NITORGEN LEVELS. (MEF, 1979)

VARIETY	NITROGEN LEVEL	TOTAL (cwt/A)	NO1 (cwt/A)	PERCENT OVER 3¼"	PERCENT UNDER 2"	SPECIFIC GRAVITY
Atlantic	120	485	474	12.8	2.5	1.087
	200	475	454	17.6	4.6	1.086
	280	494	482	16.1	2.6	1.089
	Ave.	485	470	15.5	3.2	1.087
Belchip	120	462	456	27.9	1.4	1.081
	200	474	468	35.6	6.3	1.082
	280	459	454	40.2	1.5	1.079
	Ave.	465	459	34.6	3.1	1.081
Denali	120	521	505	15.1	3.3	1.095
	200	488	478	25.3	2.5	1.093
	280	500	488	16.8	2.7	1.092
	Ave.	503	490	19.1	2.8	1.093
Monona	120	404	396	28.3	2.3	1.067
	200	400	391	29.9	2.5	1.067
	280	400	392	36.1	2.3	1.063
	Ave.	401	393	31.4	2.4	1.066
Norchip	120	397	382	11.8	4.0	1.078
	200	391	376	8.5	4.3	1.078
	280	399	388	14.7	3.0	1.078
	Ave.	396	382	11.7	3.8	1.078

TABLE 2 THE PERFORMANCE DATA OF WEEKLY HARVESTS OF FIVE POTATO VARIETIES. (MEF, 1979)

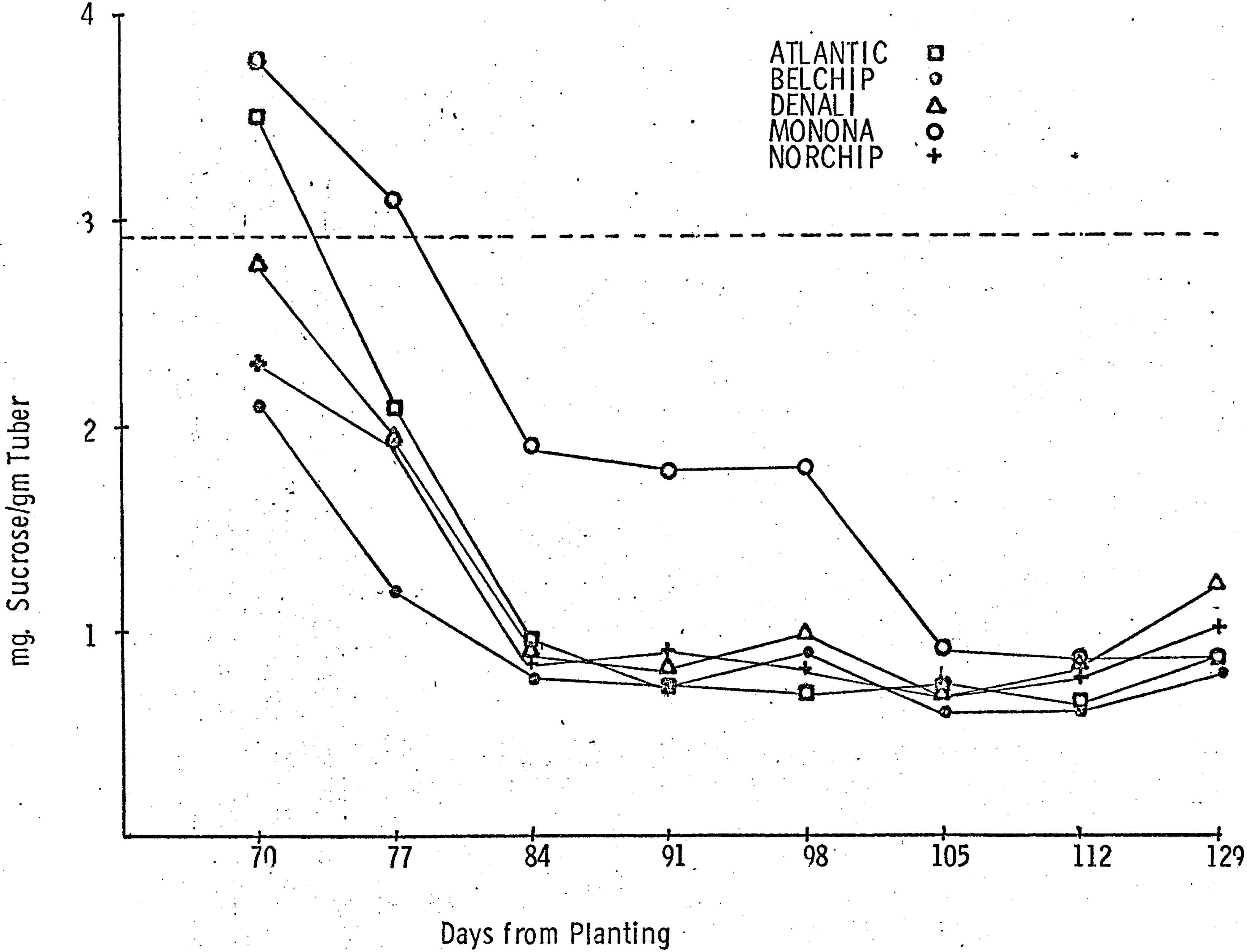
	JULY			AUGUST				SEPT.
	16	23	30	6	13	20	27	13
Atlantic								
Total wt (lbs)	3.3	3.6	6.3	7.3	9.7	8.7	10.5	
% under 2"	69	60	19	15	13	10	6	
% over 3¼"	0	0	14	8	25	8	31	
Specific gravity	1.090	1.091	1.077	1.081	1.091	1.084	1.088	1.082
Belchip								
Total wt (lbs)	3.8	3.9	5.8	6.8	8.5	11.2	11.9	
% under 2"	55	33	17	6	11	5	8	
% over 3¼"	0	0	18	17	10	9	38	
Specific gravity	1.083	1.078	1.072	1.068	1.077	1.076	1.075	1.077
Denali								
Total wt (lbs)	2.9	3.7	5.4	7.0	8.3	9.8	13.5	
% under 2"	82	57	18	27	17	11	9	
% over 3¼"	0	0	0	0	13	--	15	
Specific gravity	1.093	1.092	1.076	1.079	1.088	1.091	1.091	1.090
Monona								
Total wt (lbs)	3.1	3.3	6.1	7.0	8.0	8.7	9.7	
% under 2"	43	34	28	11	13	6	8	
% over 3¼"	0	0	0	33	31	20	--	
Specific gravity	1.073	1.070	1.064	1.062	1.066	1.065	1.064	1.063
Norchip								
Total wt (lbs)	4.5	7.3	8.7	12.6	10.9	11.7	13.4	
% under 2"	58	55	16	14	18	13	10	
% over 3¼"	0	0	0	8	--	16	18	
Specific gravity	1.080	1.079	1.070	1.075	1.078	1.077	1.075	1.077

The major factor affecting final quality of processed potato products, especially chips, is the sugar content at harvest and the amount of reducing sugars which accumulate during storage. In a storage situation, the carbohydrate, sucrose, can be enzymatically converted to two, 6 carbon reducing sugars (glucose and fructose), which then react with amino acids during frying, to produce dark colored chips. Under these circumstances, it has been shown to be very important for potatoes being stored for chipping to have minimal sucrose levels when harvested and it is this factor which separates good processing potatoes from poor processors.

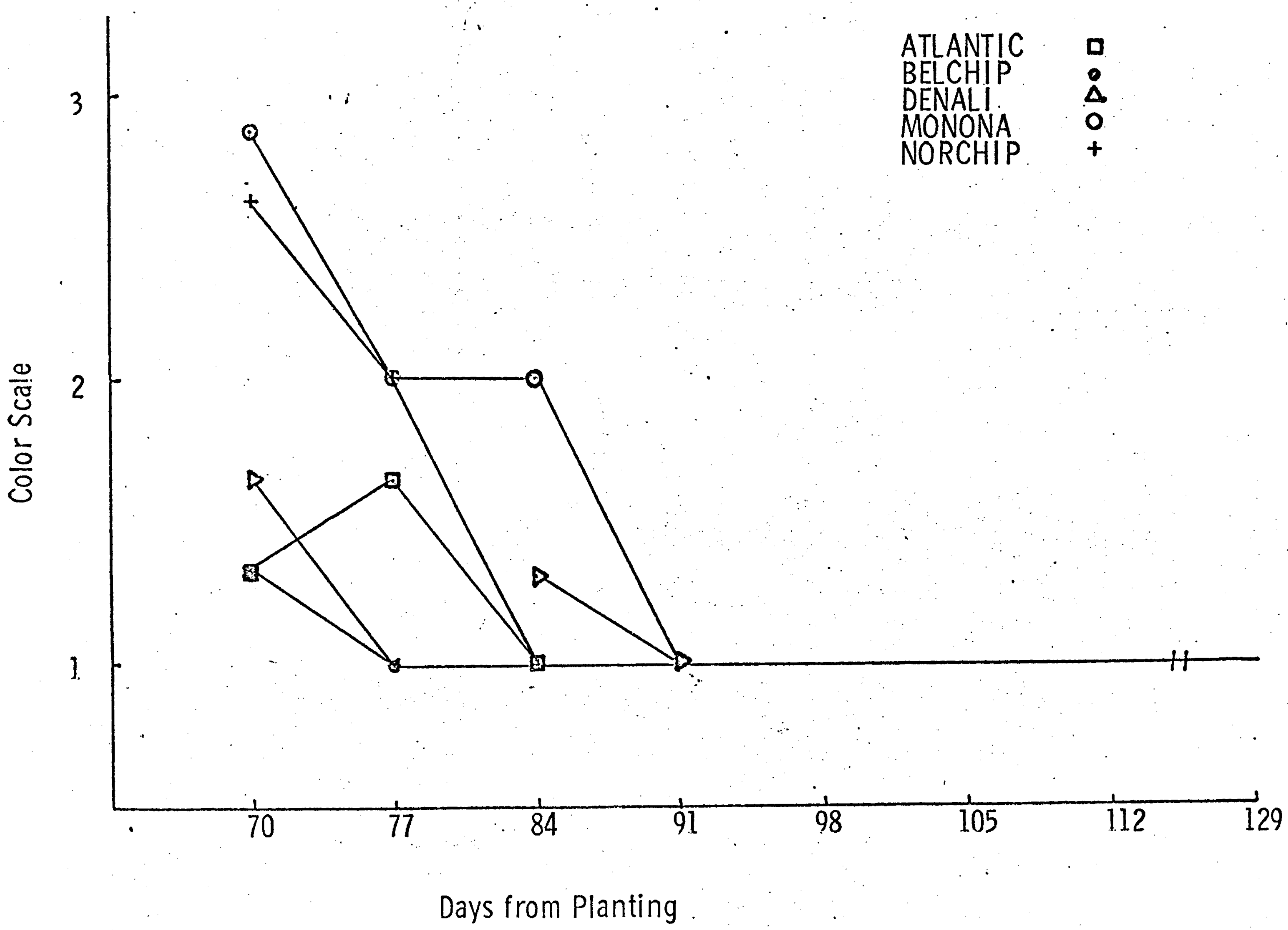
Since carbohydrate content is so important for finished product quality it is felt that monitoring the sugar changes during growth of tubers can be useful in predicting harvest maturity, however, these changes may be influenced by a number of factors, including, variety, growing conditions, soil fertility and stress conditions. The present study was designed to incorporate some of these factors in order to determine their effects on sucrose content during tuber growth.

Five potato cultivars (Atlantic, Denali, Norchip, Monona and Belchip) were grown at three nitrogen levels. Harvesting of tubers began on July 16 (70 days after planting) and continued at weekly intervals until September 14 (129 days after planting). Sugar changes were determined by a standard sucrose rating (SR) technique at each harvest date. Figure 1 shows the changes in sucrose content of the various cultivars during their growth. Previous work, using the SR analysis for predicting storage stability, indicates that an SR of 2.8 or less is desirable for good processing potatoes. All the varieties tested were below this level by July 30 (84 days after planting) but tubers were still small and specific gravity was very low at this point. The SR values leveled off and did not change significantly after the July 30 harvest. As expected, chip color tended to follow the same trend (Figure 2) with all cultivars producing chips that rated between 1 and 2 on the PC/SFA 5, code color scale (1 lightest - 5 darkest) by July 30.

In conclusion, it seems that sucrose analysis gives an indication of physiological or chemical maturity but it can not be used alone because it does not indicate physical maturity. The SR analysis, combined with a new technique for determining concentrations of glucose and fructose, which we recently developed, may give better information concerning maturity. These analyses may also be useful in making decisions concerning cultural management practices in years when potatoes are grown under stress conditions (i.e., disease, temperature, rainfall).


ATLANTIC
BELCHIP
DENALI
MONONA
NORCHIP
4
3
2
1
mg. Sucrose/gm Tuber
70
77
84
91
98
105
112
129
Days from Planting

PC/SFA CHIP COLOR



FERTILIZER CORRELATION STUDY

M.L. Vitosh
Department of Crop and Soil Sciences

The objectives of this study were to look at potato response at the Montcalm Research Farm to phosphorus supplied as diammonium phosphate (DAP) and monoammonium phosphate (MAP) and also to added sulfur (S), boron (B) and zinc (Zn) fertilizers. The experiment was a randomized complete block design with four replications. All treatments except the control received 100 lbs P_2O_5 banded at planting time. Sulfur was supplied as gypsum, boron as Borate 68 and Zinc as zinc sulfate. All were applied with the banded fertilizer at planting. Rates were 20 lbs S, one lb B and two lb Zn per acre.

Soil test values from the treated plots are shown in Table 1. Phosphorus values are extremely high and potassium values are considered to be medium. Uniformity among treatments was good as noted by non-significant (NS) LSD tests.

Yield, size distribution and specific gravity of Russet Burbank tubers as affected by fertilizer treatments are shown in Table 2. The LSD test indicates that there are no significant differences. The control treatment, however, was the lowest yielding treatment.

Potato petioles were sampled on June 26 and analyzed for 11 elements. The elemental composition is shown in Table 3. DAP and MAP significantly increased the P content with no difference due to P source. Sodium (Na) content was higher with DAP and B but little practical significance can be placed on these differences since Na is not an essential element for plants. Boron and zinc were both significantly increased in the petioles due to their addition in the fertilizer. Both elements were present in adequate amounts in the petioles.

In summary, it appears that the soil at the Montcalm Research Farm contains adequate amounts of S, B, and Zn. DAP and MAP are both good sources of P and preformed equally well in this study. Although P fertilizer did not result in a significant yield increase at the 95% level of probability, it would appear that the 35 cwt increase with DAP would easily pay for the 100 lbs of P_2O_5.

Table 1. Soil test values on samples taken from treated plots in June 1979 (Range 6).

Fertilizer Treatments[1]	Soil Tests				
	pH	P	K	Ca	Mg
Control	6.1	482	334	914	156
DAP[2]	5.9	471	356	972	153
MAP[3]	5.8	488	350	828	130
MAP + 20 lb S	5.7	494	378	914	145
MAP + 1 lb B	5.8	474	350	857	135
MAP + 2 lb Zn	5.9	489	360	886	133
LSD (.05)	(NS)	(NS)	(NS)	(NS)	(NS)

[1] All treatments except the control received 100 lbs P_2O_5.

[2] DAP = Diammonium Phosphate (18-46-0)

[3] MAP = Monoammonium Phosphate (13-52-0)

Table 2. Total yield, size distribution and specific gravity of Russet Burbank potatoes as affected by Phosphorus, Boron, Sulfur and Zinc fertilizer treatments.

Fertilizer Treatments[1]	Total Yield	Over 10 oz.	Off Type	A Size	B Size	Specific Gravity
	- - -	- - -	cwt/A	- - -	- - -	- g/cc -
Control	338.2	27.7	33.2	261.2	16.1	1.077
DAP[2]	373.6	32.7	37.1	289.0	14.8	1.080
MAP[3]	355.9	23.1	39.4	275.2	18.3	1.078
MAP + 20 lb S	359.6	30.7	41.1	276.5	11.1	1.077
MAP + 1 lb B	361.3	32.7	39.4	273.3	16.0	1.076
MAP + 2 lb Zn	363.1	25.9	40.7	281.2	15.2	1.079
LSD (.05)	NS	NS	NS	NS	NS	NS

[1] All treatments except control received 100 lbs P_2O_5

[2] DAP = Diammonium Phosphate (18-46-0)

[3] MAP = Monoammonium Phosphate (13-52-0)

Table 3. Elemental composition of Russet Burbank petiole samples June 26, 1979 as affected by phosphorus, sulfur, boron, zinc and phosphorus source.

Fertilizer Treatments[1]	P	K	Ca	Mg	Na	Mn	Fe	B	Cu	Zn	Al
	%				ppm						
Control	.22	10.6	.77	.43	48	74	138	25	6	36	182
DAP[2]	.37	10.7	.68	.40	92	86	136	26	6	39	158
MAP[3]	.35	11.1	.75	.40	52	90	143	24	7	40	179
MAP + 20 lb S	.34	10.9	.74	.39	63	86	148	24	8	42	191
MAP + 1 lb B	.33	10.4	.68	.37	90	77	133	28	6	37	167
MAP + 2 lb Zn	.37	11.2	.78	.41	46	98	146	26	7	50	184
LSD (.05)	(.04)	(NS)	(NS)	(NS)	(34)	(NS)	(NS)	(2)	(NS)	(6)	(NS)

1 All treatments except the control received 100 lbs P_2O_5

2 DAP = Diammonium Phosphate (18-46-0_

3 MAP = Monoammonium Phosphate (13-52-0)

FOLIAR FERTILIZER STUDY WITH POTATOES

Dr. Maurice L. Vitosh
Department of Crop and Soil Sciences
Michigan State University

Introduction

Recent work on foliar fertilization of soybeans at Iowa State University in 1975 has stimulated interest in foliar fertilization of other crops. Potatoes are a high value crop where a small increase in yield could easily off-set the cost of supplemental foliar fertilizers.

The purpose of this study was to evaluate two formulations of Alpine fertilizer sprayed at two rates during initial bloom stage on yield and quality of Russet Burbank potatoes.

Procedure

The experiment was established on a Montcalm-McBride sandy loam soil near Greenville, Michigan. The experiment was a randomized complete block design with six treatments and four replications. It was laid out under a center-pivot irrigation system. Potatoes were planted on May 16, 1979 by the owner. Approximately 200 lbs 0-0-60 was broadcast and plowed down prior to planting, 250 lbs 15-24-0 was used at planting and 554 lbs 28-0-0 was sidedressed during the first cultivation June 18th. The foliar fertilizer treatments were established on July 5th using a ten foot boom tractor sprayer. TX-4 Tee-Jet hollow cone nozzels were spaced at 20 inches. The pressure was regulated at 40 psi and travel speed was four mph to give a rate of five gallons per acre. The treatments were applied between the hours of five and eight p.m. Wind speed was less than five mph. The 2.5 gallon per acre rate was obtained by diluting the formulation to half strength with water.

Observations of any growth or color difference were made periodically throughout the remaining season. Plots were havested and sized on October 10th and a sample taken for determination of specific gravity.

Results

The effects of two formulations of Alpine fertilizer and the two rates of application are shown in Table 1. Total yield and size of tubers were not significantly affected by the foliar fertilizer treatments. Formula A resulted in a lower specific gravity of tubers than Formula B or the first control. The last control however was not significantly different from the Formula A treatments thus it is doubtful that any real significance can be associated with lower specific gravity of the Formula A treatments.

A considerable number of tubers were classified as off-type because of their knobby appearance. This condition has been often associated with differences in growth rate due to water management or climatic conditions.

Yields in general were not as high as anticipated based on vine growth and general condition throughout the growing season. Excellent vine growth and color were observed throughout the season. Hopefully information from an adjacent fertility study will offer some management tips for improving yields on this location.

In summary, foliar fertilization of Russet Burbank potatoes during initial bloom stage at this location had no effect on yield or quality of potatoes. Fertilizer applied prior to the application of foliar fertilizers was adequate for the production observed.

Table 1. Total yield, size distribution and specific gravity of Russet Burbank potatoes as affected by foliar fertilizer treatments.

Foliar Treatments	Total Yield	Over 10 oz.	Off Type	A Size	B Size	Specific Gravity
	- - - - - -	- - - - - -	cwt/A	- - - - - -	- - - - - -	- g/cc -
Control	233	11.8	47.1	142.9	31.7	1.080
2.5 GPA Formula A	232	6.5	55.5	141.0	28.8	1.077
5 GPA Formula A	234	6.3	48.8	144.1	34.8	1.076
2.5 GPA Formula B	229	11.8	53.3	129.7	34.1	1.081
5 GPA Formula B	243	13.4	53.6	144.1	31.7	1.080
Control	247	9.8	52.6	150.6	33.6	1.078
LSD (.05) 2/	ns 1/	ns	ns	ns	ns	.003

1/ NS = Not significant

2/ Least significant difference at the .05 level of significance.

1979 SOIL FERTILITY STUDY WITH POTATOES

Dr. Maurice L. Vitosh
Department of Crop and Soil Sciences
Michigan State University

The following study was conducted in Section 9 of Fairplain Township, Montcalm County. The soil type at this location was classified as a Montcalm and McBride loamy sand. Soil samples taken prior to spring application of fertilizer showed the following values:

Soil pH	=	6.4	(Good)
Phosphorus (P)	=	416 lb/A	(Very high)
Potassium (K)	=	433 lb/A	(Very high)
Calcium (Ca)	=	998 lb/A	(Adequate)
Magnesium (Mg)	=	148 lb/A	(Low due to High K)

The soil test indicates an imbalance between K and Mg. According to MSU recommendations when the K to Mg ratio is greater than 3 to 1 Mg will be in short supply. Since the Mg level is above the critical level of 75 lbs Mg per acre, one solution is to allow the K level to decrease by avoiding K applications. The other solution is to supply a soluble source of Mg since lime is not needed.

The experiment was a split-plot design with P as the whole plot treatment and N rate, N time, K and Mg as the sub-plot treatments. The K and Mg treatments were broadcast just prior to planting and incorporated. One-half of the experiment received 60 lb P_2O_5 as a liquid fertilizer. The other half received only nitrogen. Planting time N was equal for all plots. Russet Burbank cut seed pieces were planted on May 16. Early sidedress N was applied on June 15 and late sidedress N on July 5th.

Potato petiole samples were taken on June 26, July 10, 24 and August 8 for nitrate analysis. The nitrate content of petioles is shown in Table 1. The first sampling was taken too early to reflect the nitrogen applications. Potassium applications had a depressing effect while magnesium significantly increased the nitrate content of potato petioles. These differences remained throughout the entire season. Early sidedress N resulted in higher nitrate contents on July 10 but not at the later sampling dates. It appears that nitrogen supply was very low on July 10 for the late sidedress N plots. Rates of N were not reflected in the petioles until the last two sample dates. On July 24, the 100 lb N rate was significantly different from the 200 and 300 lb rate and on August 7 the amount of nitrate in petioles was proportional to the rate of application.

Yield, size distribution and specific gravity of tubers are shown in Table 2. Total yield was not significantly affected by any of the treatments, however, there was a noticeable trend supporting the petiole nitrate content differences due to K and Mg. The application of 200 lbs of K_2O tended to decrease yield while 44 lbs of Mg tended to increase yields. The low N rate (100 lbs) resulted in significantly greater yield of A grade tubers (greater than two inches diameter minus those over ten ounces and off type) while the higher N rates significantly increased the number of off-type or knobby tubers. Specific gravity of tubers was significantly decreased by 200 lbs K_2O and increased by 44 lbs Mg.

In concluding, too much K and too little Mg seems to be the primary soil fertility problem discovered at this site. Although total yield was not significantly affected there was a tendency toward improved yield with Mg. The K-Mg relationship can not be fully evaluated here because Mg was evaluated only where 200 lb K_2O was applied. Magnesium without K was not one of the treatments.

A response to N above 100 lbs per acre was anticipated but not obtained. Some other factor was limiting the response. It is doubtful that Mg limited N response although this factor was not looked at using all combinations of treatments. Magnesium was only evaluated at the 300 lb rate of N. Further study is needed to see if there is a N by Mg interaction.

Although we did not obtain a significant response due to P at this location, there is still a need to evaluate P fertilization on soils testing high in P, particularily in light of the P responses obtained this season at the Montcalm Experimental Farm. Treatment 19 shown in Table 3 did give the highest yield in this experiment. One can only speculate as to what that yield might have been had we used more phosphorus or no potassium.

Table 1. Effect of fertilizer treatments and date of sampling on nitrate nitrogen content of potato petioles - Russet Burbank.

Fertilizer Treatments	Sample Date			
	6-26-79	7-10-79	7-24-79	8-7-79
-lb/A-				
100 N	19,332 a[1/]	21,603 a	16,345 a	8,546 a
200 N	19,505 a	22,640 a	20,684 b	16,822 b
300 N	18,630 a	21,762 a	19,258 b	18,699 c
Early sidedress	17,372 a	21,603 b	18,380 a	13,918 a
Late sidedress	18,057 a[2/]	14,662 a	17,643 a	14,293 a
0 P_2O_5	20,123 a	22,154 a	18,932 a	-
60 P_2O_5	20,250 a	22,178 a	19,374 a	-
0 K_2O	20,209 b	26,234 b	22,686 b	21,058 b
200 K_2O	17,278 a	21,762 a	19,320 a	17,950 a
0 Mg	17,353 a	21,762 a	18,380 a	13,918 a
44 Mg	20,958 b	26,096 b	20,259 a	15,855 b

1/ Means followed by the same letter are not significantly different (P=0.05) according to the least significant difference test.

2/ Late sidedress N was not applied until July 5.

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

Fertilizer Treatments	Total Yield	Jumbo Grade	A Grade	B Grade	Off Type	Specific Gravity
-lb/A-	- - - - - - - - - - - -	- - - -	cwt/A	- - - -	- - - - - - - - - - - -	-2/cc-
100 N	296 a [1/]	44 a	174 b	32 a	47 a	1.077 a
200 N	302 a	46 a	140 a	35 a	82 b	1.075 a
300 N	291 a	37 a	132 a	35 a	87 b	1.075 a
Early Sidedress	291 a	43 a	142 a	33 a	74 a	1.075 a
Late Sidedress	290 a	39 a	141 a	32 a	78 a	1.074 a
0 P_2O_5	293 a	44 a	141 a	33 a	74 a	1.076 a
60 P_2O_5	300 a	42 a	154 a	34 a	70 a	1.076 a
0 K_2O	294 a	51 a	136 a	32 a	76 a	1.078 b
200 K_2O	283 a	37 a	129 a	35 a	83 a	1.074 a
0 Mg	291 a	43 a	142 a	33 a	74 a	1.075 a
44 Mg	308 a	45 a	163 a	37 a	63 a	1.078 b

1/ Means followed by the same letter are not significantly different (P=0.05) according to the least significant difference test.

Table 3. Influence of nitrogen, phosphorus, potassium and magnesium on yield, size and specific gravity of Russet Burbanks.

Treatment No	Treatments N	P_2O_5	K_2O	Mg	Total Yield	Jumbo Grade	A Grade	B Grade	Off Type	Specific Gravity
	- - - - -lb/A			- - - - -		- - - - - - - -	cwt/A		- - - - - - - -	
10	300	0	0	0	300 a[1/]	44 a	135 ab	33 a	88 ab	1.078 b
3	300	0	200	0	285 a	39 a	118 a	32 a	96 b	1.074 a
9	300	0	200	44	311 a	45 a	146 b	43 a	77 a	1.077 b
20	300	60	0	0	288 a	58 a	136 a	31 a	63 a	1.078 b
13	300	60	200	0	280 a	34 a	139 ab	37 a	70 a	1.074 a
19	300	60	200	44	319 a	45 a	163 b	36 a	76 a	1.077 b

1/ Means followed by the same letter are not significantly different (P=0.05) according to the least significant difference test.

WEED CONTROL IN POTATOES

William Meggitt and Richard Chase
Department of Crop and Soil Science

Herbicide treatments for control of barnyard grass and annual broad-leaved weeds are shown in Table 1. The most effective control of barnyard grass was obtained from EPTAM or Vernam (same group as EPTAM) applied preplant incorporated. Sencor, Lexone, or Lorox applied as a delayed preemergence treatment (after weeds had emerged but before potatoes emerged) gave complete control of broadleaved weeds. Lasso or Dual applied pre-emergence (immediately after planting) gave excellent grass control. The grass control was reduced when the Lasso or Dual application was delayed 10 days and some grass has started to emerge. Appling Sencor or Lexone preemergence resulted in somewhat less control of broadleaved weeds.

Combining the Lasso or Dual and Sencor or Lexone or Lorox and appling preemergence or delayed preemergence did not result in effective control of both broadleaved weeds and grasses. Postemergence grass control is possible with new herbicides Hoelon and KK80 not yet registered.

Research results in summary show that an effective weed control program in potatoes for annual grasses and broadleaved weeds will require two herbicide application times; at the preplant incorporated or pre-emergence for annual grasses and delayed preemergence for broadleaved weeds.

The study on the effect of Basagran on potato varieties is shown in Table 2. Basagran is effective for control of nutsedge and certain broad-leaved weeds. There was marked differences in varietial responses to Basagran. Russet Burbank was severely injured and yields reduced by rates of 1 lb/A and by split applications of lower rates (rates necessary for weed control). Certain varieties; Atlantic, Jewel, Michimac showed little injury and no yield reduction. Onaway showed some visible foliage injury and Superior showed yield reductions. At the present time it is not feasible to pursue the registration and use of Basagran on potatoes because of the injury potential to certain important varieties.

TABLE 1: PREPLANT INCORPORATED, PREEMERGENCE AND POSTEMERGENCE WEED CONTROL IN POTATOES, MONTCALM COUNTY, MICHIGAN, 1979

Trt. No.	Treatment	Rate (lbs/A)	Weed Control Ratings*			Cwt/A		Specific Gravity
			BG	PW	LQ	A's	Total	
1.	Eptam (ppi)	4 1/2	9.3	7.0	8.3	280	329	1.079
2.	Eptam + Sencor/Lexone (ppi)	4 1/2 + 1/2	9.8	10.0	10.0	351	400	1.082
3.	Eptam (ppi) + Dupont 6573 (d. pre)	4 1/2 + 3/4	10.0	10.0	10.0	320	383	1.077
4.	Eptam (ppi) + Sencor/Lexone (d. pre)	3 + 1/2	9.7	10.0	10.0	331	407	1.076
5.	Eptam (ppi) + Sencor/Lexone (d. pre)	4 1/2 + 3/4	10.0	10.0	10.0	360	405	1.075
6.	Eptam (ppi) + Sencor/Lexone (d. pre)	3 + 1/2	9.9	9.9	10.0	335	407	1.079
7.	Vernam + Sencor/Lexone (ppi)	3 + 1/2	10.0	10.0	10.0	342	403	1.081
8.	Prowl + Sencor/Lexone (ppi)	1 + 1/2	9.3	9.0	9.3	299	352	1.080
9.	Eptam (ppi) + Lorox (d. pre)	3 + 3/4	10.0	10.0	10.0	337	417	1.079
10.	Lasso (pre) + Sencor/Lexone (d. pre)	2 + 1/2	9.0	10.0	10.0	350	416	1.079
11.	Lasso (pre) + Lorox (d. pre)	2 + 3/4	7.8	9.8	9.8	324	375	1.079
12.	Dual (pre) + Sencor/Lexone (d. pre)	2 + 1/2	9.3	9.7	9.7	306	382	1.077
13.	Dual (pre) + Lorox (d. pre)	2 + 3/4	9.8	10.0	9.9	340	393	1.080
14.	Antor (pre) + Sencor/Lexone (d. pre)	3 + 1/2	8.3	9.0	9.0	311	371	1.077
15.	Dual + Sencor/Lexone (pre)	2 + 1/2	8.3	9.3	9.0	346	406	1.080
16	MON 097 (pre) = Sencor/Lexone (d. pre)	1 1/2 + 1/2	9.2	10.0	9.7	335	393	1.080
17.	Surflan (pre) + Sencor/Lexone (d. pre)	1 + 1/2	7.0	9.3	9.3	306	381	1.078
18.	Sencor/Lexone (d. pre)	1/2	6.0	8.7	8.7	314	386	1.077
19.	Lasso + Sencor/Lexone (pre)	2 + 1/2	6.0	9.0	8.0	315	368	1.078
20.	Sencor/Lexone (d. pre) + Sencor/Lexone + Hoelon (post)	1/2 + 1/4 + 1	9.5	10.0	10.0	350	414	1.079
21.	Sencor/Lexone (d. pre) + KK 80 + X-77 (post)	1/2 + 1 + 1 pt.	9.5	9.7	9.8	355	403	1.078
22.	Lexone Dry Flow (d. pre)	1/2	9.0	10.0	10.0	331	388	1.078
23.	No Treatment	–	0.0	0.0	0.0	114	142	1.077

*Rating based on a 1-10 scale; 0 = no injury, 10 = complete kill

TABLE 2: POSTEMERGENCE INJURY STUDY IN POTATOES
MONTCALM COUNTY, MICHIGAN, 1979

Variety	Treatment	Rate (lbs/A)	Cwt/A A's	Cwt/A Total	Specific Gravity	Injury* Rating
R. Burbank	1. Basagran	1	290	343	1.079	4.3
	2. Basagran	2	259	327	1.079	5.3
	3. Basagran (Split)	(1)2	191	280	1.074	4.3
	4. Basagran + Oil Conc. (Split)	(3/4 + 1 qt)2	210	244	1.075	3.7
	5. Basagran + Oil Conc. (Split)	(1 + 1 qt)2	224	288	1.076	4.0
	6. No Treatment		307	359	1.076	0.0
Onaway	1. Basagran	1	329	340	1.067	3.3
	2. Basagran	2	309	322	1.064	4.7
	3. Basagran (Split)	(1)2	288	310	1.067	3.7
	4. Basagran + Oil Conc. (Split)	(3/4 + 1 qt)2	298	312	1.067	1.7
	5. Basagran + Oil Conc. (Split)	(1 + 1 qt)2	265	296	1.065	2.3
	6. No Treatment		336	349	1.066	0.0
Superior	1. Basagran	1	221	237	1.068	1.7
	2. Basagran	2	187	203	1.069	2.3
	3. Basagran (Split)	(1)2	193	203	1.065	1.7
	4. Basagran + Oil Conc. (Split)	(3/4 + 1 qt)2	226	235	1.070	0.3
	5. Basagran + Oil Conc. (Split)	(1 + 1 qt)2	234	242	1.069	0.3
	6. No Treatment		226	245	1.069	0.0
Michimac	1. Basagran	1	347	366	1.069	1.0
	2. Basagran	2	365	382	1.069	2.3
	3. Basagran (Split)	(1)2	349	367	1.069	0.7
	4. Basagran + Oil Conc. (Split)	(3/4 + 1 qt)2	365	378	1.070	1.0
	5. Basagran + Oil Conc. (Split)	(1 + 1 qt)2	348	363	1.071	1.3
	6. No Treatment		389	405	1.071	0.0
Jewel	1. Basagran	1	275	306	1.085	0.7
	2. Basagran	2	269	295	1.086	1.0
	3. Basagran (Split)	(1)2	370	387	1.086	0.7
	4. Basagran + Oil Conc. (Split)	(3/4 + 1 qt)2	338	356	1.087	0.3
	5. Basagran + Oil Conc. (Split)	(1 + 1 qt)2	300	327	1.084	1.0
	6. No Treatment		315	346	1.083	0.0
Atlantic	1. Basagran	1	385	400	1.089	3.3
	2. Basagran	2	329	343	1.090	4.0
	3. Basagran (Split)	(1)2	332	349	1.086	3.0
	4. Basagran + Oil Conc. (Split)	(3/4 + 1 qt)2	339	351	1.088	1.7
	5. Basagran + Oil Conc. (Split)	(1 + 1 qt)2	309	333	1.088	2.7
	6. No Treatment		348	359	1.085	0.0

* Rating based on a 1-10 scale; 0 = no injury, 10 = complete kill

IMPACT, BIOLOGY AND MONITORING OF INSECT AND NEMATODE PESTS OF POTATOES

E. Grafius, G. W. Bird, J. W. Noling, and M. A. Otto
Department of Entomology

Current strategies for control of insect and nematode pests of potatoes (primarily the use of chemical insecticides and nematicides) have proven to be very effective under a wide variety of conditions. However, the costs of these controls are high (an average of approximately \$75 - 100 per acre, or \$3-4 million to the Michigan potato industry = 7-9% of gross sales). The primary goal of these studies is to minimize the costs of insect and nematode control by determining the levels of damage that can be sustained without significant reductions in yield (economic thresholds).

In addition to studying the effects of specific pests on potato yield, it is understood that any environmental factor that reduces plant vigors (e.g. poor soil nutritional levels, poor soil moisture, or the presence of other pests) will act to increase the potato plant's susceptibility to damage. The economic threshold, then, will vary depending on these factors, as well as factors such as potato cultivar and the stage of plant growth at the time of damage.

A secondary objective of these studies is to gather information on life history and biology of the various pests and to determine the best methods for detection and sampling of these pest populations.

The studies were divided into two parts: 1) The impacts of Colorado potato beetle (CPB) foliar feeding and Pratylenchus penetrans (root lesion nematode) damage under various conditions, and 2) The impact of foliar feeding by cutworms and the potential for tuber damage.

CPB/Nematode Studies

Field Plots

Seedpieces (cv Superior) were planted on May 17, 1979 at the Montcalm Potato Research farm in Entrican, Michigan. Each plot consisted of four rows 50 ft (15.24 m) in length and 34 in (.86m) apart, with 8 to 12 in. (20.5-30.5m) spacings between plants. Plant growth and development was monitored at various intervals throughout the season. This was accomplished by randomly selecting two plants from the outside rows of each plot and returning them to the laboratory for analysis. In the laboratory, root weight, foliage weight and tuber weight and number were recorded at each sampling date. Soil and root populations of nematodes were estimated from samples taken at these times. Soil samples (centrifugation-floatation technique) for nematode analysis were taken by core sampling the two outside rows of each plot. Root samples (shaker technique) were derived from plants returned to the laboratory for plant growth analysis. At harvest, the center two rows of each plot were harvested, graded and weighed. During the season plants were maintained under commercial irrigation practices. Plants were sampled weekly (40 plants/wk) to determine CPB population densities and instar distributions. Plots were treated with two levels of NPK fertilizer (0 and 500 lb/acre, NPK 20-10-10) and a nematicide (1,3-D broadcast 20 gal/acre). Plots treated with 1,3-D were injected to a 6-8 in (15-20 cm) soil depth on April 1, 1979. Those plots to receive fertilizer were also sidedressed during hilling at an application rate of 145 lb/acre (45% urea) on June 22, 1979. Insect control programs were initiated at various times during the season to achieve three levels of plant defoliation (no defoliation, early-season defoliation and full-season defoliation). Within the no defoliation plots, foliar treatments were applied as needed for CPB control. An insect control program was not initiated until flowering within the early-season defoliation plots. No insecticides were applied season long within the full-season defoliation plots. A complete random block, two factorial design was used to analyze the data, with each treatment replicated five times.

Within the no defoliation plots, total yield increased with nematicide application and fertilizer (Table 1). Total yield was significantly increased within the no defoliation plots when compared to the unfertilized, fumigated full season defoliation plots (P = .05). Total yields were significantly increased in the no defoliation plots, with the exception of the no defoliation unfertilized treatments with no nematicide application (P = .05). Highest total yield of Grade A potatoes were observed in the no defoliation plots (Table 1). Yield of Grade A potatoes were significantly increased in the no defoliation plots, with the exception of the no defoliation, unfertilized treatments with no nematicide application (P = .05). Highest total yield of Grade B potatoes occurred in both the early and full season fertilized plots with no nematicide treatment (Table 1). Yield of Jumbo grade potatoes were significantly increased in the fumigated no defoliation plots (Table 1) (P = .05). Regardless of the treatment, yields of Jumbo grade potatoes increased with the application of fertilizer. No significant differences in the soil population densities of P. penetrans were observed among the plots except for the sample of August 6, 1979. Soil population densities of P. penetrans were significantly lower in the early season defoliation, fumigated plots without fertilizer compared to the unfertilized early season defoliation plots with no nematicide treatment (P = .05) (Table 2). There were no significant differences in either the root or total population densities of P. penetrans season long (P = .05) (Table 3 and Table 4, respectively).

Table 1

Influence of selected management inputs on the yield and grade of potatoes (cv Superior)

TREATMENT				YIELD (CTW/ACRE)			
Defoliation Level	Pre-plant Fumigation (Telone II)	Ferti-lizer	A Grade	B Grade	Jumbo Grade	Total
1. No defoliation	-	-	237.2bc[1]	7.1ab	6.6ab	250.9b
2. No defoliation	+	-	257.8c	5.5a	33.0c	296.3c
3. No defoliation	-	+	252.6c	8.9abc	16.8b	278.3c
4. No defoliation	+	+	258.4c	6.8ab	53.1c	318.3c
5. Early-season defoliation	-	-	183.4a	8.8abc	2.9a	195.1ab
6. Early-season defoliation	+	-	193.3ab	6.3ab	5.2ab	204.8ab
7. Early-season defoliation	-	+	194.7ab	10.2bc	2.9a	207.8ab
8. Early-season defoliation	+	+	184.8a	6.8ab	7.2ab	198.8ab
9. Full-season defoliation	-	-	187.0a	6.5ab	4.5ab	197.9ab
10. Full-season defoliation	+	-	176.0a	8.0abc	2.6a	186.7a
11. Full-season defoliation	-	+	201.9ab	10.9c	4.6ab	217.5ab
12. Full-season defoliation	+	+	197.9ab	7.4abc	8.9ab	214.2ab

[1] Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newman-Keuls Multiple Range Test.

Table 2

Influence cf selected management inputs on population density of P. penetrans on potatoes (cv Superior)

TREATMENT Defoliation Level	Pre-plant Fumigation (Telone II)	Fertilizer	P. penetrans per 100 cm^3 soil 6/12/79	8/06/79	9/11/79
1. No defoliation	-	-	20.4a[1]	80.6ab	178.4a
2. No defoliation	+	-	17.0a	24.0ab	157.0a
3. No defoliation	-	+	15.4a	26.8ab	115.2a
4. No defoliation	+	+	19.6a	18.8ab	73.4a
5. Early-season defoliation	-	-	25.8a	80.8b	149.8a
6. Early-season defoliation	+	-	28.8a	9.2a	97.2a
7. Early-season defoliation	-	+	20.8a	41.0ab	128.6a
8. Early-season defoliation	+	+	11.0a	15.2ab	65.8a
9. Full-season defoliation	-	-	28.6a	35.4ab	160.8a
10. Full-season defoliation	+	-	17.6a	21.4ab	94.6a
11. Full-season defoliation	-	+	18.2a	24.8ab	240.0a
12. Full-season defoliation	+	+	14.6a	18.2ab	78.0a

[1] Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newman-Keuls Multiple Range Test.

Table 3

Influence of selected management inputs on population density of P. penetrans on potatoes (cv Superior)

TREATMENT: Defoliation Level	Pre-plant Fumigation (Telone II)	Fertilizer	P. penetrans per gram root tissue: 6/12/79	8/06/79	9/11/79
1. No defoliation	-	-	104.6a[1]	147.0a	411.0a
2. No defoliation	+	-	82.8a	150.8a	386.0a
3. No defoliation	-	+	96.4a	189.2a	563.6a
4. No defoliation	+	+	50.2a	118.4a	288.0a
5. Early-season defoliation	-	-	96.0a	289.6a	573.2a
6. Early-season defoliation	+	-	85.4a	143.4a	490.6a
7. Early-season defoliation	-	+	98.4a	240.6a	325.8a
8. Early-season defoliation	+	+	54.0a	102.2a	207.4a
9. Full-season defoliation	-	-	89.6a	156.6a	407.2a
10. Full-season defoliation	+	-	73.2a	171.6a	300.6a
11. Full-season defoliation	-	+	85.0a	195.2a	447.8a
12. Full-season defoliation	+	+	49.6a	64.8a	284.8a

[1] Column followed by the same letter are not significantly different (P = 0.05) according to the Student-Newman-Keuls Multiple Range Test.

Table 4

Influence of selected management inputs on population density of *P. penetrans* on potatoes (cv Superior)

TREATMENT Defoliation Level	Pre-plant Fumigation (Telone II)	Ferti-lizer	*P. penetrans* per 100 cm^3 soil and per gram root tissue combined 6/12/79	8/06/79	9/11/79
1. No defoliation	-	-	125.0a[1]	223.4a	589.4a
2. No defoliation	+	-	99.8a	201.2a	543.0a
3. No defoliation	-	+	111.8a	238.6a	678.8a
4. No defoliation	+	+	69.8a	168.2a	361.4a
5. Early-season defoliation	-	-	149.8a	435.6a	723.0a
6. Early-season defoliation	+	-	145.8a	194.6a	587.8a
7. Early-season defoliation	-	+	176.2a	382.6a	454.4a
8. Early-season defoliation	+	+	76.0a	119.2a	273.2a
9. Full-season defoliation	-	-	143.4a	282.8a	568.0a
10. Full-season defoliation	+	-	114.6a	231.2a	395.2a
11. Full-season defoliation	-	+	133.6a	307.6a	687.8a
12. Full-season defoliation	+	+	76.0a	89.8a	362.8a

[1] Column followed by the same letter are not significantly different ($P = 0.05$) according to the Student-Newman-Keuls Multiple Range Test.

Cage Studies

Seedpieces (cv Superior) were planted on May 24, 1979 at the Montcalm Potato Research Farm in Entrican, Michigan. Each plot consisted of two rows 6 ft (1.83m) in length and 34 in (.86m) apart, with 8 to 12 in (20.5-30.5cm) spacings between plants. Twenty-seven insect cages, measuring 6 ft by 6 ft ($1.83m^3$), were erected over the plots after planting.

Cages selected at random were assigned 1 of 9 different treatments. A treatment consisted of 1 of 3 population levels of CPB and 1 of 3 population levels of P. penetrans. The population levels were achieved by stapling egg masses to the leaves of the newly emerged plants within the cages, allowed them to hatch and then manipulated the plant densities to either 0, 10 or 20 larvae per plant. The nematode population levels of P. penetrans were achieved by various techniques. The low initial population levels were achieved by pre-plant fumigation with Telone II (20 gal/acre) on May 1, 1979. The medium population levels represent natural field populations. The high population levels of P. penetrans were achieved by complementing the natural field populations with a liquid suspension of nematodes obtained from potato roots cultured in the laboratory. A 10 ML aliquot of the nematode suspension was applied at planting to these treatments and represents an approximate addition of 500 nematodes to the root rhizosphere of the germinating potato plant.

Plant growth and development was monitored at various intervals throughout the season. This was accomplished by randomly selecting a plant from one specific row of each plot and then returning them to the laboratory for analysis. In the laboratory, root weight, stem weight, leaf weight, leaf surface area, tuber weight and number were recorded at each sampling date. Soil and root populations of nematodes were estimated from samples taken at these times. Soil samples (centrifugation-flotation technique) for nematode analysis were taken by removing the soil adjacent to plant roots. Root samples (shaker technique) were derived from plants returned to the laboratory for plant growth analysis. At harvest, the remaining row within each plot was harvested, graded and weighed. During the season, plants were maintained under normal commercial irrigation and disease control practices. A completely randomized, 2 factorial design was used to analyze the data, with each treatment replicated three times.

Larval feeding, by the CPB, appears to directly influence the population dynamics of P. penetrans and the growth and development of the potato plant. The direct effect of the CPB feeding was a reduction in leaf weight which increased with increasing beetle density (Fig. 1). As larvae reduced the leaf dry weight there was a corresponding reduction in the plant root dry weight (lowest in the 20 beetle per plant treatments, Fig. 2). These changes are directly reflected in the reduced plant and tuber weights thru time for the beetle infested treatments (Fig. 3 and Fig. 4, respectively). Beetle feeding had no significant influence on soil population densities of P. penetrans season long (Fig. 5). The root population density of P. penetrans tended to be lower in the beetle infested treatments than in the beetle free treatments (Fig. 6). By reducing the leaf weight thru time, beetle feeding influences the size of the total root system and also the number of P. penetrans per gram of root tissue is affected. Both nematodes and beetles affect the final tuber yield, with the Colorado potato beetle having the most significant impact in terms of decreasing yields (Fig. 7). Total yield of potatoes decreased with increasing beetle density per plant and with increasing population level of P. penetrans.

Fig. 5

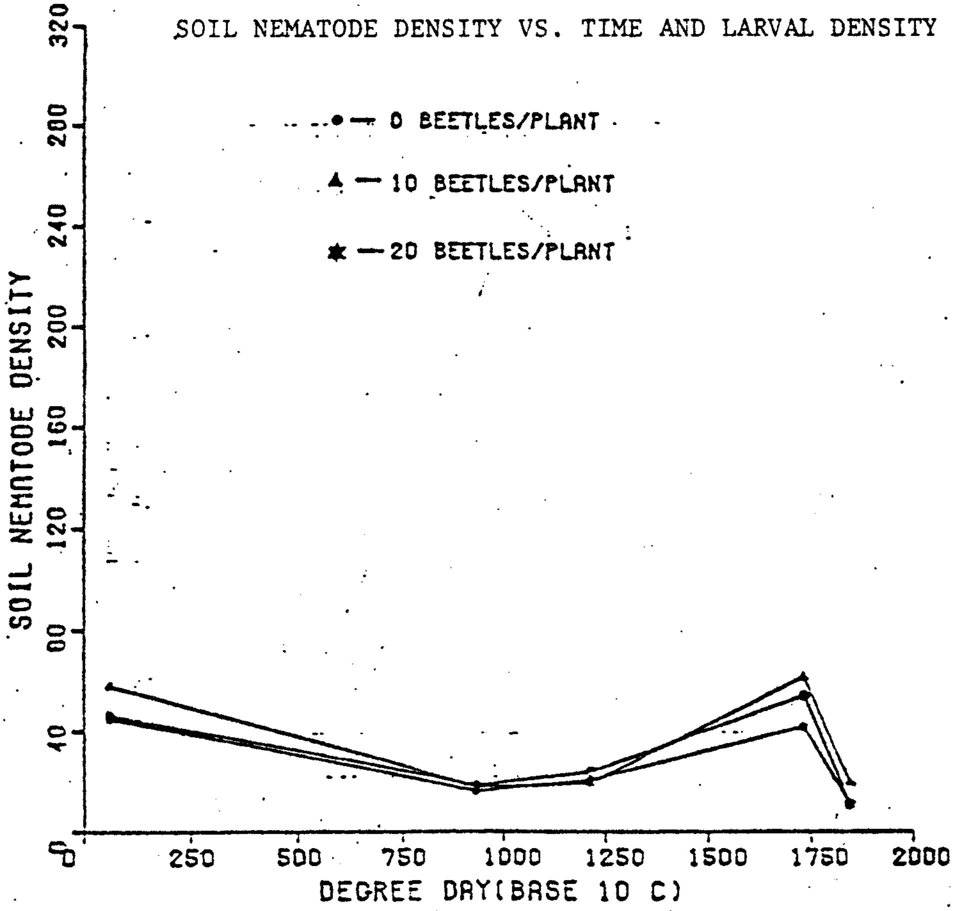
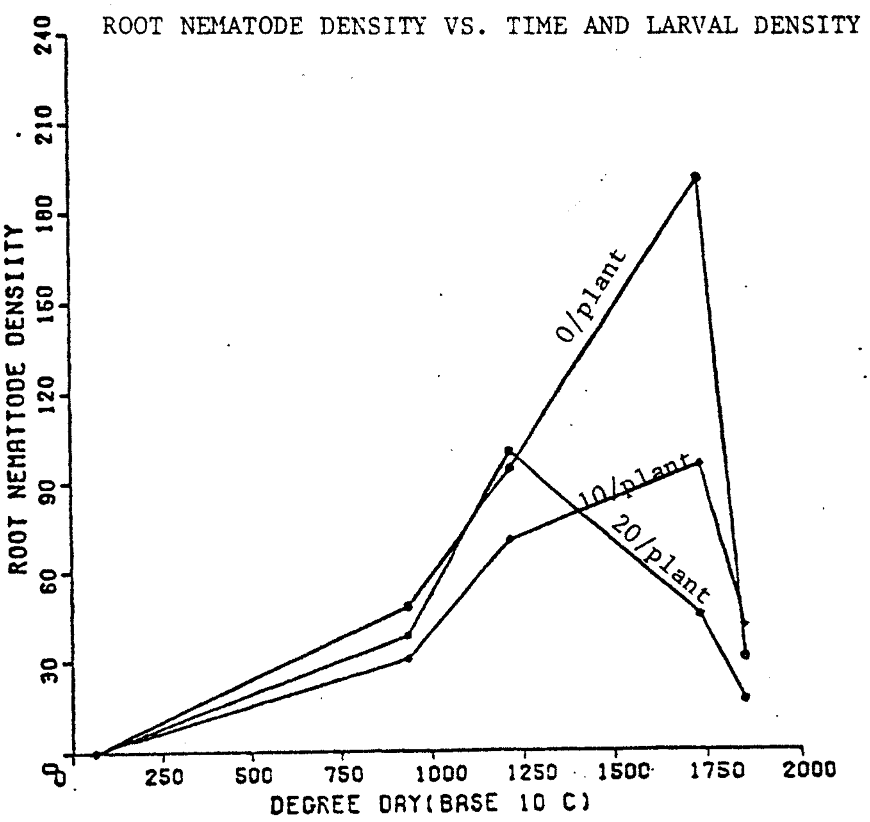

SOIL NEMATODE DENSITY VS. TIME AND LARVAL DENSITY
0 BEETLES/PLANT
10 BEETLES/PLANT
20 BEETLES/PLANT
SOIL NEMATODE DENSITY
0
40
80
120
160
200
240
280
320
0
250
500
750
1000
1250
1500
1750
2000
DEGREE DAY(BASE 10 C)

Fig. 6


ROOT NEMATODE DENSITY VS. TIME AND LARVAL DENSITY
0/plant
10/plant
20/plant
ROOT NEMATODE DENSITY
0
30
60
90
120
150
180
210
240
0
250
500
750
1000
1250
1500
1750
2000
DEGREE DAY(BASE 10 C)

CPB/Russet Burbank Yields

Another portion of the field plot was set up as a preliminary study of the impact of CPB foliar feeding on yield of Russet Burbanks and the effects that time of defoliation have on this impact. Plots were four rows by 25-50 ft (depending on treatment) and the middle two rows were harvested for yield data, as before. There was a mean of approximately 7 - 10 CPB adults and/or larvae per plant from July to mid-August.

The most severe damage occurred from June through mid-August (Fig. 8). Damage after mid-August (Temik treatment) caused no further yield reductions, in part due to reduced feeding pressure by CPB adults and larvae). Although Russet Burbank is a late season variety, the defoliation that had occurred by mid-August (nearly 100%) was too severe to allow recovery and the mean yield from plots treated with foliar insecticides late in the season was no different from the mean yield in plots left untreated.

As was the case in 1978, the most severe CPB feeding pressure occurred in early August from newly-emerged adults and the few remaining larvae. The 1979 results reinforce those of 1978, indicating that the timing of defoliation is critical in determining its impact on potato yield, particularly as this timing relates to the growth stage of the potato plant.

An additional benefit of the CPB studies was the identification of at least two species of predator on CPB larvae, one parasite, and a disease acting on larvae in the study area. These will be monitored more closely in the future with the possibility of using them as aids in control of CPB.

Cutworm Complex Studies

Our cutworm complex research has been proceeding in 3 areas to provide the necessary information for the formulation and implementation of management strategies. These areas include: 1) sampling or biological monitoring, 2) dynamic economic threshold determination, and 3) cultural practice manipulations to reduce tuber feeding.

Monitoring cutworm population levels is important since they are sporadic pests and it is not necessary to control them every year. We focused on variegated cutworms (VCW) when we began our research. However, 3 other species are commonly found as well. Darksided cutworms will cut stems early in the season. They usually are not a major problem unless large larvae attack newly-emerged plants. Black cutworms (BCW) are frequently found in southeast Michigan potato fields and sporadically in other areas starting in July. This second generation follows the one that damages corn and soy beans. BCW populations now appear to be more closely associated with the tuber feeding problem than are VCW populations and more work will be done on this in 1980. Spotted cutworms are also commonly found in potato fields in July and August. They are foliar feeders similar to VCW's but do not consume as much foliage and have not been implicated in the tuber feeding problem. Thus, they are not a serious concern at this time.

FIG. 7

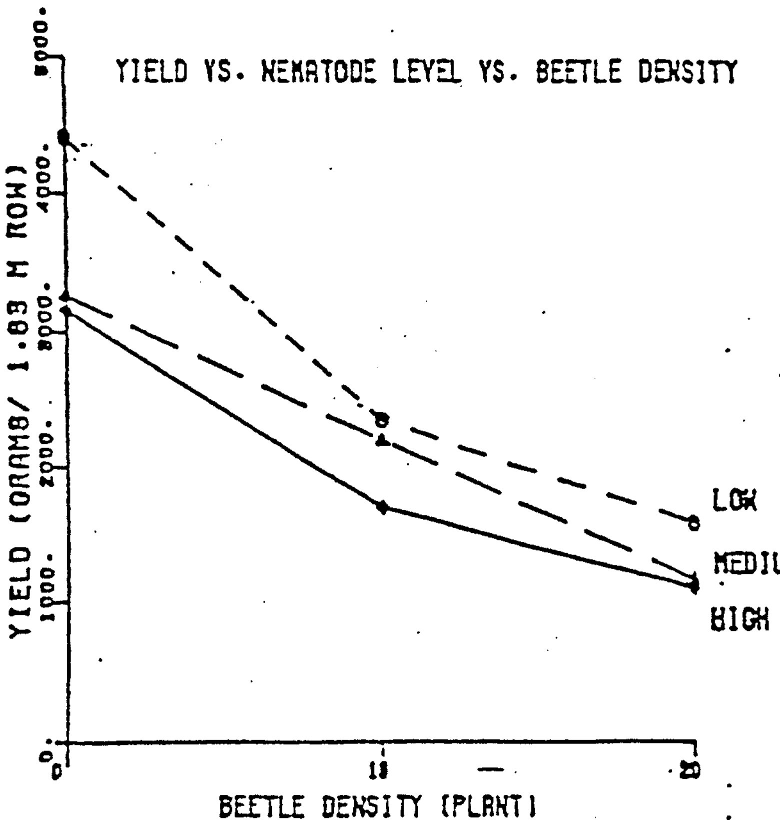
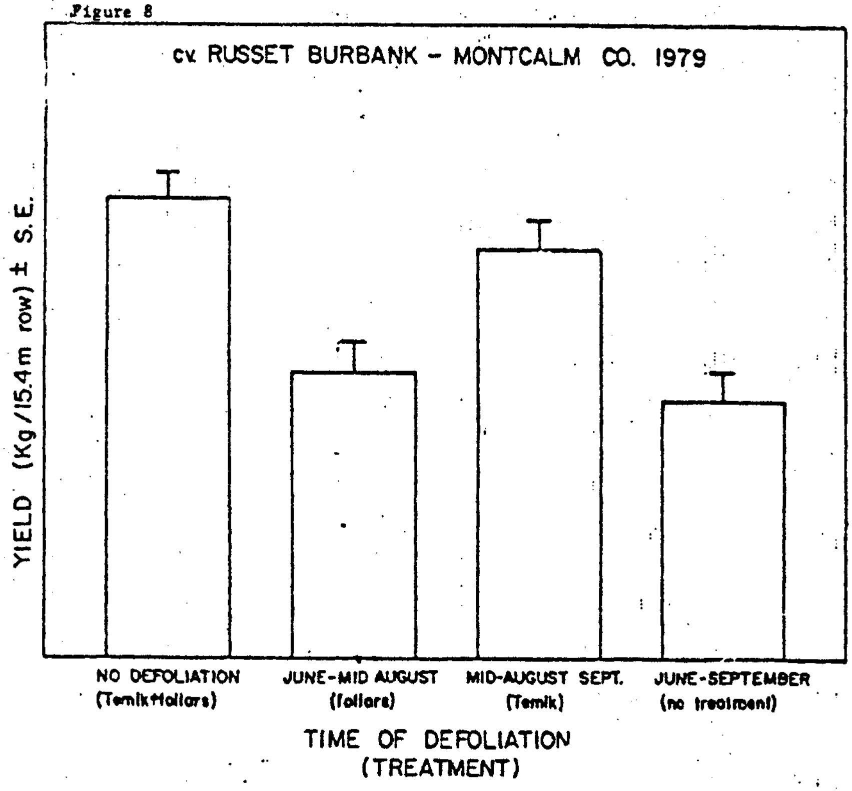


Figure 8



Cutworm sampling is difficult and time consuming. In order to more efficiently utilize larval sampling resources, a system of monitoring regional adult moth activity is being developed. Coupling this information with developmental information will allow us to concentrate sampling effort at appropriate times. Traditionally, black light traps have been used to monitor flight activity. However, it takes a lot of time and knowledge to sort and count trap catches. This minimizes the number of locations that can be observed. In 1979 VCW sex attractant traps were tested. Many more trap locations were used because of their specificity and ease of monitoring. Another advantage was illustrated at the farm in 1979. June beetles were abundant and destroyed many of the black light trap specimens in June and July. Sex attractant traps did not have that problem and were thus a better indicator of adult activity (Fig. 9). Information on the relative density of the VCW population would also be very useful. It might be possible to use this system within or at least between seasons to give a better picture of the relative density. An illustration of this potential is seen in data from the Hudsonville muck area. 1977 was an "outbreak" year for VCW's, the population crashed in 1978, and the population increased in 1979. These population trends did appear at least between seasons in black light trap information (Figure 10). Work will continue in this area in 1980.

Dynamic Economic Threshold Determination for VCW

After assessing population levels, it becomes necessary to make a decision on the appropriate management action. Many factors enter into this decision. Rarely will a simple economic threshold (e.g. 15 cutworms per plant or row foot) be entirely satisfactory. In 1979 the influence of several factors (e.g. VCW density, time of infestation, potato variety, time of planting and soil moisture) on yields and the amount of tuber feeding were investigated. VCW density and time of infestation were controlled in microplots planted with the variety Onaway, since most tuber feeding has been reported on early varieties. Aluminum flashing barriers were used to make the 9 x 12 foot microplots, which held 3 rows 34 inches apart with 7 or 8 plants 8 inches apart in each row. Microplots were artifically infested with either 0, 2, 6, or 18 lab reared second or third instar VCW larvae on 11 July. There were 6 replications of each density. A second release was made 3 weeks later, but only 3 or 4 replications of each density were possible due to natural infestations in several microplots.

There was virtually no tuber feeding even with the high VCW density or the late infestation time. The foliar feeding resulted in no statistically significant differences in specific gravity or yield at either the first or second releases (Figures 11 and 12). The reason for this lack of differences is that the 95% confidence intervals increase tremendously as the VCW density increases.

Unirrigated microplots showed significantly reduced yields compared to the irrigated ones, but again, there were no significant yield reductions due to different VCW densities and there was no tuber feeding. Apparently the reason for this is that there was higher mortality of the VCW's.

There was virtually no tuber feeding in the plots designed to assess the influence of variety, planting time, and depth of hilling on subsequent tuber feeding.

Figure 9

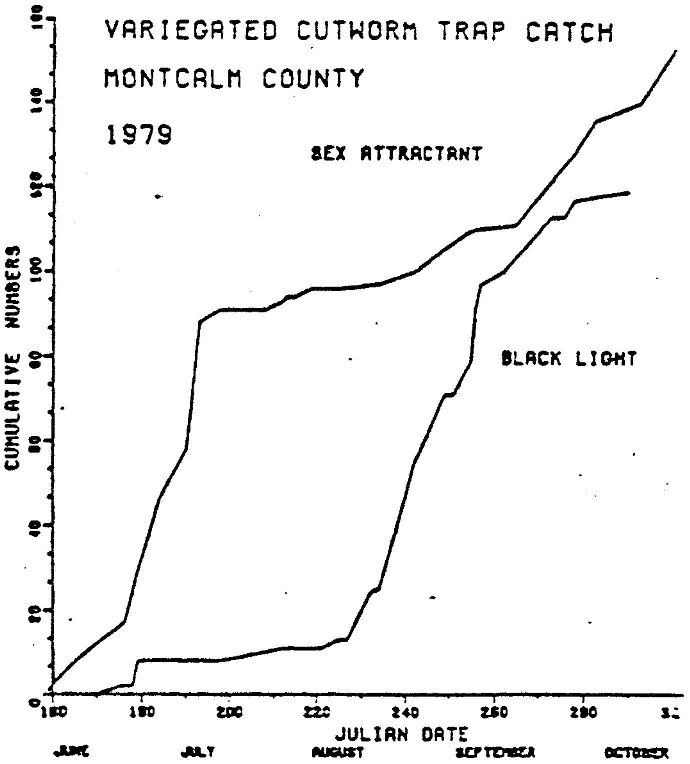


Figure 10

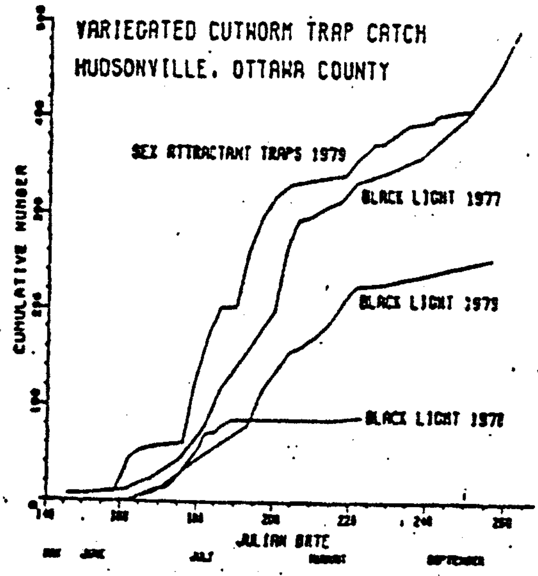


Figure 11

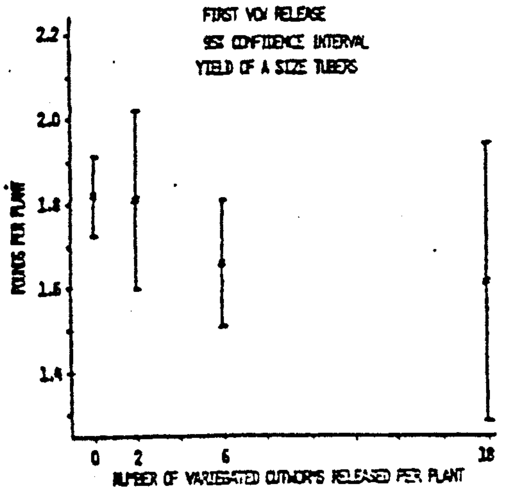
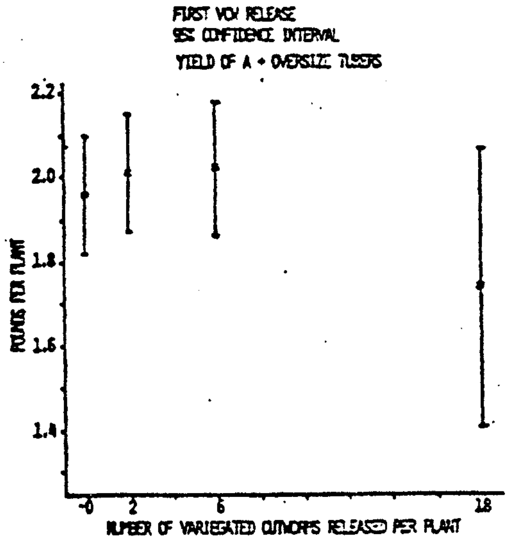


Figure 12



Conclusions

The results of the above studies indicate that the interactions between potato yield, defoliation, nematode damage, and environmental factors are extremely complexed. The cutworm problem is also difficult, particularly in detection and sampling. However, with increased understanding, we should soon be able to begin predictions of safe levels of infestation, where the cost of control greatly exceeds the benefits of preventing the slight crop losses that might occur.

EFFECT OF NEMATICIDES ON THE CONTROL OF PRATYLENCHUS PENETRANS AND POTATO YIELDS

G.W. Bird and J. Noling
Department of Entomology

One liquid and two granular nematicides were evaluated for control of Pratylenchus penetrans associated with Solanum tuberosum (cv Superior) production. A complete randomized block design was used with each treatment, replicated 5 times. Seed pieces were planted May 10, 1979 (degree days at base 10 C (DD_{10}) = 196) at the Móntcalm Potato Research Farm in Entrican, Michigan. Each plot consisted of four rows 15.24 m in length and 0.86 m apart, with 20.5-30.5 cm spacing between plants. All nematicides were applied at planting. Both Nemacur 15G and Nemacur 3S were, in addition to the single application treatment, also applied in a split application, receiving the second application at hilling (DD_{10} =790, June 25, 1979). Monitor was applied when necessary for insect control, and irrigation water as needed throughout the season. Soil samples for nematode analysis (centrifugation-floatation, 1.14 specific gravity sucrose) were taken immediately before planting, twice during the season (DD_{10} = 753, June 25, 1979; DD_{10} = 1810, August 21, 1979) and at harvest on September 21, 1979 (DD_{10} = 2285). Root samples were processed for nematodes (shaker technique) at DD_{10} = 753 and 1810. The center two rows of each plot were harvested, graded and weighed.

Temik 15G significantly ($P = 0.05$) increased total tuber yield and yield of Grade A and oversized tubers. There were no significant differences in soil population densities of P. penetrans among the plots at DD_{10} = 197 and 753. All treatments significantly reduced P. penetrans soil population densities at DD_{10} = 1810 and 2285. All treatments significantly reduced the root population densities of P. penetrans at DD_{10} = 753 and DD_{10} = 1810. The sum of the root and soil population densities indicated a significant population decrease for all treatments at DD_{10} = 753 and DD_{10} = 1810.

Table 1. Effect of nematicides on *Pratylenchus penetrans* and potato yields.

Treatment, formulation and rate per acre	*Pratylenchus penetrans* per DD_{10}[1]: No. per 100 cm^3 soil				No. per g root		No. per g root plus No. per 100 cm^3 soil		Tuber yield (ctw per acre)			
	196	753	1810	2285	753	1810	753	1810	A Grade	B Grade	Oversize Grade	Total
Check	30.0a[2]	38.0a	138.0b	135.0b	111.0b	530.0b	149.0b	668.0b	148.6a	8.8a	2.8a	160.2a
Temik 15G (3 lb a.i./Acre)	21.0a	25.0a	5.0a	8.0a	4.0a	8.0a	39.0b	13.0a	188.5b	7.7a	12.3b	208.5b
Nemacur 3S (3 lb a.i./Acre)	29.0a	34.0a	21.0a	50.0a	24.0a	46.0a	58.0a	66.0a	165.4a	6.8a	5.0a	177.2a
Nemacur 15G (3 lb a.i./Acre)	21.0a	31.0a	25.0a	47.0a	46.0a	102.0a	77.0a	135.0a	164.7a	9.2a	7.0a	180.9a
Nemacur 3S (3 lb + 3 lb a.i./Acre)	18.0a	22.0a	7.0a	14.0a	11.0a	66.0a	33.0a	73.0a	151.9a	10.2a	7.2a	169.3a
Nemacur 15G (3 lb + 3 lb a.i./Acre)	22.0a	36.0a	10.0a	30.0a	45.0a	77.0a	81.0a	87.0a	166.1a	9.4a	5.3a	180.8a

[1] DD_{10} = degree day accumulation base 10 C.

[2] Column means followed by the same letter are not significantly different (P = 0.05) according to the Student-Newman Keul Multiple Range Test.

EFFECT OF POTATO SEED PIECE TREATMENT ON STAND AND YIELD - 1979

H.S. Potter
Department of Botany and Plant Pathology

Potato seed piece treatment tests were conducted at the Montcalm Experimental Farm primarily to evaluate chemicals used by Michigan farmers to reduce seed piece decay. Certified Sebago seed was cut and treated before planting on May 12. Chemicals were applied to seed pieces by either dusting in paper bag or by dipping for 2 minutes and allowing them to dry. All seed was planted by hand within a few whours after treatment. Planting was done with the seed pieces 9 inches apart. Treatments were randomized and replicated three times in a single block planting. Plots consisted of a single row 50 feet long and 34 inches wide. Sprays were applied at regular intervals for control of disease and insects and irrigated when necessary to maintain a vigorous growth.

Cool weather delayed sprouting but once growth started the stand was good in most cases. A stand count was taken 4 weeks after planting and again 2 weeks later.

One of the most effective of the standard seed treatments tested was Captan-Streptomycin which was superior to captan by itself. A captan-Terraclor combination also resulted in a better stand and a higher yield than either captan or terraclor alone. Sodium hypochlorite had one of the best stands of any of the treatments and one of the highest yields. The Kalo experimental compounds KL 489, 490 and 491 all had a good stand and high yields. KL 489 was particularly outstanding. The Kocide 101 treatments with and without Firbark were phytotoxic. The 1 lb rate of application was a mistake, it whould have been only 4 oz per acre. The plain water dip reduced the stand and the yield below that of the dry check (no treatment).

1979 RESULTS: POTATO SEED TREATMENT TRIALS

TREATMENT	METHOD OF APPLICATION	% STAND[1]	YIELD CWT/A 1 US # 1	B GRAD
TERRACLOR 10D 1LB/CWT OF SEED	DUST	81.3 efghi	285.6 h	8.3
TERRACLOR 5D 1LB/CWT OF SEED	DUST	72.2 kl	258.6 i	3.7
TERRACLOR + TERRAZOL (SUPER X) 10D = 2 1/2D	DUST	85.9abcdefg	335.5abcdef	6.8
TERRACLOR 75W 1LB/10 GAL WATER	DIP	81.8 efghi	330.0 de	6.8
CAPTAN 10D 1LB/CWT OF SEED	DUST	79.3 fghijk	303.8 gh	7.7
CAPTAN + TBZ 10D + 1/2D 3/4 LB/CWT OF SEED	DUST	80.8 fghij	312.4 g	9.2
CAPTAN + TERRACLOR 10D + 10D 1LB/CWT OF SEED	DUST	89.6abcde	336.4abcdef	5.2
CAPTAN + STREPTOMYCIN 10D + 10D 1LB/CWT OF SEED	DUST	93.9ab	354.0ab	5.2
POLYRAM 10D 1LB/CWT OF SEED	DUST	80.8 fghij	328.7 def	4.9
DITHANE M-45 10D 1LB/CWT OF SEED	DUST	83.3 defgh	311.8 g	4.0
KL 489 (KALO) 5W 15 1/4 GR/2 GAL OF WATER	DIP	91.9abc	354.9a	6.8
KL 490 (KALO) 10W 15 1/4 GR/2GAL OF WATER	DIP	93.0ab	344.7abcd	6.2
KL 491 (KALO) 25W 15 1/4 GR/2GAL OF WATER	DIP	90.3abcd	342.6abcde	4.9
CHLORINE DIOXIDE (PENETRAAT CLO_2) 100PPM	DIP	87.9abcdef	325.6 def	4.6
SODIUM HYPOCHLORITE (CLOROX) 500PPM	DIP	93.9ab	353.4abc	6.8
KOCIDE 101 + FIRBARK 10D + 5D 1LB/CWT OF SEED	DUST	29.7 n	155.4 j	4.0
KOCIDE 101 20D 1LB/CWT OF SEED	DUST	36.4 n	120.6 k	4.6
WATER	DIP	67.2 lm	266.6 i	7.7
NO TREATMENT	--	75.8 jk	271.8 i	5.5
LSD .05		8.3	22.4	N.S.

SMALL LETTERS INDICATE TREATMENTS THAT DO NOT DIFFER SIGNIFICANTLY AT THE 5% LEVEL ACCORDING TO THE LSD TEST.

1979 FIELD TRIALS ON POTATOES TO COMPARE THE APPLICATIONS OF FUNGICIDES FOR DISEASE CONTROL BY SOLID SET IRRIGATION, BY BOOM SPRAYER AND BY AIRCRAFT

H.S. Potter
Department of Botany and Plant Pathology

Investigators: H. S. Potter, Department of Botany and Plant Pathology Michigan State University, East Lansing, Michigan 48824.

Cooperators: Allen Grigg, grower
James Crosby, Montcalm County, Extension Director

Location: Alen Grigg Farms, Lakeview, MI.

Variety: Russet Burbank

Diseases and Pathogens: Early Blight Alternaria solani
Late Blight Phytopnthora Infestans
Botrythis Blight Botrytis spp.
Soil type: Sandy loam, irrigated (Solid set system)

Planting Dates: May 18-23, 1979

Harvest Dates: September 27,- October 3, 1979

Experimental Design: Treatments applied by aerial, ground and irrigation methods were laid out in two adjacent fields in a randomized design. The ground and aerial treatments were replicated but irrigation treatments were not. Plots varied in size. Those treated by the irrigation method were 4.5 acres those treated with a boom sprayer were 3.5 acres and those treated by air were 10 acres.

Application Methods: (A) Irrigation - Solid set system with 31 inch risers spaced 40 feet apart in line and 60 ft. apart between lines. Sprinklers were Rainbird # 1400 with 1/8 in. nozzles. The operating pressure was 80 psi at pump and 65 psi (average) at the nozzle. The nozzle output was estimated to be 3.71 gals/min and the total volume of application 1450 gals/A. Fungicides at a 20x spray concentration were pumped into the irrigation system at 120 psi using a gasoline powered garden sprayer and a fertilizer injector with a 1/4 inch orifice. With this system it took approximately 20 minutes to treat 1.8 acres. A red dye was used to make this determination.

(B) Ground Sprayer: 10 row brush boom sprayer with flat fan nozzles. The operating pressure was 40 psi and the volume of application 20 gals/A.

(C) Aircraft: Biplane Ag-Cat Model A with a boom and 46 hollow cone nozzles oriented 45° backward. The operating pressure was 40 psi and the volume sprayed 5 gals/A.

Treatment: Fungicides (see Table) Sprays applied 5-7 days between July 7 and August 18, 1979; 8 applications
Insecticides - All plots received an in-furrow application of Temik 3 lb ai/A at planting. After midseason Thiodan 1 1/2 qts/A applied every 14 days with all fungicide treatments except Redomil applied by fungigation. Pirmore 8 oz/A applied in place of Thiodan.

Data Collection: Treatments were rated for foliage diseases, yield and tuber rot within subplots. Each subplot consisted of a transect 50 feet wide extending across the plot. There were 4 subplots in non replicated plots. Replicated polts had two subplots per replication.

Summary: The predominent disease on the foliage was early blight. All treatments except those containing only Ridamil controlled this disease. Of the fungigation treatments Du-ter, Bravo and Super Tin where the most effective. Super Tin was better than all other treatments for control of Botrytis Blight. It also had the highest yields of US #1 potatoes.

Late blight infection was very light and symptoms were not noticeable in the unsprayed control until the end of the season. There was also virtually no tuber rot except in a few of the ground sprayed treatments.

1979 RESULTS: APPLICATION OF FUNGICIDES FOR CONTROL OF POTATO DISEASES BY SOLID SET IRRIGATION, BY GROUND SPRAYER AND BY AIRCRAFT

TREATMENT	SPRAY SCHEDULE	METHOD OF APPLICATION	FOLIAR DISEASE INDEX[1,2] E. BLIGHT	L. BLIGHT	BOT. BLIGHT	AVERAGE YIELD CWT/A[2] US # 1	B GRADE	% [2,3] TUBER ROT
BRAVO 500 4F 2PT/A	7 DAYS	IRRIGATION	1.8a	0.1a	1.7 bc	368.5ab	81.2a	0.0a (trace)
DU-TER 47½W 8OZ/A	7 DAYS	IRRIGATION	1.7a	0.1a	1.3 b	338.0 bc	44.6 bc	0.4a
SUPER TIN 4L 9OZ/A	7 DAYS	IRRIGATION	2.2abc	0.1a	0.8a	398.4a	32.3 c	0.0a
MANEX 4F 4½ PT/A	7 DAYS	IRRIGATION	2.8 bcd	0.1a	2.5 de	375.4ab	81.4a	0.0a (trace)
RIDOMIL 2E 1/4 lb Ai/A	14 DAYS	IRRIGATION	6.6 f	0.0a	2.2 d	332.3 bc	30.2 c	0.3a
RIDOMIL 2E 3/16 LB AI/A	14 DAYS	AIR	4.7 e	0.0a	2.8 e	362.1ab	97.3a	0.1a
RIDOMIL 2E 3/16 LB AI/A	14 DAYS	GROUND	4.2 e	0.1a	2.2 d	294.7 cd	54.1 bc	2.4 b
RIDOMIL 2E + DITHANE M-45 80W 1/10 LB AI + 1 LB/A	7 DAYS	GROUND	2.7 bcd	0.1a	2.7 e	300.1 cd	45.8 bc	1.8ab
DITHANE M-45 80W 2LB/A	7 DAYS	AIR	2.0ab	0.1a	2.0 c	386.1ab	34.5 c	0.0a (trace)
DITHANE M-45 80W 2LB/A	7 DAYS	GROUND	2.2abc	0.5a	2.5 de	360.6ab	77.1ab	2.8 b
NO TREATMENT	--	--	6.8 f	2.7 b	3.7 f	251.7 d	78.8a	5.8 c
LSD .05			.6	1.2	.4	56.6	32.5	2.3

[1] DISEASE INDEX 0= NO INFECTION - 10=100% INFECTION

[2] SMALL LETTERS INDICATE TREATMENTS THAT DO NOT DIFFER SIGNIFICANTLY AT THE 5% LEVEL ACCORDING TO THE LSD

1979 FIELD TRIALS ON POTATOES COMPARING APPLICATION OF FUNGICIDES BY CENTER PIVOT IRRIGATION AND BY AIRCRAFT

H.S. Potter
Department of Botany and Plant Pathology

Investigator: H. S. Potter, Department of Botany and Plant Pathology Michigan State University, East Lansing, MI 48824

Cooperators: Allen Anderson, grower
James Crosby, Montcalm County Extension Director

Location: Allen Anderson Farm, Blanchard, MI

Variety: Monona

Disease and Pathogens: Early Blight - Alternaria solani
Botrytis Blight - Botrytis spp.

Soil Type: Sandy loam, irrigated (center pivot system)

Planting Dates: May 23-27, 1979

Harvest Dates: October 3-5, 1979

Experimental Design: An irrigated circle covering approximately 132 acres. In one half of the circle fungicides were applied thru the irrigation system and in the other half by aircraft. Treatments applied by the irrigation method (Fungigation) were randomized and replicated twice. The aerial treatments were randomized but not replicated. Fungigation plots were 8 1/4 acres and those sprayed by air were 10 acres.

Application Methods: (A) Irrigation Equipment - Gifford Hill electrically driven center pivot systems model # 360 with a 1300 ft. boom. The unit was designed to irrigate 132 acres and was regulated to cover 8 1/4 acres per hour. The operating pressure was 70 psi and the volume output 850 gals per minute.

Fungicides as concentrate suspensions (12X) were injected into the system at the rate of 70 gals/hr using two double piston proportioning pumps (Inject - 0 - Meter; Duplex Electric Model # 69-1). Treatments were applied with .22 acre inches of water.

(B) Aircraft - Biplane, Gruman Ag-Cat Model A with boom and 46 hollow cone nozzles (D 12-45) oriented 45^{o} backward. Treatments were applied at 40 psi in 5 gals of water per acre.

Treatments: (A) Fungicides (see Table) were applied on a 5 to 7 day schedule (based on Potato Late Blight Forcast Recommendations) starting July 2, 1979 and ending September 18, 1979.

(B) Insecticides - Temik applied in furrow at planting 3 lb ai/A and one foliar spray each of Thiodan 1 1/2 qts/A and Monitor 1 qt/A applied overall by air.

Data Collection: Foliage disease index ratings, yield and incidence of tuber rot were taken within 50' X 50' subplot. There were four of these subplots for each of the unreplicated aerial treatments and two in each replications of the fungigation treatments.

Results: See table.

Summary: All treatments whether applied by air or by the irrigation method significantly reduce disease infections.

Dithane M-45, Du-ter and Difolatan thru the irrigation system appeared to give the best control of early blight. These treatments also had the highest yeilds of US #1 potatoes. Bravo 500 had the least amount of Botrytis infection.

1979 RESULTS: APPLICATION OF FUNGICIDES FOR CONTROL OF POTATO DISEASES
BY CENTER PIVOT IRRIGATION AND BY AIRCRAFT

TREATMENTS	METHOD OF APPLICATION	FOLIAGE DISEASE INDEX [1,2] EARLY BLIGHT	BOTRYTIS BLIGHT	AVERAGE YIELD CWT/A2 US # 1	B GRADE	%[2,3] TUBER ROT
DIFOLATAN 4F 3PT/A	AIR	2.1 c	3.4 d	341.6 c	62.8 bc	1.1a
DIFOLATAN 4F 3PT/A	IRRIGATION	1.7abc	2.0 bc	376.4a	62.1 bc	.6a
DUTER 10 OZ/A	AIR	1.8 bc	3.1 d	366.8 b	79.2 b	.7a
DUTER 10 OZ/A	IRRIGATION	1.4a	1.6ab	384.6a	75.3 bc	.7a
DITHANE M-45 80W 2 LB/A	IRRIGATION	1.2a	2.1 bc	390.8a	69.6 bc	.3a
BRAVO 500 4F 2PT/A	IRRIGATION	2.1 bc	1.2a	365.5 b	56.2 c	.4a
NO TREATMENT	--	5.5 d	3.8 e	309.2 d	101.6a	2.4 b
LSD .05		.5	.5	20.4	21.2	.9

1 DISEASE INDEX 0=NO INFECTION - 10=100% INFECTION

2 SMALL LETTERS INDICATE TREATMENTS THAT DO NOT DIFFER SIGNIFICANTLY AT THE 5% LEVEL ACCORDING TO THE LSD TEST

3 BACTERIAL SOFT ROT, FUNGAL ROTS INCLUDING LATE BLIGHT.

POTATO INSECT CONTROL STUDIES

A. L. Wells
Department of Entomology

A. Soil Insecticide Evaluation Studies

A plot to evaluate 22 different treatments including combinations of experimental and registered insecticides on soil insects was conducted. At the Comden Farm adjacent to the Montcalm Experimental Farm in Montcalm County. The plot was located in a field which has been out of production several years and had become established with weeds and grasses. An early inspection of the area indicated soil insects, especially wireworms were prevalent.

The treatments were applied in six replications of paired 25 foot rows in a randomized black design. The outside and every third plot was left untreated so the insect damage in each treated plot could be compared with an adjacent untreated plot. This plot layout was selected to assume adequate evaluation of the data since past research indicated that soil insect populations are seldom evenly distributed over an area. Eight foot alleys were left untreated between the ends of the replicated plots.

The broadcast applications were distributed as granules or in sprays at forty gallons of water to the soil surface and incorporated immediatly with a double disc to a depth of 6-8 inches. The treatments were made on May 14 and they were planted the following day. The potatoes were planted with a two row planter leaving the seed furrow open for application of the band or in furrow treatments after which they were covered with a disc and weeder attachment on a tractor. The NC-6897 seed treatment was applied directly to the cut seed and planted by hand prior to covering. Wisconsin 718, a round white variety of potato, was used as cut seed in the study. Recommended fertilizer, herbicide and fungicide programs were followed during the study.

The potato plants in the eight foot alleys between the ends of plots were pulled by hand during mid season so the untreated potato plants and tubes would not interfere with the sampling of the treated plots. A vine killer was applied prior to harvest to facilitate the use of the plot mechanical harvester. The plots were harvested on October 2nd. and 3rd. and placed in bags which were then labeled and taken to the research building at the Montcalm Research Farm. The B size tubers (up to 1 7/8" diam.) were sorted with the plot harvester and kept separate in the labeled bags.

To determine the effects of the soil treatments on the potato yields and quality the tubers were sorted by size (i.e. B's = up to 1 7/8", A's = 1 7/8 to 3 1/4" and over 3 ;/4) and according to insect damage (1- no wireworm scars, 2 - minor surface feeding only, 3 - extensive damage, grub and cutworm damage. The tubers in each of the size and damage rating classes were counted and weighed for adequate analysis of the data. Samples of tubers from three replications of the treated plots were saved to determine their specific gravity. The plot data are presented in Table 1.

Results

Although the primary objective of the study was to obtain control data for white grub infestations the populations were too low to show differences between any of the treatments. The populations of wireworms appeared to be evenly distributed over the study area since the damage rating to the tubers was consistent in all of the untreated plots. The seed treatment and all of the broadcast soil treatmentswith the exception of the Diazinon treatment reduced the wireworm damage to the tubers when compared with the adjacent untreated plots. All of the treated plots produced more tubers than the adjacent untreated plots which indicate early season protection of the plant is essential for a higher potential yield.

The combination treatments of Temik or Furadan with any of the broadcast applications provided better wireworm protection than any of the treatments alone. The use of the systemics also provided higher yields and better size than did the other non-systemic plots. If a full foliar program had been applied this difference would probably not have been as great.

B. Foliar Insecticide Evaluation

Fourteen soil systemic and foliar insecticides including both registered and experimental compounds were evaluated on potatoes in 1979. The treated plots consisted of paired 25 foot rows randomized in three replications using Russet Burbank seed. The rows were left open during the planting operation so the band applications of the systemics could be made prior to covering. A second application of granules was sidedressed to the Sisyston plot at the time of hilling. Recommended fertilizer, herbicide and fungicide programs were followed during the study.

Foliar applications were started on June 26 and re-applied on July 12 and August 22. A CO_2 sprayer delivering 50 gallons per acre was used to apply the foliar insecticides. The foliar insect populations were samples with an insect net on July 12, 25, August 1 and 22 at which time the plots were rated for vigor and insect damage. The data are presented in Table 2. Vine killers were applied in September and the plots were harvested on October 1. The yields, size grades and specific gravity of the tubers are given in Table 3.

Results

The foliar insect populations on the plots were very low during the study except for the Colorado potato beetle. If the plots could have been treated more often during late July and early August the data would have shown more differences between the treatments. The plot ratings in late August indicate that the systemics and certain foliar applications protected the plots more than others. These plot ratings weren't reflected in the yields, however, indicating the plants had matured earlier in some plots. The Temik treatment provided the highest yield in the study, indicating additional nematode protection to the plants.

Table 1. Yields and insect tuber damage data from soil insect research plot, Montcalm County, 1979. Planted: May 15; Harvested: October 2 and 3, 1979.

Material and Placement		Rate ai/A	Yield/A	Percent tubers by Grade Size			Spec.	Total	Damage Rating (per cent by weight)			
				B,s	A's	Over	Grav.	tubers	1	2	3	Grub,et al
NC-6897 76W	Seed Trt	4 oz ai/ 100 lb	317 cwt	4%	79%	17%	1.069	2064	70%	14%	16%	0.2%
Untreated	--	--	245	2	79	19	--	1508	36	26	37	0.2
NC-6897 76W	Brdcst	4 lb	333	4	71	25	1.070	1905	73	11	16	0.5
Untreated	--	--	255	3	69	28	--	1395	40	14	45	0.4
NC-6897 76W	Brdcst	4 lb										
+ Temik 15G	Band	3 lb	386	2	64	34	1.071	2031	79	10	11	0.1
Untreated	--	--	249	3	75	22	--	1462	55	14	31	0.2
NC-6897 76W	Brdcst	4 lb										
+ Furadan 10G	Band	3 lb	387	3	64	33	1.070	2048	85	8	7	0.1
Untreated	--	--	245	3	69	28	--	1331	33	17	50	0.2
Mocap 6EC	Brdcst	3 lb	269	5	77	18	1.068	1687	80	9	11	0.3
Untreated	--	--	273	4	70	26	--	1428	48	12	40	0.2
Mocap 6EC	Brdcst	3 lb										
+ Temik 15G	Band	3 lb	368	2	65	33	1.072	1893	90	6	4	0.2
Untreated	--	--	269	3	68	29	--	1481	44	10	45	1.0
Dyfonate 10G	Brdcst	4 lb	272	4	77	19	1.067	1719	77	9	14	0.1
Untreated	--	--	270	3	75	22	--	1504	53	12	34	1.0
Dyfonate 10G	Brdcst	4 lb										
+ Temik 15G	Band	3 lb	375	3	68	29	1.071	2056	86	7	7	0.2
Untreated	--	--	258	3	69	28	--	1451	45	16	39	0.4
Dyfonate 4E	Brdcst	4 lb	255	4	81	15	1.065	1658	66	13	21	0.2
Untreated	--	--	245	5	74	21	--	1433	57	14	29	0.6
Dyfonate 4E	Brdcst	4 lb										
+ Temik 15G	Band	3 lb	379	4	66	30	1.072	2103	85	6	9	0.3
Untreated	--	--	268	3	73	24	--	1576	46	15	39	0.3

contd.

Table 1, contd.

Material and Placement		Rate ai/A	Yield/A	Percent tubers by Grade Size B's	A's	Over	Spec. Grav.	Total tubers	Damage Rating (percent by weight) 1	2	3	Grub,et al
Dyfonate 4E	Brdcst	4 lb										
+ Furadan 10G	Band	3 lb	362 cwt	4%	69%	27%	1.071	2026	87%	6%	7%	0.1%
Untreated	--	--	257	3	75	22	--	1553	36	20	43	0.6
Dasanit 15G	Brdcst	5 lb	329	3	68	29	1.069	1815	65	16	19	0.03
Untreated	--	--	278	3	78	19	--	1612	34	18	48	0.4
Dasanit 15G	Brdcst	5 lb										
+ Temik 15G	Band	3 lb	387	3	64	33	1.073	2050	77	11	12	0.2
Untreated	--	--	279	3	66	31	--	1521	43	12	44	0.9
Diazinon 4E	Brdcst	4 lb	259	5	72	23	1.068	1674	60	17	23	0.2
Untreated	--	--	219	4	74	22	--	1302	58	9	32	0.6
Diazinon 4E	Brdcst	4 lb										
+ Temik 15G	Band	3 lb	394	2	63	35	1.070	2052	72	12	16	0.1
Untreated	--	--	264	3	73	24	--	1526	44	16	39	0.7
Diazinon 4E	Brdcst	4 lb										
+ Furadan 10G	Band	3 lb	367	2	63	35	1.070	1918	78	10	12	0.2
Untreated	--	--	292	2	70	28	--	1597	31	15	53	0.5
Lorsban 4E	Brdcst	4 lb	293	4	73	23	1.067	1778	66	14	20	0.0
Untreated	--	--	263	3	68	29	--	1400	37	13	49	1.3
Lorsban 4E	Brdcst	4 lb										
+ Temik 15G	Band	3 lb	396	4	63	33	1.070	2147	78	11	11	0.3
Untreated	--	--	270	3	71	26	--	1510	44	10	45	0.9
Temik 15G	Band	3 lb	381	3	60	37	1.069	1512	63	13	24	0.1
Untreated	--	--	244	4	72	24	--	1426	45	15	40	0.7
Furadan 10G	Band	3 lb	340	3	68	29	1.069	1847	69	13	18	0.1
Untreated	--	--	244	3	67	30	--	1283	32	17	51	0.3
Control	--	--	292	3	70	27	1.060	1599	45	17	38	0.2
Untreated	--	--	258	3	72	25	--	1471	48	15	37	0.4

contd.

Table 1, contd.

Material and Placement		Rate ai/A	Yield/A	Percent tubers by Grade Size B's	A's	Over	Spec. Grav.	Total tubers	Damage Rating (percent by weight) 1	2	3	Grub, et al
Control	--	--	269 cwt	3%	68%	29%	1.068	1479	36%	11%	52%	0.5%
Untreated	--	--	249	3	71	25	--	1446	40	15	45	0.2

[1]Grade sizes: B - to 1 7/8 in.; A - 1 7/8 to 3 1/4 in.; Over - over 3 1/4 in.

[2]Insect Damage Rating: 1 - No wireworm scars; 2 - Minor surface feeding; 3 - Extensive damage; Other - Grub, cutworm, etc.

Table 2. Foliar Insects Sampled form Insecticide Evaluation Study.

Total Insects Collected[2]

Treatment[1]	Potato leafhopper	Aster leafhopper	Spittle bugs	Flea beetles	Tarnished Plant bug	Aphids	Col. Potato Beetle (Adult)	Col. Potato Beetle (Larvae)	Predators Parasites	Plot Rating[3]
NC-6897 0.5 lb	27	9	2	3	15	56	22	23	13	3.0
NC-6897 1.0 lb	20	10	2	4	13	26	3	3	11	3.7
Vydate 1.0 lb	23	4	3	1	11	44	44	1	8	2.0
Vyd + Lan	21	7	2	3	19	21	22	5	17	2.0
Pounce 0.1 lb	28	9	4	3	16	13	42	114	8	3.3
Pounce 0.2 lb	25	5	5	2	15	7	57	26	10	3.3
Ambush 0.2 lb	35	7	4	1	7	13	35	62	11	3.3
Pydrin 0.2 lb	16	5	3	3	8	7	20	5	4	3.0
BFN 4886 1.0 lb	67	16	7	5	13	21	38	83	10	4.0
Monitor 0.75 lb	27	6	8	1	17	11	49	71	11	4.0
Thiodan 1.0 lb	40	9	3	11	9	23	45	54	8	3.7
Temik 3.0 lb	8	2	2	2	7	5	4	1	12	1.6
Furadan 3.0 lb	9	13	1	1	14	40	2	3	14	2.7
Disyston 3+3 lb	19	6	3	0	17	8	42	27	7	3.0
Untreated	21	10	3	0	17	40	70	137	14	4.0
Untreated	28	7	6	2	12	32	101	123	11	4.3

[1] Refer to Table 3 for Formulations and rates

[2] Total of 30 sweeps (10 sweeps per replication) on July 12, 25, Aug. 1 and 22

[3] Plot ratings made on Aug. 28 for Plant vigor and Maturity: 1 - Vigorous growth to 5 - Most of plants dead or drying down.

Table 3. Yield data and Specific Gravity from Foliar Evaluation Study

Material and Formulation	Rate/A (Tox)	Yield/A	Percent by Grade Size: B's	A's	10 oz	Off-type	Spec. Grav.
Fison NC-6897	o.5 lb	340 cwt	5%	80%	9%	6%	1.076
Fison NC-6897	1.0 lb	328	7	80	4	9	1.075
Vydate 2L	1.0 lb	342	5	73	5	17	1.076
Vydate 2L +Lannate 1.8L	0.5 lb 0.5 lb	367	5	78	6	11	1.078
Pounce 3.2EC	3.2 lb	318	7	82	2	9	1.072
Pounce 3.2EC	0.2 lb	321	6	76	4	14	1.076
Ambush 2EC	0.2 lb	321	8	77	5	10	1.075
Pydrin 2.4EC	0.2 lb	333	5	80	4	11	1.075
Boots BFN 4886 25W	1.0 lb	292	9	76	4	11	1.075
Monitor 4WDL	0.75	303	7	73	7	13	1.074
Thiodan 3EC	1.0 lb	332	6	79	7	8	1.076
Temik 15G	3.0 lb	405	4	71	8	17	1.077
Furadan 10G	3.0 lb	351	4	69	11	16	1.075
Disyston 15G 3.0 +	3.0 lb	332	5	73	7	15	1.075
Untreated	--	321	5	78	6	11	1.076
Untreated	--	282	8	82	1	9	1.075

CONTROL OF THE ROOT-LESION NEMATODE (PRATYLENCHUS PENETRANS) ASSOCIATED WITH NAVY BEANS

G.W. Bird and A.P. Elliott
Department of Entomology

Seven nematicides were evaluated. Each treatment was replicated 5 times in a randomized block design on a sandy clay loam soil at the Michigan State University Montcalm Experimental Farm in Entrican. Each plot consisted of 4 rows 6.1m in length and 0.9m apart. All nematicides were applied in 0.2m bands at the time of planting on June 5, 1979 (accumulated degree days at base 50 F (DD_{50} = 372). The foliar Vydate spray was applied 3 weeks after planting (DD_{50} = 705). Soil and root samples for nematode analysis were taken at 6 intervals during the growing season. The centrifugal-flotation and shaker techniques were used to determine poulation densities of P. penetrans in soil and root samples, respectively. The two center rows of each plot were harvested on September 21, 1979 (DD_{50} = 2196), and the weight of bean seeds from each plot was recorded.

There were no significant differences (P = 0.05) in soil population densities among plots at the time of planting (DD_{50} = 372). Soil population densities of P. penetrans were significantly reduced (P = 0.05) throughout the season by all nematicide treatments. Root population densities were significantly reduced (P = 0.05) by Vydate L at 1.0 lb a.i. per acre plus 1.0 lb a.i. foliar spray, and by all rates of Temik 15G except the lowest rate (0.5 lb a.i. per acre). Dry bean yields were significantly increased (P = 0.05) by treatments of Vydate at 1.0 lb a.i. plus 1.0 lb a.i. foliar spray per acre and Temik 15 G at 1.0, 1.5 and 2.0 lb a.i. per acre respectively.

Effect of Nematicide Treatments on *Pratylenchus penetrans* and Yield of Dry Beans

Treatment, Formulation and Rate Per Acre	Yield (cwt/A)	*Pratylenchus Penetrans* at DD_{50}*												
		No./100cm^3 soil							No./g root tissue					
		372	873	1144	1568	1737	2110	2196	873	1144	1568	1737	2110	2196
Check.	13.91a**	117a	41b	56b	48b	125b	72b	250b	145c	200b	48c	328b	103b	25b
Vydate L 1.0 lb a.i./ A.	16.76ab	89a	15a	12a	12a	20a	17a	85a	16a	76a	6ab	17a	9a	4a
Vydate L 1.0 lb a.i./A plus 1.0 lb a.i./A foliar spray.	22.21bcd	98a	20a	7a	10a	34a	13a	80a	17a	12a	6ab	12a	16a	4a
Terr-o-cide 54-45 1.0 gal./A	16.52ab	132a	18a	14a	13a	20a	16a	54a	72b	120ab	24ab	4a	8a	11ab
Temik 15G 0.5 lb a.i./A.	19.14abc	121a	35b	17a	33ab	24a	19a	122a	41a	104ab	37bc	45a	20a	14ab
Temik 15G 1.0 lb a.i./A.	21.29bcd	116a	12a	11a	20a	10a	12a	51a	15a	12a	16ab	18a	14a	5a
Temik 15G 1.5 lb a.i./A	24.14cd	111a	6a	8a	13a	6a	10a	38a	8b	6a	10ab	10a	9a	3a
Temik 15G 2.0 lb a.i./A	25.06d	122a	7a	5a	9a	3a	5a	34a	4a	4a	3a	9a	5a	3a

*DD_{50} = accumulated degree days base 50 F$=\sum\left(\frac{(\text{min. temp.} + \text{max. temp})}{2} - 50F\right)$

**Column means followed by the same letter are not significantly different (P = 0.05) according to the Student Newman Keuls multiple range test.

CONTROL OF THE ROOT-LESION NEMATODE (*PRATYLENCHUS PENETRANS*) ASSOCIATED WITH FIVE DRY BEAN VARIETIES

G.W. Bird and A.P. Elliott
Department of Entomology

Temik 15G at 2.0 lb a.i. per acre was evalutated for control of *P. penetrans* on dry beans. Five bean cultivars, Sanilac, Seafarer, Tuscola, Montcalm Kidney and Charlevoix Kidney were planted in a randomized block design of five replicates of plots treated with Temik at 2.0 lb a.i. per acre and five replicates of control plots without Temik 15G. Each plot consisted of 4 rows 6.1m in length and 0.9m apart. Temik 15G was applied in 0.2m bands at the time of planting on June 5, 1979 (accumulated degree days at base 50F (DD_{50} = 372). Soil and root samples for nematode analysis were taken at 6 intervals during the growing season. The centrifugal-flotation and shaker techniques were used to determine soil and root population densities respectively. The two center rows of each plot were harvested on October 15, 1979 and the weight of bean seeds from each plot was recorded.

There were no significant differences (P = 0.05) in population densities among plots at the time of planting (DD_{50} = 327). Soil and root population densities were significantly reduced (P = 0.05) by Temik 15G at DD_{50} = 873. Compared to all other varieties, *P. penetrans* densities were highest on Sanilac and Montcalm kidney beans at DD_{50} = 1737 Temik 15G at 2.0 lb a.i. per acre significantly increased (P = 0.05) the yield of all varieties.

Effect of Aldicarb (Temik 15G) for Control of *Pratylenchus penetrans* on Five Dry Bean Varieties

Bean Variety, Treatment, Formulation, and Rate	Yield (cwt./A)	*Pratylenchus penetrans* at DD_{50}*												
		No./100cm³ soil							No./g root tissue					
		372	873	1144	1568	1737	2110	2305	873	1144	1568	1737	2110	2305
Sanilac.	12.46a**	134a	25b	14a	104c	39b	142c	518c	130b	320b	249b	448b	134a	74c
Seafarer.	16.76b	126a	16ab	5a	88bc	11a	40ab	338bc	113b	36a	15a	82a	56a	37ab
Tuscola.	17.99b	116a	15ab	12a	84bc	23a	44ab	324bc	174b	40a	9a	162a	136a	26a
Montcalm Kidney.	10.30a	128a	18ab	19a	51bc	17a	71b	332bc	138b	62a	80a	408b	490b	63bc
Charlevoix Kidney.	18.53b	133a	10a	4a	32ab	18a	53ab	184ab	45a	27a	9a	179a	152a	34ab
Sanilac + Temik 15G 2.0 lb a.i./A.	19.91b	131a	5a	2a	12a	4a	14a	34a	10a	18a	4a	18a	8a	4a
Seafarer + Temik 15G 2.0 lb a.i.A.	25.06c	168a	4a	8a	6a	2a	4a	18a	2a	15a	2a	8a	5a	5a
Tuscola + Temik 15G 2.0 lb a.i./A.	24.21c	125a	1a	2a	4a	5a	5a	8a	17a	6a	3a	11a	4a	4a
Montcalm Kidney + Temik 15G 2.0 lb a.i./A	22.29c	149a	2a	4a	11a	7a	12a	16a	5a	22a	3a	16a	9a	2a
Charlevoix Kidney + Temik 15G 1.0 lb a.i./A.	25.83c	140a	5a	2a	12a	4a	7a	15a	2a	10a	5a	5a	3a	2a

*DD_{50} = accumulated degree days base 50 F = $\sum\left[\frac{(\text{min. daily temp.} + \text{max. daily temp})}{2} - 50\text{ F}\right]$

**Column means followed by the same letter are not significantly different (P = 0.05) according to the Student-

CONTROL OF THE ROOT-LESION NEMATODE (*PRATYLENCHUS PENETRANS*) ASSOCIATED WITH SOYBEANS

G.W. Bird and A.P. Elliott
Department of Entomology

Five nematicide treatments were evaluated. Each treatment was replicated 5 times in a randomized complete block design on a sandy clay loam soil at the Michigan State University Montcalm Experiment Farm in Entrican. Each plot consisted of 4 rows 6.1m in length and 0.9m apart. All nematicide treatments were applied in 0.18m bands at the time of planting on June 5, 1979 (accumulated degree days at base 50 F (DD_{50} = 372). Soil and root samples for nematode analysis were taken at 6 intervals during the growing season. The centrifugal-flotation and shaker techniques were used to determine soil and root population densities, respectively. Yield data was obtained from the two center rows which were harvested on October 22, 1979 (DD_{50} = 2378).

There were no significant differences (P = 0.05) in soil population densities among plots at the time of planting (DD_{50} = 372). Soil and root population densities were significantly reduced (P = 0.05) throughout the season by all nematicide treatments. Soybean yields were significantly increased (P = 0.05) with Vydate L at 1.0 lb a.i. per acre and Temik at 1.0 and 2.0 lb a.i. per acre.

Effect of Nematicide Treatments on Pratylenchus penetrans and Yield of Soybeans

Treatment, Formulation and Rate	Yield (cwt/A)	*Pratylenchus penetrans* at DD_{50}*												
		No./100cm^3 soil							No./g root tissue					
		372	873	1144	1568	1737	2110	2378	873	1144	1568	1737	2110	2378
Check.	16.45a	120a**	32b	13b	36b	50b	62b	213b	166b	49b	94b	126c	216b	9a
Vydate L. 1.0 lb a.i./A.	22.34b	65a	7a	2a	16a	4a	10a	46a	40a	8a	34a	21ab	26a	3a
Vydate L. 1.0 lb a.i./A + 1.0 lb a.i. foliar spray.	19.91ab	73a	4a	1a	19a	4a	23a	108a	50a	6a	24a	52b	58a	2a
Nemacur 15G .1 oz a.i./1000 row ft 7" band	19.52ab	95a	4a	2a	15a	7a	29a	58a	46a	11a	25a	49ab	57a	3a
Temik 15G 1.0 lb a.i./A.	21.14b	107a	3a	5a	2a	3a	14a	18a	23a	4a	38a	11a	3a	1a
Temik 15G 2.0 lb a.i./A.	23.45b	94a	3a	2a	2a	4a	16a	48a	30a	6a	19a	24ab	18a	2a

*DD_{50} = accumulated degree days (base 50F) $= \sum \left[\frac{(\text{min. daily temp.} + \text{max. daily temp.})}{2} - 50F \right]$

**Column means followed by the same letters are not significantly different (P = 0.05) according to the Student Newman Keuls multiple range test.

INFLUENCE OF EXPERIMENTAL NEMATICIDES ON PRATYLENCHUS SPP. AND ON YIELD OF FIELD CORN

G.W. Bird and E. Caswell
Department of Entomology and Department of Botany and Plant Pathology

Four nematicides were evaluated using ten different treatments. Each treatment was replicated five times in a randomized block design on sandy clay loam soil (66.4% sand, 11.08% silt, 22.5% clay) at the Michigan State University Montcalm Experimental Farm located in Entrican, Michigan. Each plot was four rows wide (86 cm rows) and 9.2 m in length. A fertilizer treatment consisting of 400 lb/A 6-24-24 was applied on 5/25/79, with an additional 75 lb/A of actual Nitrogen side dressed on 6/25/79. Granular nematicides were applied in a .2m band at planting. Liquid nematicides were applied broadcast at plant, with the exception of Vydate which was applied in a .2m band. A Vydate foliar spray was applied on 6/22/79 for one treatment. Dyfonate was added to control corn rootworm. Soil samples were taken prior to planting, and at 3 intervals during the growing season. The last soil sample was taken post-harvest (11/15/79). The centrifugal-flotation and shaker techniques were used to determine Pratylenchus spp. populations in soil and roots, respectively. The corn was harvested and weighed on 11/08/79.

There were no significant differences (P = 0.05) in nematode densities among the plots prior to planting. During the course of the growing season visual inspections of the plots revealed no differences between treatments. The nematode densities within the root were significantly higher in the check with Dyfonate treatment, throughout the growing season. There were no significant differences in yield (either weight or number of ears per plot) among treatments.

Table 1. The Effect of Experimental Nematicides on Pratylenchus spp. and Field Corn Yield.

Treatment, formulation, application rate	Yield weight of ears (kg)	Yield No. of ears	Pratylenchus spp. per sampling period: No/100cc soil 5/24	7/03	8/16	10/11	11/15	No/gm root tissue 7/03	8/16	10/11
Check	14.5a[1]	83a	42a	41a	2a	24a	220a	126ab	19ab	132ab
Check + Dyfonate 1.0 lb a.i./A	13.9a	81a	72a	56a	2a	24a	158a	174b	29b	159b
Vydate L 1.0 lb a.i./A + Dyfonate 1.0 lb a.i./A	14.6a	85a	46a	25a	1a	15a	103a	8a	7a	66ab
Vydate L 1.0 lb a.i./A + Dyfonate 1.0 lb a.i./A + Vydate L foliar application 1.0 lb a.i./A	13.8a	87a	52a	38a	0a	5a	96a	14a	3a	26a
Mocap 10G 1.0 lb a.i./A	13.9a	83a	36a	47a	1a	17a	121a	20a	3a	29a
Mocap 6EC 2.0 lb a.i./A	14.0a	77a	44a	38a	2a	5a	94a	21a	3a	39a
Mocap 6EC 3.0 lb a.i./A	14.3a	82a	41a	34a	1a	1a	90a	44a	2a	46a
Mocap 6EC 4.0 lb a.i./A	13.8a	80a	48a	29a	2a	7a	46a	13a	3a	14a
Furadan 10G 1.5 lb a.i./A	14.0a	82a	28a	44a	2a	7a	46a	64a	1a	17a
Amaze 15G 3.0 oz. a.i./1000 ft.	14.2a	84a	48a	59a	2a	20a	179a	81a	5a	56a

[1] Column means followed by the same letter are not significantly different according to the Student-Newman-Keuls Multiple Range Test (P = 0.05).

LARGE SEEDED COLORED BEAN EVALUATION TRIAL

Jerry Taylor and M.W. Adams
Department of Crop and Soil Sciences

Test 9218

This test of 15 large-seeded entries was planted on June 20, 1979, in 4 row plots, 16 feet long, rows 21" apart, in 4 replications, Eptam, pre-plant incorporated, was the only herbicide used. The nursery was sprinkle-irrigated six times at a rate of 1" per irrigation*, and hand-hoed twice during the growing season. No disease symptoms were observed. Growth was normal to unusually luxuriant for this location, although yields were not outstanding. Rainfall was adequate for June, very deficient for July, and barely adequate in August. The supplemental irrigation was needed to assure satisfactory yields.

Table 1. Test 9218: Yields in lbs/A Clean Seed Adjusted to 15% Moisture, Montcalm Farm, 1979.

Entry	Type	Mean Yield*
70684	L. R. Kid.	2238
70688	L. R. Kid.	2002
70700	L. R. Kid.	2149
61144		1956
5408	Large white	1911
Alubia	Large white	1748
Charlevoix	D. R. Kid.	2204
Manitou	L. R. Kid.	1740
Montcalm	D. R. Kid.	2269
Mecosta	L. R. Kid.	2064
Redkloud	L. R. Kid.	2216
Sacramento	L. R. Kid.	2220
Michicran	Cranberry	1904
Cran 028	Cranberry	2150
Valley	Great North.	1842

*Differences among means not significant.

Discussion

This test was conducted primarily to compare the yield performance of 3 experimental light red kidney selections, namely, 70684, 70688, and 70700, with other kidney varieties. The objective has been to replace Mecosta and Manitou with an earlier maturing light red possessing halo blight resistance.

This test resulted in non-significant yields for all entries, although some had somewhat higher mean values than others. At least, the 3 strains of interest appeared to yield satisfactorily, and as good as standard varieties. A decision as to whether to increase seed of any of the experimentals will be made following canning tests.

*Plots irrigated on the following dates: July 20, 27, August 6, 14, 21, and 27.

The bush Cran 028 continues to perform well, though not significantly better than the vine Michicran. There is a question concerning seed size of Cran 028. It may be somewhat smaller than the bean export trade would like, and for this reason we have not moved ahead to a final decision as respects its release.

CORN HYBRIDS, PLANT POPULATION AND IRRIGATION

E.C. Rossman and Keith Dysinger
Department of Crop and Soil Sciences

Performance data for 83 commercial corn hybrids evaluated in 1979 with irrigation and without irrigation are presented in Table 1 along with two and three year averages for those tested in 1978 and 1977. A total of 6 inches of supplemental water was applied during July and August. Bouyoucous soil moisture blocks were placed at 6, 12, 18 and 24 inch depths in both irrigated and unirrigated plot areas. Irrigation was applied when soil moisture reached 50% or less of water holding capacity at 6" level.

Irrigated yields averaged 42.0 bushels more than unirrigated--108.5 vs 66.5, an increase of 63%. Hybrids ranged from 66.9 to 142.0 irrigated and 42.0 to 91.5 bushels per acre without irrigation. Hybrids significantly better than the average yield (arranged in order of increasing grain moisture content at harvest) are listed below. Eighteen of the 22 hybrids were in the highest yielding group for both irrigated and unirrigated plots.

Irrigated	Not Irrigated
Garno S90 (2x)	Garno S90 (2x)
Pioneer 3901 (2x)	Pioneer 3901 (2x)
Michigan 407-2x (2x)	Michigan 407-2x (2x)
Super Crost 2350 (2x)	Super Crost 2350 (2x)
Pioneer 3780 (2x)	Pioneer 3780 (2x)
ADI 232 (2x)	ADI 232 (2x)
Asgrow RX2345 (2x)	Asgrow RX2345 (2x)
Blaney B 507 (2x)	Blaney B 507 (2x)
Select 3000 (2x)	Select 3000 (2x)
DeKalb XL 23 (2x)	DeKalb XL 23 (2x)
Customaize CFS 1000 (2x)	Michigan 4122 (2x)
Blaney B606 (2x)	Customaize CFS 1000 (2x)
Migro M-2018X (2x)	Blaney B606 (2x)
Michigan 5802 (2x)	Migro M-2018x (2x)
Pride 4488 (2x)	Michigan 5802 (2x)
Amcorn 7300 (2x)	Pride 4488 (2x)
Great Lakes GL-552 (2x)	Amcorn 7300 (2x)
Kaltenberg KX68 (2x)	Great Lakes GL-552 (2x)
Cargill 924 (2x)	Kaltenberg KX68 (2x)
	ADI 325 (2x)
	Michigan 5912 (2x)
	Michigan 5922 (2x)
	Cargill 924 (2x)

The correlation of irrigated with unirrigated yields was highly significant, .855, indicating that the hybrids tended to respond alike in both situations. During the 12-year period, 1968-1979, the correlations have ranged between .7 and .9 except for 1976 when it was .490. All correlations have been highly significant.

Average, highest and lowest yields for corn hybrids irrigated and not irrigated for the 12-year period, 1968-1979, are given in Table 2. The average yielding hybrids have yielded 49 more bushels when irrigated. The highest yielding hybrids have responded with 60 bushels added yield while the lowest yielding hybrids have given only 32 bushels added yield when irrigated. These results demonstrate the importance of choosing high yielding hybrids to maximize returns from irrigation with little, if any, additional cost.

Stalk lodging averaged 14.2% irrigated and 11.0% not irrigated. In 1978 there was twice as much lodging on irrigated plots and three times more lodging when irrigated in 1977. In most of the previous years 1968-1976, there was less lodging on the irrigated plots. Generally, stressed weaker plants on unirrigated plots have been more susceptible to lodging except during the past three years. In 1979, the highest lodging was 47% stalk breakage when irrigated compared to 42% unirrigated. The lowest lodging was only 1% irrigated and 0% unirrigated.

Plant Population x Irrigation

Five adapted hybrids at four plant populations irrigated and not irrigated have been grown in each of 12 years, 1968-1979, Table 3. Over the 12-year period, a population of 23,400 has given the highest average yield (168 bushels per acre) when irrigated while 19,200 has given the highest yield (108 bushels) without irrigation. The 23,400 population irrigated has given the highest yield in 10 out of the 12 years (1973 and 1979 being the exceptions). The 12-year average increase due to irrigation has been 71 bushels per acre at the 23,400 population.

Moisture content of grain at harvest has averaged .5 - 1.0% higher for the higher plant populations. Stalk lodging has increased with increased plant populations.

Table 2. Average, highest and lowest yields for corn hybrids irrigated and not irrigated for 12 years, 1968-1979.

Year	No. of Hybrids Tested	AVERAGE		HIGHEST		LOWEST	
		Irrigated	Not Irrigated	Irrigated	Not Irrigated	Irrigated	Not Irrigated
1979	83	109	67	142	92	67	42
1978	73	144	88	186	112	92	61
1977	74	125	73	158	88	89	56
1976	80	156	72	183	93	120	49
1975	75	154	125	207	157	106	80
1974	76	112	103	134	122	65	58
1973	72	114	101	138	120	78	73
1972	72	157	137	206	179	99	91
1971	56	163	28	211	42	91	11
1970	64	144	103	194	128	95	70
1969	63	146	86	185	109	97	56
1968	56	136	96	182	123	92	65
AVERAGE		139	90	177	114	91	59

Table 3. Average yield at four plant populations irrigated and not irrigated for 12 years, 1968-1979.

Year	15,100		19,200		23,400		27,400	
	Irrigated	Not Irrigated	Irrigated	Not Irrigated	Irrigated	Not Irrigated	Irrigated	Not Irrigated
1979	123	77	140	87	138	83	131	78
1978	146	92	164	110	175	100	165	94
1977	141	74	152	81	160	70	150	69
1976	153	72	174	84	181	81	161	68
1975	158	136	183	164	196	151	172	146
1974	118	100	130	111	135	98	120	94
1973	108	97	134	116	128	106	108	102
1972	152	132	187	159	191	149	161	144
1971	173	37	189	35	191	20	181	11
1970	122	91	144	112	158	93	151	85
1969	126	91	158	109	173	96	148	86
1968	144	114	169	130	193	107	178	89
AVERAGE	140	94	160	108	168	97	152	89

Table 1

Zone 3

NORTH CENTRAL MICHIGAN
Montcalm County Trial - Irrigated vs. Not Irrigated
One, Two, Three Year Averages - 1979, 1978, 1977

Hybrid (Brand-Variety)	% Moisture			Bushels per acre						% Stalk lodging					
	1979	2 yrs.	3 yrs.	1979		2 years		3 years		1979		2 years		3 years	
				Irrig	Not Irrig	Irrig	Not Irrig	Irrig	Not Irrig	Irrig	Not Irrig	Irrig	Not Irrig	Irrig	Not Irrig
Hyland HL-2217	21.2	---	---	66.9	45.1	---	---	---	---	32.8	30.8	-	-	-	-
McKenzie 901 (3X)	22.4	---	---	72.3	46.2	---	---	---	---	14.3	9.3	-	-	-	-
Hyland HL-2430 (2X)	22.5	---	---	95.9	58.9	---	---	---	---	11.0	6.4	-	-	-	-
McKenzie 840 (3X)	22.6	---	---	70.9	42.0	---	---	---	---	26.4	15.0	-	-	-	-
Michigan 280 (4X)	22.7	21	22	90.8	52.8	91	61	94	61	17.6	14.8	13	12	12	9
Dairyland 1095 (2X)	22.7	---	---	92.4	51.2	---	---	---	---	14.1	7.9	-	-	-	-
Select 1400 (MSX)	22.7	---	---	83.1	51.3	---	---	---	---	17.8	12.6	-	-	-	-
Pioneer 3950 (3X)	22.9	---	---	110.8	60.2	---	---	---	---	15.0	6.7	-	-	-	-
Hyland HL-2418 (2X)	23.1	---	---	73.6	43.6	---	---	---	---	38.0	42.1	-	-	-	-
Hyland HL-2442 (2X)	23.1	---	---	104.9	59.0	---	---	---	---	12.7	7.3	-	-	-	-
Michigan 333-3X (3X)	23.2	21	22	102.2	63.1	118	76	115	73	10.5	11.5	7	7	5	5
Super Crost 1402 (2X)	23.5	22	---	77.9	44.8	85	53	---	---	27.5	17.3	17	10	-	-
Migro M-0101 (2X)	23.5	21	23	102.0	63.1	119	72	116	72	9.0	9.7	7	5	8	5
Funk G-4195 (3X)	23.7	---	---	94.9	68.9	---	---	---	---	23.9	13.5	-	-	-	-
Michigan 3093 (3X)	23.7	22	23	94.8	58.3	109	73	111	70	18.5	11.7	11	8	8	6
*+Garno S-90 (2X)	23.7	23	---	123.0	91.5	133	91	---	---	13.8	8.3	7	4	-	-
P-A-G Exp. 263048 (2X)	23.7	---	---	112.8	73.6	---	---	---	---	12.6	10.3	-	-	-	-
Blaney B302-wx (2X)	23.9	23	---	99.3	65.5	115	73	---	---	20.9	28.8	12	15	-	-
Amcorn 4010 (2X)	24.0	---	---	90.3	54.7	---	---	---	---	21.5	12.6	-	-	-	-
DeKalb XL13 (2X)	24.0	---	---	94.3	66.4	---	---	---	---	47.1	28.1	-	-	-	-
Pride 2206 (2X)	24.0	---	---	112.4	63.0	---	---	---	---	14.8	11.3	-	-	-	-
Michigan 3102 (2X)	24.0	23	25	111.8	70.5	146	86	139	81	9.8	8.0	6	6	5	4
Super Crost 1950 (2X)	24.5	23	---	109.9	57.0	138	78	---	---	15.2	14.7	11	10	-	-
*+Pioneer 3901 (2X)	24.5	23	25	136.1	94.6	150	98	149	93	7.2	5.7	4	3	4	2
Migro M-0105 (2X)	24.5	24	26	98.9	72.4	125	85	124	81	17.5	11.8	12	8	12	6

Table 1 Continued.

Select 2200 (MSX)	24.5	---	---	109.6	73.1	---	---	---	---	21.9	19.9	-	-	-	-
Acco UC1151 (2X)	24.6	23	---	82.7	55.0	117	70	---	---	21.3	11.0	15	7	-	-
DeKalb XL15 (2X)	24.9	23	---	109.9	73.4	115	74	---	---	7.5	2.8	6	3	-	-
Super Crost 1692 (2X)	24.9	23	25	104.2	72.8	114	78	110	75	11.7	13.6	8	7	5	5
McKenzie 950 (MSX)	25.0	---	---	104.9	69.9	---	---	---	---	9.2	14.1	-	-	-	-
Great Lakes GL-452 (2X)	25.0	---	---	106.1	62.3	---	---	---	---	19.9	16.7	-	-	-	-
Super Crost 1580 (2X)	25.0	---	---	96.1	53.4	---	---	---	---	19.7	9.1	-	-	-	-
Super Crost 78015 (2X)	25.1	---	---	93.8	49.5	---	---	---	---	18.7	9.0	-	-	-	-
Hyland HL-2440 (2X)	25.1	---	---	100.5	59.1	---	---	---	---	18.5	14.6	-	-	-	-
Funk G-4224 (MSX)	25.1	24	---	110.0	59.3	125	70	---	---	6.2	10.0	8	6	-	-
Pioneer 3958 (2X)	25.1	23	25	108.9	73.2	117	81	114	73	8.4	8.0	6	4	5	3
*+Michigan 407-2X (2X)	25.1	24	26	132.3	85.8	147	94	146	91	12.4	8.6	8	5	6	3
Migro HP16 (2X)	25.1	---	---	104.2	59.4	---	---	---	---	17.6	11.3	-	-	-	-
P-A-G SX189 (2X)	25.3	24	---	89.2	63.5	118	74	---	---	17.9	11.3	12	7	-	-
Dairyland 1099 (2X)	25.4	---	---	103.9	65.1	---	---	---	---	25.2	14.2	-	-	-	-
*+Super Crost 2350 (2X)	25.5	24	26	125.5	74.0	155	91	141	85	11.0	6.5	8	4	7	3
Customaize CFS144 (2X)	25.8	---	---	108.6	59.6	---	---	---	---	30.1	18.8	-	-	-	-
Michigan 3953 (3X)	25.9	24	25	114.3	72.3	128	78	128	75	15.2	12.9	10	8	7	7
*+Pioneer 3780 (2X)	26.4	24	26	120.6	90.3	151	97	151	94	18.4	8.0	14	5	10	3
*+ADI 232 (2X)	26.4	24	25	134.4	75.6	149	88	138	77	15.8	10.5	12	9	8	7
*+Asgrow RX2345 (2X)	26.4	---	---	126.8	78.4	---	---	---	---	19.0	8.1	-	-	-	-
*+Blaney B507 (2X)	26.4	---	---	125.8	79.0	---	---	---	---	12.3	9.9	-	-	-	-
Migro M-2022X (2X)	26.5	25	27	113.1	73.0	141	87	139	85	5.1	10.2	5	5	5	4
*+Select 3000 (2X)	26.7	---	---	132.1	79.0	---	---	---	---	9.8	8.0	-	-	-	-
Funk G-4272 (3X)	27.1	25	27	115.7	66.9	132	77	126	72	21.0	12.3	14	9	12	7
*+DeKalb XL23 (2X)	27.1	---	---	121.3	73.9	---	---	---	---	4.0	5.4	-	-	-	-
+Michigan 4122 (2X)	27.1	25	26	119.5	79.3	131	88	133	84	12.2	7.4	9	4	7	4
Blaney B506 (2X)	27.4	25	27	103.5	56.2	132	79	132	76	9.4	9.3	6	5	7	4
Amcorn 4100 (2X)	27.5	25	27	101.3	56.3	123	72	122	73	9.0	6.6	7	4	7	5
*+Customaize CFS1000 (2X)	27.6	24	---	127.3	80.0	129	79	---	---	4.6	3.5	7	4	-	-
Kaltenberg KX58 (2X)	27.7	---	---	110.2	67.3	---	---	---	---	16.8	15.3	-	-	-	-
Acco UC2301 (2X)	27.7	25	27	95.3	63.6	125	77	124	73	6.1	6.1	5	7	5	6
Kaltenberg KX54 (2X)	28.0	---	---	113.8	69.4	---	---	---	---	8.8	8.0	-	-	-	-
Migro HP23R (2X)	28.1	---	---	114.5	63.2	---	---	---	---	12.3	6.3	-	-	-	-
Migro HP20 (2X)	28.1	---	---	114.4	67.2	---	---	---	---	22.2	14.0	-	-	-	-

Table 1 Continued.

*+Blaney B606 (2X)	28.4	25	28	142.0	85.2	146	90	138	86	2.2	1.4	2	1	2	1
Cargill 872 (2X)	28.8	---	---	101.5	62.5	---	---	---	---	15.8	12.3	-	-	-	-
Asgrow RX544 (2X)	28.9	---	---	114.0	64.8	---	---	---	---	15.1	9.8	-	-	-	-
*+Migro M-2018X (2X)	29.1	26	28	130.6	84.2	156	95	151	92	5.3	2.3	3	1	3	1
*+Michigan 5802 (2X)	29.1	27	28	140.5	83.6	147	90	142	86	12.9	11.3	9	7	7	6
Customaize CFS WX128 (2X)	29.1	---	---	118.7	68.7	---	---	---	---	29.3	21.1	-	-	-	-
*+Pride 4488 (2X)	29.2	26	---	131.6	74.2	146	87	---	---	1.4	0.8	1	2	-	-
*+Amcorn 7300 (2X)	29.8	26	28	122.0	74.7	124	78	126	78	9.9	7.6	9	7	6	5
Migro HP27 (2X)	30.0	---	---	103.5	56.6	---	---	---	---	8.5	3.1	-	-	-	-
Trojan TXS102 (2X)	30.0	27	---	100.8	51.1	135	76	---	---	28.9	22.8	17	14	-	-
Acco UC3002 (2X)	30.1	28	29	117.5	59.7	143	79	143	80	12.5	8.2	12	4	9	3
*+Great Lakes GL-552 (2X)	30.2	---	---	122.6	75.2	---	---	---	---	8.0	6.6	-	-	-	-
ADI 197 (X)	30.3	30	---	108.8	55.6	143	77	---	---	9.7	5.6	5	3	-	-
*+Kaltenberg KX68 (2X)	30.4	---	---	131.2	75.4	---	---	---	---	5.8	4.6	-	-	-	-
McKenzie 1001 (MSX)	30.8	---	---	103.7	56.7	---	---	---	---	17.7	12.8	-	-	-	-
Cargill 892 (2X)	31.1	---	---	105.7	58.8	---	---	---	---	34.4	23.9	-	-	-	-
+ADI 325 (2X)	31.1	---	---	116.1	79.5	---	---	---	---	13.1	8.9	-	-	-	-
+Michigan 5912 (2X)	31.2	28	30	113.3	75.4	141	89	147	89	5.3	6.1	4	3	3	2
+Michigan 5922 (2X)	31.2	---	---	120.0	81.1	---	---	---	---	1.1	2.0	-	-	-	-
*+Cargill 924 (2X)	31.3	---	---	135.8	82.5	---	---	---	---	11.4	8.4	-	-	-	-
Amcorn 7480 (2X)	31.8	27	29	106.0	67.5	136	85	134	82	1.8	2.3	2	1	1	1
Migro M-0301 (2X)	32.0	28	30	103.0	54.3	133	83	137	81	20.6	12.5	14	7	10	5
ADI 315 (2X)	34.4	---	---	119.2	71.2	---	---	---	---	9.0	5.8	-	-	-	-
Average	26.8	24	26	108.5	66.5	131	81	131	80	14.2	11.0	9	6	7	4
Range	21.2 to 34.4	21 to 30	22 to 30	66.9 to 142.0	42.0 to 91.5	85 to 156	53 to 98	94 to 151	61 to 94	1.1 to 47.1	0.8 to 42.1	1 to 17	1 to 15	1 to 12	1 to 9
Least significant difference	1.5	1.0	0.7	12.3	7.3	9	6	6	5	---	---	-	-	-	-

*Significantly better than average yield, irrigated, 1979

+Significantly better than average yield, not irrigated, 1979

Table 1 Continued.

		1979	1978	1977
Planted		May 19	May 3	April 26
Harvested		November 19	November 9	October 28
Soil type		Montcalm sandy loam	Montcalm sandy loam	Montcalm sandy loam
Previous crop		Alfalfa	Corn	Corn
Population		20,800	20,700	20,500
Rows		30"	30"	30"
Fertilizer		213-80-80	197-60-60	283-90-90
Irrigation		6 inches	8 inches	13 inches
Soil test:	pH	5.4	6.7	6.7
	P	493 (very high)	362 (very high)	391 (very high)
	K	336 (very high)	188 (medium)	174 (medium)

Farm Cooperator: Theron Comden, Montcalm Experimental Farm, Lakeview

County Extension Director: James Crosby, Stanton