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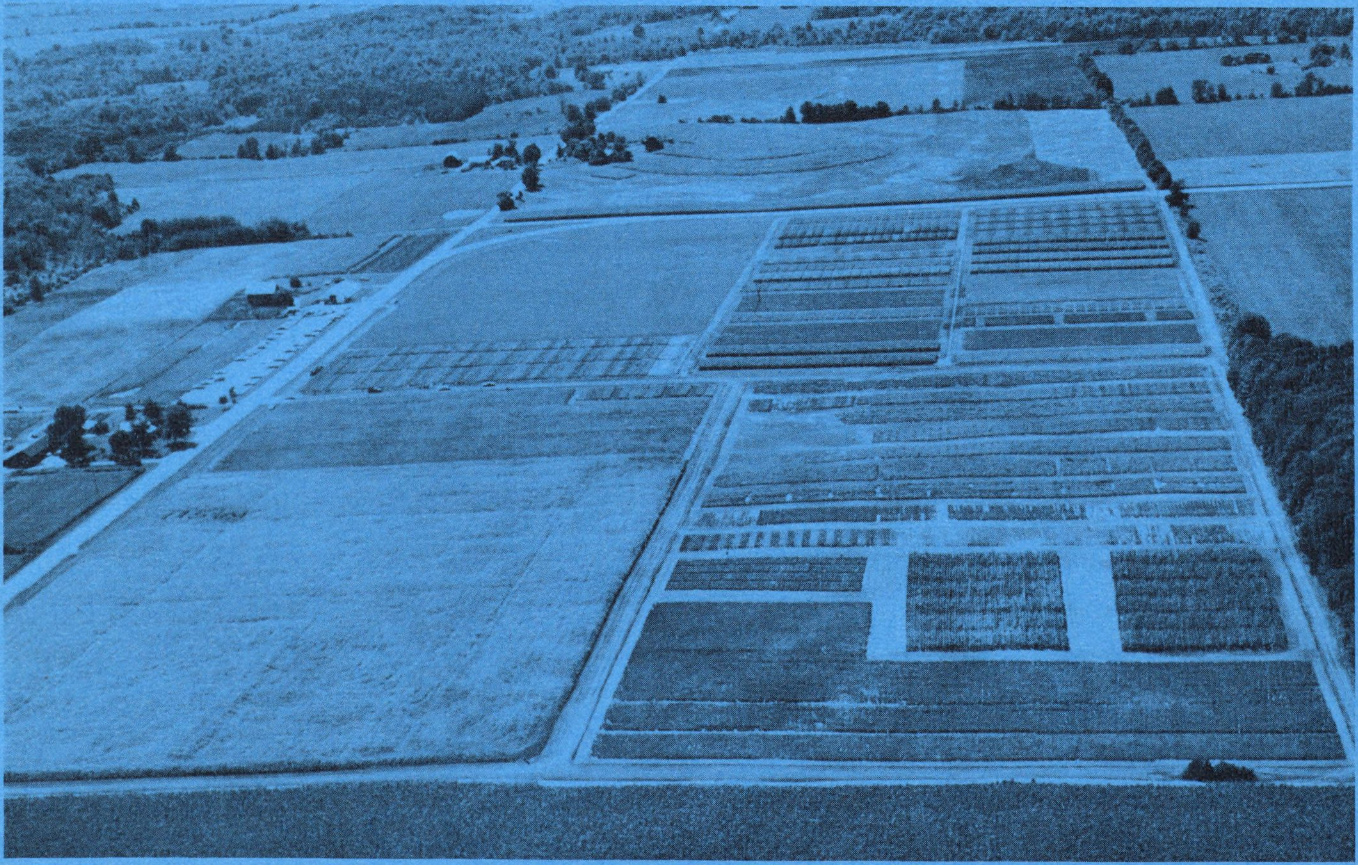
1977 Research Report



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, 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.

Foliar fungicide and insecticide sprays were applied with a new FMC side boom sprayer. The sprayer was purchased by the Michigan Potato Industry Commission and donated to Michigan State University and the Montcalm Experimental Farm for research use. Appreciation for this support is hereby gratefully acknowledged.

TABLE OF CONTENTS

MONTCALM BRANCH EXPERIMENT STATION RESEARCH REPORT

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INTRODUCTION

The Montcalm Branch Experiment Station was established in 1966 with the first experiments initiated in 1967. This report marks the completion of ten 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 inthe heart of a major potato producing area.

This report is designed to coordinate all of the research obtained at this facility during 1977. 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 10 year temperature and rainfall data. Without question, weather during the 1977 growing season was the most unusual we have experienced during our tenure at the research farm. The average maximum temperatures for April and May were well above the ten year average with May being 13° higher. Maximum temperatures for the balance of the growing season were more nearly normal. There was little deviation from the 10 year average of the minimum temperature. In May there were 6 days with a maximum temperature above 90°F and 13 days when it exceeded 85°F.

The rainfall distribution was very erratic also. Less than one-half inch rain was recorded in May which is far below the 3.08 ten year average. Similarly, April and June were substantially below the average which resulted in the driest initial growing season we have experienced. At the other extreme, September rainfall was more than twice the 10 year average which interfered with intended harvests, however, all harvests were completed before the first freeze which occurred on October 7.

Irrigation applications of approximately one inch each were made 13 times (June 17, 24, July 3, 11, 18, 22, 25, 29, August 2, 9, 16, 21 and 26).

SOIL TESTS

Soil test results for the general plot area were:

Pounds per Acre

pH	P	K	Ca	Mg
6.4	459	216	1,011	142

Table 1. The 10-year summary of recorded maximum and minimum temperatures during the growing season at the Montcalm Branch Experiment Station.

Year	April		May		June		July		August		September		6-month average	
	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
10-year average	55	34	67	44	75	54	81	58	79	56	71	49		

Table 2. The 10-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
10-year average	2.56	3.08	3.84	2.39	4.50	3.39	19.8

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	- 12-12-12	- 600 lbs/A
Sidedressed at hilling	- 46-0-0	- 300 lbs/A
Fall seeded rye plowed down		

HERBICIDES

Preemergence - metribuzin (Sencor) 1/2 lb/A + alachlor (Lasso) 2 qts/A

DISEASE & INSECT CONTROL

The systemic insecticide Temik was applied at planting at 3 pounds per acre.

Foliar fungicide and insecticide sprays were as follows:

July 5	Bravo + Thiodan
July 11	Bravo + Monitor
July 26	Bravo
August 5	Bravo + Metasystox-R
August 13	Bravo + Thiodan
August 20	Bravo + Thiodan
August 29	Bravo
September 6	Bravo

INFLUENCE OF SELECTED PRODUCTION MANAGEMENT INPUTS ON THE YIELD, QUALITY, STORABILITY OF RUSSET BURBANK, ONAWAY AND SUPERIOR POTATOES

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Department of Entomology

Four pesticide treatments (Check, DiSyston 15G, Temik 15G and Vorlex plus DiSyston 15G), three nitrogen levels (70, 150, and 30 lb/acre) and three potato cultivars were used to evaluate the combined influence of pesticides and nitrogen on potato growth and development, associated pest population dynamics and potato yields. The three cultivars were planted in separate, but adjacent ranges at the M.S.U. Montcalm Potato Research Farm. Each treatment was replicated four times in a randomized block design. Each plot consisted of four rows 50 feet in length and 34 inches apart. Vorlex was injected to a soil depth of 6-8 inches in a broadcast manner on April 21, 1977. The other pesticides were applied at planting on May 9-10, 1977. All plant growth and development measurements and nematode population dynamics samples were taken from the outside two rows of each plot. Yield data were taken by harvesting of center two rows of each plot.

DiSyston, Temik and Vorlex significantly (P=0.05) increased yields of Superior potatoes at all nitrogen rated (Table 1). The greatest yield, however, was with Temik at the 150 lb. nitrogen rate. Yields of Onaway were not enhanced as much as those of Superior by the pesticides. With Russett Burbank, only the Vorlex treatment at the 300 lb. nitrogen rate resulted in a significant increase in yield. The results were similar, but more pronounced when the data were analyzed for the pesticides without respect to the nitrogen treatments (Table 2). Increasing the nitrogen rate had no influence on the yield of any of the cultivars (Table 3).

Both Temik and Vorlex gave good control of root-lesion nematodes associated with all three cultivars (Tables 4-6). The nitrogen rates had no influence on the nematode control associated with any of the three cultivars. DiSyston application resulted in approximately 20% nematode control. The growth and development of the shoot systems, root systems and tubers progressed throughout the growing season, reflecting early nematode control and enchanced growth and development.

The results of this investigation are similar to those obtained for nematode control studies on mineral soil in Michigan in the past. They reflect the fact that cv Superior is highly susceptible to root-lesion nematode damage, and that Russet Burbank is tolerant. Economic losses, however, can occur with this cultivar. Onaway is in an intermediate category. The population dynamics information is similar to that obtained in 1976. Population development was condiderable earlier. This was probably due to the warm temperatures in May. All of the data will be plotted using a physiological base as a substitute for calendar days. This will make it possible to compare the 1977 and 1978 data.

Better evidence of root-lesion nematode control with Vorlex would have been obtained if soil and root samples were taken between planting and June 15. Earlier nematode control with Temik may have been prevented because of the extremely dry conditions at the time of planting. This factor may have resulted in lower yields with this treatment than if it had been applied under more optimal environmental conditions. For the second year, season-long nematode control was obtained with Temik. This is the first report of this! It may be that it has been overlooked because of the way nematologists make their observations. A limited amount of root-lesion nematode control with DeSyston should have been expected. The results of the foliage analysis is in general agreement with the way plant-parasitic nematodes cause diseases of most crops.

Table 1. Influence of nitrogen and pesticides on yields of three potato cultivars

Treatment	Yield (ctw/A) Superior	Onaway	Russet Burbank
N (75 lb/A)			
Check	119a[1]	140a	200a
DiSyston (3.0 lb/A)	166bc	177b	236ab
Temik (3.0 lb/A)	172bc	174ab	211ab
Vorlex (10 gal/A)	183bc	199bc	256ab
N (150 lb/A)			
Check	105a	174ab	213ab
DiSyston (c.0 lb/A)	152bc	172ab	229ab
Temik (3.0 lb/A)	196c	211bc	243ab
Vorlex (10 lb/A)	189bc	203bc	245ab
N (300 lb/A)			
Check	86a	143a	194a
DiSyston (3.0 lb/A)	139b	172ab	223ab
Temik (3.0 lb/A)	174bc	193bc	249ab
Vorlex (10 gal/A)	179bc	214c	270b

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

Table 2. Influence of three pesticides on yields of three potato cultivars

Pesticide	Yield (ctw/A)		
	Superior	Onaway	Russett Burbank
Check	111a[1]	152a	203a
DiSyston (3.0 lb/A)	152b	174b	229b
Temik (3.0 lb/A)	180c	193c	231b
Vorlex (10 gal/A)	183c	206c	257c

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

Table 3. Influence of three levels of nitrogen on yields of three potato cultivars

N level	Yield (ctw/A)		
	Superior	Onaway	Russet Burbank
75 lb/A	160a[1]	172a	226a
150 lb/A	160a	189b	232a
300 lb/A	149a	183ab	232a

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

Table 4. Influence of pesticides on population densities of root-lesion nematodes associated with "Superior" potatoes.

Treatment	Root-lesion nematodes/100 cm^3 soil							Root-lesion nematodes/g root				
	4/14	6/15	6/30	7/18	8/1	8/8	9/22	6/15	7/30	7/18	8/1	8/8
Check	43a	28a	3ab	10a	58a	13a	67a	43a	163a	145a	60a	110a
DiSyston	35a	37a	13b	23b	32b	25a	57a	45a	130a	183a	30ab	57ab
Temik (3.0 lb/A)	24a	25a	0a	5a	7b	10a	5b	5a	1b	8b	8b	0b
Vorlex (10 gal/A)	28a	22a	5ab	8a	20b	13a	20b	30a	78ab	82ab	38ab	26b

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

Table 5. Influence of pesticides on population densities of root-lesion nematodes associated with "Onaway" potatoes

Treatment	Root-lesion nematodes/100 cm^3 soil							Root-lesion nematodes/g root				
	4/14	6/15	6/30	7/18	8/1	8/8	9/22	6/15	7/30	7/18	8/1	8/8
Check	40a[1]	28a	17a	18a	28a	5a	5a	26ab	195a	187a	48a	36a
DiSyston (3.0 lb/A)	30a	23a	22a	8ab	8ab	5a	5a	33b	148a	177a	25a	16a
Temik (30 lb/A)	29a	38a	17a	2b	2b	8a	0a	7a	25b	28b	2b	3a
Vorlex (10 gal/A)	29a	30a	15a	5ab	11ab	8a	10a	26ab	65b	70a	27a	27a

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

Table 6. Influence of pesticides on population densities of root-lesion nematodes associated with "Russet Burbank" potatoes.

Treatment	Root-lesion nematodes/100 cm^3 soil							Root-lesion nematodes/g root					
	4/14	6/15	6/30	7/18	8/8	8/25	9/22	6/15	6/30	7/18	8/1	8/8	8/25
Check	55a[1]	27a	18a	12a	7a	32a	50a	48a	110a	210a	73a	195a	40a
DiSyston (3.0 lb/A)	30a	32a	7a	15a	10a	25a	27a	37a	83a	115a	67a	162a	23ab
Temik (3.0 lb/A)	51a	17a	7a	5a	3a	0b	30a	6b	2b	17b	8b	12b	7b
Vorlex (10 gal/A)	29a	27a	12a	7a	8a	22a	37a	36a	75a	100a	42a	120a	38a

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

INFLUENCE OF SELECTED PRODUCTION MANAGEMENT INPUTS ON THE YIELD, QUALITY, STORABILITY OF RUSSET BURBANK, ONAWAY AND SUPERIOR POTATOES

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This project was a study conducted as part of an overall project to look at insects, nematodes, nitrogen and varieties and the interactions which might occur. Only the nutritional aspect is reported on here. Information on other apsects are reported by Dr. G.W. Bird.

Influence of nitrogen on elemental composition of potato petioles.

Table 1 which shows the overall averages of three varieties, four insecticide treatments and four replications, shows that increasing rates of N increased nitrogen (N), phosphorus (P), manganese (Mn) and copper (Cu) of the petioles. The same observations are seen in Table 2 for the Russet Burbank variety when data were averaged over two sampling dates. In addition zinc (Zn) was increased by increasing N rates.

In Table 3, 300 lbs N/A decreased the magnesium (Mg) content for the Superior variety while increasing it for the Russet Burbank variety. The iron content of Superior petioles was significanlty increased by 300 lbs N/A over the 75 lb N treatment (Table 4). The iron (Fe) content of the other two varieties was unaffected by N fertilizer.

In Table 6, the Russet Burbank variety shows a higher potassium (K) content in petioles than in the Superior variety at the 300 lb N rate.

Influence of insecticides on elemental composition of potato petioles.

Values in the center of Table 1 represent averages for three varieties, three nitrogen rates and four replications for petiole samples taken July 14. The following observations were significantly different when compared to the check.

(a) Temik increased N, P and Mg
(b) Temik and Vorlex decreased Mn
(c) Vorlex increased Mg

Table 2 shows the effect of insecticides on the Russet Burbank variety when averaged over two sample dates, three rates of nitrogen and four replications. When compared with the check the following observations were significantly different.

(a) Temik and Vorlex increased N
(b) Temik reduced Ca and Zn
(c) DiSyston reduced Cu and Zn
(d) Temik increased Cu

Table 3 shows three treatment interactions for magnesium. The following observations when compared to the check were significantly different for the insecticide, N rate and variety interactions.

(a) Temik and Vorlex increased Mg at the 75 and 300 lb N rates
(b) None of the insecticides affected Mg at 150 lb N rate
(c) DiSyston increased Mg at 300 lb N rate
(d) Temik and Vorlex increased Mg for the Onaway and Superior varieties

Although the analysis of variance indicated a significant interaction between variety and insecticides for N, the differences were entirely related to N content of the varieties (Table 5) and not due to insecticide treatments.

A look at how insecticides affected the elemental composition of potato petioles receiving only 75 lbs of N can be found in Table 7. For the Superior variety, K, Mn, Fe and Cu were significantly affected by the insecticides. Only Mn was significantly affected by insecticides for the Onaway and Russet Burbanks varieties. The overall averages for the three varieties indicates that Temik and Vorlex significantly increased Mg and decreased Mn.

Correlation of yield with elemental composition of potato petioles.

Simple correlation coefficients were determined comparing all elements in petioles for the July 14 sampling date with total potato yield. Nitrogen ($r = .379$) and Mn ($r = -.405$) were highly correlated with Russet Burbank yields. Aluminum (Al) ($r = -.294$) and Calcium (Ca) ($r = .236$) were also related to yield at a lower level of significance.

For the Onaway variety; Al ($r -434$), N ($r = .310$) and Mg ($r = .341$) were significantly correlated. Significant correlations for the Superior variety were; Al ($r = -.654$) Fe ($r = -.511$) and Mn ($r = -.320$).

Summary

Nitrogen fertilizer consistently increased the N, P, Mn and Cu content of potato petioles. Insecticides consistently decreased the manganese content of petioles. Temik and Vorlex usually had more effect than DiSyston for decreasing Mn. Aluminum and manganese were found to be negatively correlated with total yields. Further studies are needed to characterize the effect of insecticides on manganese uptake. Many of the manganese levels in this study were above the plant sufficiency range approaching the toxicity range. Any treatments which reduce the uptake of Mn on acid sandy soils should be valued as beneficial to plant growth.

Table 1. Elemental composition of potato petioles for three varieties as affected by nitrogen rate and insecticide treatments.

Treatments	N	P	K	Ca	Mg	Mn	Fe	Cu	Zn
	Elements								
	%					ppm			
N-Rate									
75	2.13	.21	8.30	.99	.64	168	78	10	33
150	2.26	.23	8.06	1.01	.63	204	82	11	37
300	2.29	.23	8.04	1.00	.64	224	87	11	37
LSD (.05)	(.06)	(.01)	(ns)	(ns)	(ns)	(17)	(ns)	(1)	(ns)
Insecticide									
Check	2.17	.22	8.20	1.01	.60	227	89	11	34
DiSyston	2.22	.22	8.18	.99	.63	211	79	10	32
Temik	2.28	.24	8.09	1.03	.65	207	82	11	39
Vorlex	2.23	.21	8.06	.97	.67	149	79	11	37
LSD (.05)	(.07)	(.02)	(ns)	(ns)	(.04)	(20)	(ns)	(ns)	(ns)
Variety									
Superior	2.21	.19	7.71	1.04	.54	173	80	10	31
Onaway	1.88	.17	8.04	1.24	.76	210	94	10	30
Russet Burbank	2.59	.31	8.64	.73	.62	214	73	12	46
LSD (.05)	(.11)	(.03)	(.46)	(.04)	(.07)	(14)	(11)	(1)	(7)

Table 2. Elemental composition of potato petioles for the Russet Burbank variety as affected by nitrogen rate, insecticide treatment and date of sampling.

Treatment	Elements								
	N	P	K	Ca	Mg	Mn	Fe	Cu	Zn
	%					ppm			
N-Rate									
75	2.41	.28	7.89	.75	.70	281	74	10	36
150	2.55	.31	7.59	.82	.75	363	77	11	42
300	2.74	.36	7.60	.77	.72	418	81	13	48
LSD (.05)	(.13)	(.03)	(ns)	(ns)	(.06)	(37)	(ns)	(1)	(3)
Insecticide									
Check	2.51	.32	7.80	.82	.74	403	83	11	44
DiSyston	2.50	.30	7.62	.80	.71	390	73	10	38
Temik	2.61	.33	7.68	.78	.73	350	76	12	45
Vorlex	2.67	.32	7.67	.71	.71	274	76	11	40
LSD (.05)	(.10)	(ns)	(ns)	(.06)	(ns)	(43)	(ns)	(1)	(4)
Sample Date									
7-14-77	2.59	.31	8.64	.73	.61	214	73	12	46
8- 9-77	2.55	.32	6.74	.83	.83	494	81	11	37
LSD (.05)	(ns)	(ns)	(.38)	(.06)	(.08)	(57)	(ns)	(ns)	(3)

Table 3. Magnesium content of potato petioles as affected by three treatment interactions.

	Insecticide Treatments				Varieties		
	Check	DiSyston	Temik	Vorlex	Onaway	Superior	Russet Burbank
	% Mg				% Mg		
N-Rate							
75	.59	.61	.67	.69	.53	.80	.58
150	.65	.61	.64	.63	.52	.75	.62
300	.56	.66	.66	.68	.55	.71	.65
				LSD (.05) = .07			LSD (.05) = .07
Variety							
Superior	.47	.54	.57	.56			
Onaway	.68	.75	.79	.81			
Russet Burbank	.64	.60	.61	.63			
				LSD (.05) = .09			

Table 4. Iron content of potato petioles as affected by a variety x nitrogen treatment interaction.

Variety	N Rate (lbs/A)		
	75	150	300
	------- ppm Fe ------		
Superior	68	79	92
Onaway	97	95	89
Russet Burbank	69	71	80

LSD (.05) = 16

Table 5. Nitrogen content of potato petioles as affected by a variety x insecticide interaction.

Variety	Insecticide			
	Check	DiSyston	Temik	Vorlex
	---------------- % N ---------------			
Superior	2.19	2.27	2.27	2.12
Onaway	1.82	1.80	1.97	1.91
Russet Burbank	2.51	2.58	2.60	2.66
				LSD (.05) = .16

Table 6. Potassium content of Potato Petioles as affected by a variety x nitrogen interaction.

Variety	N Rate (lbs/A) 75	150	300
	-------	% K	------
Superior	8.00	7.73	7.40
Onaway	8.00	7.78	8.35
Russet Burbank	8.90	8.65	8.38

LSD (.05) = .61

Table 7. Elemental composition of potato petioles for three varieties at the low nitrogen rate as affected by insecticide treatments.

Insecticide Treatment	N	P	K	Ca	Mg	Mn	Fe	Cu	Zn
	%					ppm			
					Superior				
Check	2.08	.16	7.32	.98	.46	160	74	8	24
DiSyston	2.16	.18	8.72	.99	.50	167	59	8	21
Temik	2.04	.20	8.15	1.19	.57	164	77	11	27
Vorlex	2.00	.16	7.80	.95	.60	85	62	8	49
LSD (.05)	(ns)	(ns)	(.70)	(ns)	(ns)	(52)	(12)	(2)	(ns)
					Onaway				
Check	1.75	.16	8.09	1.30	.74	215	100	10	28
DiSyston	1.88	.18	8.04	1.33	.80	228	108	10	32
Temik	1.82	.16	8.04	1.21	.81	176	84	10	28
Vorlex	1.70	.16	7.80	1.24	.86	125	98	11	26
LSD (.05)	(ns)	(ns)	(ns)	(ns)	(ns)	(49)	(ns)	(ns)	(ns)
					Russet Burbank				
Check	2.46	.30	9.47	.70	.56	229	59	10	42
DiSyston	2.50	.28	8.64	.66	.54	189	68	10	39
Temik	2.52	.30	8.75	.73	.63	171	80	13	44
Vorlex	2.66	.31	8.73	.64	.60	108	70	10	40
LSD (.05)	(ns)	(ns)	(ns)	(ns)	(ns)	(36)	(ns)	(ns)	(ns)
					Overall Average				
Check	2.10	.20	8.29	.99	.59	201	78	9	31
DiSyston	2.18	.21	8.47	.99	.61	195	79	10	31
Temik	2.12	.22	8.32	1.04	.67	171	80	11	33
Vorlex	2.12	.21	8.11	.94	.69	106	77	10	38
LSD (.05)	(ns)	(ns)	(ns)	(ns)	(.07)	(24)	(ns)	(ns)	(ns)

INFLUENCE OF SELECTED PRODUCTION MANAGEMENT INPUTS ON THE YIELD, QUALITY, STORABILITY OF RUSSET BURBANK, ONAWAY AND SUPERIOR POTATOES

Arthur L. Wells and Mark Otto
Department of Entomology

The foliar insect populations on the plots in the integrated project were monitored to determine the efficacy of the systemic insecticides and when foliar applications would be needed. The plots were first sampled on June 27 by taking 10 sweeps on the foliage with an insect net on each of the four replications of each variety. The samples were then tabulated and although other insects were present their low numbers are not included here with the data on the potato leafhopper and Colorado potato beetle which are presented in Tables 1 and 2. Since the counts indicated populations of both insects were highest on the untreated plots it was decided to apply a foliar insecticide on July 5. Applications were then made on all of the plots on July 11 and the insects sampled again on July 15. At this time only the check plots had any significant numbers of potato beetles which had probably emerged after the foliars had been applied.

Samples were taken from the Burbanks on July 27 at which time the potato beetle adults were lowest on the Temik treated plots. The foliage on the other varieties was nearing maturity so sampling was discontinued. The plots were sprayed again on August 5 and the Burbanks only on August 13 and 20. The treatments and dates of application are summarized in Table 1. The harvest dates and data are presented in the previous report so are not repeated here.

Summary

The data indicate the value of the systemic treatments on early leafhopper reproduction since only the untreated plots had any significant numbers of nymphs. These did not develop after the spray treatments were started. Only the Temik treatments reduced the numbers of first generation potato beetle larvae on the plots. The early control is reflected in the adult numbers in July after the spray program had started.

Table 1. Seasonal Development of Potato Leafhopper Populations on the Potato Varieties in the Integrated Project

	Superior				Onaway				Russet Burbank					
	June 27		July 15		June 27		July 15		June 27		July 15		July 27	
Plot Treatments*	Adult	Nymph**	Adult	Nymph	Adult	Nymph	Adult	Nymph	Adult	Nymph	Adult	Nymph	Adult	Nymph
(50 lb N)														
Check	4	24	1	0	10	21	1	0	45	0	1	0	0	0
Disyston 15G 3 lb	0	1	2	0	2	0	1	0	4	0	4	0	1	0
Temik 15G 3 lb	1	0	0	0	0	0	0	0	5	0	0	0	0	0
Vorlex + Disyston	0	1	0	0	0	4	0	0	4	0	3	0	0	0
(150 lb N)														
Check	19	19	2	0	13	23	2	0	7	0	3	0	2	0
Disyston 15G 3 lb	0	3	0	0	0	2	2	0	6	0	3	0	0	0
Temik 15G 3 lb	0	2	0	0	0	0	1	0	2	0	0	0	0	0
Vorlex + Disyston	0	5	3	0	1	0	2	0	5	0	3	0	0	0
(300 lb N)														
Check	2	30	0	0	13	28	0	0	15	0	4	0	2	0
Disyston 15G 3 lb	0	1	3	0	1	1	0	0	8	0	2	0	3	0
Temik 15G 3 lb	0	0	0	0	1	0	0	0	1	0	0	0	0	0
Vorlex + Disyston	2	7	0	0	2	1	0	0	3	0	2	0	0	0

*Granular treatments applied in fertilizer band at planting (rates based on 34 in. rows). Insecticide foliar sprays applied to the plots at recommended rates as follows: July 5 (Check plots only) - Thiodan; July 11 - Monitor; Aug. 5 - MetaSystox R; Aug. 13 - Thiodan (Burbanks only); Aug. 20 - Thiodan (Burbanks only).

**Total insects per 40 sweeps (10 per replication) on each sampling date.

Table 2. Seasonal Development of Colorado Potato Beetle Populations on the Potato Varieties in the Integrated Project

	Superior				Onaway				Russet Burbank					
	June 27		July 15		June 27		July 15		June 27		July 15		July 27	
Plot Treatments*	Adult	Larva**	Adult	Larva	Adult	Larva	Adult	Larva	Adult	Larva	Adult	Larva	Adult	Larva
(50 lb N)														
Check	0	53	17	2	0	75	26	1	0	5	1	0	6	10
Disyston 15G 3 lb	1	19	9	3	0	8	3	0	0	21	0	12	24	2
Temik 15G 3 lb	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Vorlex + Disyston	0	27	3	0	1	26	12	0	0	14	0	1	5	0
(150 lb N)														
Check	1	19	8	4	1	60	13	0	0	61	5	0	13	10
Disyston 15G 3 lb	0	32	11	2	0	14	2	1	0	17	0	0	18	0
Temik 15G 3 lb	0	0	0	0	0	2	0	0	0	0	0	0	2	0
Vorlex + Disyston	0	39	10	5	0	13	5	1	0	24	0	8	19	3
(300 lb N)														
Check	0	73	10	1	0	48	5	0	0	67	26	2	16	5
Disyston 15G 3 lb	1	29	6	3	0	15	6	2	0	5	3	5	24	1
Temik 15G 3 lb	0	1	0	0	0	0	0	0	1	0	0	0	4	0
Vorlex + Disyston	0	27	16	1	0	10	2	0	0	14	2	6	33	3

*For insecticide rates and application data refer to Table 1.

**Total insects per 40 sweeps (10 per replication) on each sampling date.

VARIETY AND SEEDLING EVALUATION

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Six replications of sixteen varieties and advanced seedlings were planted at the Montcalm Experimental Farm on May 3 in three complete blocks. A block was then harvested on August 9, September 1 and September 27 to determine the stage of growth at which economical marketable yields could be produced.

Dry weather with high temperatures at planting time and throughout much of the growing season adversely affected both yield and quality. The abnormally high rainfall in September delayed the last harvest date.

While yields were lower than in 1976 both Atlantic and AK 37-19 produced the highest yields and highest solids at the August 9 harvest. Both varieties made good potato chips. In the later harvests Katahdin and the seedlings A 6789-7, Ms 711-8 and Ms 706-34 produced the high yields. All are good general purpose table varieties.

In the seedling trials, yields of the very early selections were much lower than in 1976. Eighteen of the thirty-eight seedlings continued to make good chips and demonstrated their potential as chipping varieties. Many of the new introductions have a golden flesh color which makes a most attractive chip.

Cooking trials, where cultivars are evaluated for general culinary qualities, mealiness, after cooking darkening, etc. will be completed in January. All potential chip varieties will be reconditioned from 40° storage and chipped.

Three seedlings in the trials have been named; Michimac (Ms 711-8), Michigami (Ms 706-34) and Denali (AK 37-19).

Seed of all entries in the tests was increased on the Lennard Farm in Emmet County where yields were good. High quality seed is available to plant all variety yield trials on the Montcalm Experimental Farm in 1978.

Research supported by a grant from the Michigan Potato Industry Commission.

Variety Yield Trials 1977
Montcalm Experimental Farm
Yield of Marketable Tubers in Cwt/Acre

HARVESTED

Variety	Aug. 9 Cwt/A	Aug. 9 Specific Gravity	Aug. 9 Chip Color	Sept. 1 Cwt/A	Sept. 1 Specific Gravity	Sept. 1 Chip Color	Sept. 27 Cwt/A	Sept. 27 Specific Gravity	Sept. 27 Chip Color
A6789-7	190	1.066	3	384	1.072	2	448	1.068	6
Katahdin	145	1.057	4	410	1.070	3	424	1.071	3
Ms 711-8	151	1.060	3	363	1.069	3	392	1.069	4
Ms 706-34	146	1.062	5	412	1.066	5	370	1.070	5
AK 37-19	237	1.084	2	304	1.087	2	292	1.081	3
Rus. Burbank	150	1.070	4	239	1.074	2	275	1.072	4
Monona	181	1.066	1	278	1.077	2	267	1.066	1
Atlantic	250	1.085	1	318	1.088	1	264	1.084	2
Jewel	174	1.081	1	250	1.086	1	250	1.082	1
Onaway	195	1.066	4	215	1.065	5	229	1.068	6
Oneida	167	1.073	3	226	1.077	2	173	1.071	2
Superior	135	1.070	2	157	1.070	1	165	1.067	4
Norchip	130	1.076	1	164	1.076	1	158	1.074	2
Ms 003-69	135	1.070	1	173	1.086	1	150	1.079	1
Cent Russet	150	1.068	5	198	1.070	3	134	1.064	3
Wischip	118	1.080	1	147	1.072	1	115	1.068	1

Potential Chipping Seedlings 1977
Montcalm Experimental Farm

Progeny No.	Flesh Color	Yield Cwt/A	Maturity	Specific Gravity	Chip color 9/12	Chip color 10/11
305-19	Yellow	640	V. Late	1.075	2	3
004-408	Yellow	398	Medium	1.078	1	2
004-377	Yellow	296	Medium	1.077	2	2
002-302	Yellow	257	Medium	1.075	2	3
203-2	Yellow	242	V. Early	1.073	1	1
402-1	Cream	242	Early	1.062	1	2
401-1	White	211	Early	1.074	2	2
004-198	Yellow	203	V. Early	1.075	1	1
004-439	White	203	Medium	1.081	1	3
002-171	Yellow	195	V. Early	1.075	1	2
404-2	Cream	195	Early	1.074	1	3
402-5	Yellow	187	V. Early	1.071	1	2
403-2	White	179	V. Early	1.075	1	3
003-69	Yellow	164	V. Early	1.079	1	1
407-1	White	140	V. Early	1.063	1	2
404-1	White	117	V. Early	1.072	1	1
402-6	White	109	V. Early	1.068	2	3
402-4	White	94	V. Early	1.076	2	2

Potential Table Stock Seedlings 1977

Montcalm Experimental Farm

Progeny No.	Flesh Color	Yield Cwt/A	Maturity	Specific Gravity
305-22	White	484	Medium	1.069
308-4	White	406	Medium	1.085
004-169	White	382	Early	1.084
108-5	White	320	Medium	1.071
002-152	White	304	Late	1.078
004-506	White	304	Medium	1.071
305-15	Yellow	265	Early	1.059
231-1	White	187	Early	1.066
402-3	White	164	Early	1.080
202-2	Yellow	133	V. Early	1.071

INFLUENCE OF EXPERIMENTAL NEMATICIDES ON CONTROL OF ROOT-LESION NEMATODES AND POTATO YIELDS

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Eleven formulations of nematicides were evaluated for control of root-lesion nematodes (Pratylenchus penetrans) associated with the growth and development of potatoes (cv Superior) at the Michigan State University Montcalm Potato Research Farm. Each treatment was replicated four times in a randomized block design, with each plot consisting of four rows, 34 inches apart and 50 ft in length. The fumigant nematicides were injected into the soil to a depth of 6 to 8 inches on April 21, 1977. Soil samples were taken for nematode analysis immediately before application of the soil fumigants. The non-fumigant nematicides and DiSyston 15G insecticide were applied at planting on May 13, 1977. Soil and root samples for nematode analysis (centrifugation-flotation and shaker techniques, respectively) were taken at mid-season (July 13, 1977) and at harvest (August 25, 1977). The center two rows of each plot were harvested and analyzed for quality. During the growing season the plants were maintained under normal commercial fertility, irrigation, insect control and disease control practices.

There were no significant differences in the initial soil nematode population densities among the experimental plots, and in all cases the population densities were above the economic threshold levels for cv Superior grown in mineral soil under Michigan conditions (see Table). All of the pesticide treatments resulted in good nematode control. The best control, however, was obtained with Temik 15G at 3.0 lb a.i./acre. For the second year in a row, this treatment provided season-long nematode control. This conclusion is based on several additional tests conducted in 1976 and 1977. Nemacur 15G may have provided a similar response in this test. Unfortunately, it was learned in another field test in 1977 that the insecticide standard (DiSyston 15G 3.0 lb a.i./acre) is providing about 20% control of P. penetrans. While this is not good enough for commercial nematode control, it has a significant detrimental influence on the experimental results.

The only treatment that resulted in a significant increase in potato yields was Vorlex at 10 gal/acre. This result is very different than that obtained in 1974, 1975 and 1976. A possible explanation for this may be that the soil was extremely dry and warm at planting. This could have prevented optimum movement of the carbamate and phosphate nematicides in the soil and lessened the amount of early-season nematode control. This is by far the most important time for maximum control of root-lesion nematodes associated with cv Superior potatoes.

The higher rate of Dacamox appeared to have greater nematicidal activity than the lower rate.

Influence of eleven nematicides on the control of Pratylenchus penetrans associated with cv Superior potatoes grown in mineral soil in Michigan in 1977.

Treatment and rate per acre (a.i.)	P. penetrans per 100 cm^3 soil			P. penetrans per g root		Yield (ctw/A)
	4/21/77	7/13/77	8/25/77	7/13/77	8/25/77	
Check (nontreated) + DiSyston 15G 3 lb/A	26a[1]	28a	99a	46a	90a	225a
Vorlex 10 gal/A + DiSyston 15G 3 lb/A	30a	3b	11b	4b	60ab	310b
NA055 10 gal/A + DiSyston 15G 3 lb/A	41a	1b	17b	20ab	64a	248ab
Mocap 10G 2 lb/A + DiSyston 15G 3 lb/A	33a	16ab	17b	7b	12b	273ab
Temik 15G 3 lb/A	48a	12ab	11b	0b	4b	262ab
Dasanit 15G 5 lb/A + DiSyston 15G 3 lb/A	18a	14ab	4b	4b	22ab	233ab
Furadan 10G 3 lb/A	19a	7ab	28b	4b	8b	239ab
Nemacur 15G 3 lb/A	15a	13ab	6b	1b	4b	220a
Nemacur 4SC 3 lb/A	14a	18ab	22b	2b	6b	270ab
Vydate 10G 2 lb/A	23a	7ab	52b	0b	34ab	229ab
Dacamox 10G 3 lb/A	25a	2b	19b	18ab	27ab	282ab
Dacamox 10G 5 lb/A	28a	1b	8b	6b	12b	251ab

[1] The column means followed by the same letter are not significantly different (P=0.05) according to the

SOIL INSECT RESEARCH -- 1977

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Wireworms and white grubs often cause extensive feeding damage to the underground portion of potato plants especially to the tubers. This damage usually results in the lowering of grade or to the rejection of the crop by a buyer. These insects are usually most severe when new land which has been in a grass crop is brought into potato production. If the normal food such as grass roots is destroyed before the insects complete their development they will continue to feed on the roots of any growing crop such as potatoes. Current control programs for wireworms include broadcast applications of an organophosphate insecticide incorporated prior to planting. The only material currently labeled for white grub control is chlordane which is a chlorinated hydrocarbon. The residue problems associated with chlordane in the potato waste from processing plants can restrict its use when the wastes are fed to livestock. The current status of the chlordane registration make it imperative that alternate control programs be studied.

Methods

A plot to evaluate thirty different treatments including experimental materials as well as registered insecticide was established at the Norman Crook farm in Montcalm County. The plot was established in a fallow field which had been selected for its location and anticipation of an infestation of soil insects. The treatments were applied in six replications of 25 foot plots in a randomized design. The outside and every third row was left untreated so each treated row could be compared with an adjacent untreated row. This plot lay-out was done to assure adequate statistical analysis of the data since the soil insect population is often not evenly distributed over an area. Five foot alleys were left untreated between the replications.

The broadcast applications were applied in water at 50 gal. per acre or as granules to the soil surface and incorporated to approximately 6 in. with a rototiller. The wide band treatments were applied as granules to a one foot wide strip (above the seed row) on the soil surface and lightly incorporated with a rake until incorporated by the opening shoes of the planter. The preplant soil treatments were applied on May 16 and the plots were planted with Superior seed with a 16 row planter on May 17. The covering discs were removed from the planter so the soil systemics Temik (aldicarb) or Furadan (carbofuran) could be applied in a band in the seed furrow of certain plots. All of the plots were then covered in another operation. The plots were fertilized, and maintained by the grower similar to the rest of the field.

The plots were killed with vine killer in mid September and four hills selected at random from each plot for soil insect evaluation. The soil around the tubers was sifted to determine the numbers of wireworms, white grubs and cutworms associated with the tubers. The tubers were then placed in sacks, counted, weighed and taken to the laboratory for damage evaluation. The sampling operation for the 1200 hills took approximately 3 weeks to complete. The plot harvester from the Montcalm Experimental Farm was then used to harvest the plots and yield and tuber size from the treated plots were determined. A sample for specific gravity analysis of the tubers was saved at this time.

The hill samples were washed at our Collins Rd. research laboratory and the tubers were counted and rated for wireworm damage on a scale depending on number and severity of feeding scars:

Class 1 -- No feeding scars
Class 2 -- One to two minor feeding scars
Class 3 -- Two to three scars in one area
Class 4 -- Three to five scars in separated areas
Class 5 -- Extensive feeding damage

(A photograph to portray these damage classes is available.) The damage ratings of the individual tubers were combined to give a mean tuber rating per hill. The hill ratings for the four sample hills in each replication were compared statistically to the adjacent untreated hills. The numbers of wireworms associated with each of the hills were analyzed similarly. Since there were very few white grubs or their damage present they were not analyzed. The list of treatments, placement, wireworms per hill, mean tuber rating and percent of tubers in each damage class are presented in Table 1.

Results

It is unfortunate that the white grub populations were too low to evaluate since efficacy data for their control is greatly needed. The data from the wireworm numbers and damage, however, were very helpful in evaluating the efficacy of the different treatments. The numbers per hill although rather low, were evenly distributed over the plots since no significant differences were present between the untreated plots and can be assumed to have been present similarly in the treated plots. A summary of the data from the untreated plots are summarized below:

Wireworms per hill		3.0
Percent tubers damaged		65%
Damage rating per tuber		2.2
Percent of tubers in:		
Class 1	35%	
Class 2	26%	
Class 3	20%	
Class 4	13%	
Class 5	6%	

These results indicate that the low numbers (3.0 per hill) caused damage to 65% of the tubers with a large percentage of these being unmarketable (Classes 3-5). Control programs would therefore be warrented for these populations to make the tubers marketable for most uses. Several of the treatments especially those including the systemic insecticides significantly reduced the wireworm populations and/or the damage ratings. The damage ratings are best exemplified in the class distributions.

The broadcast treatments especially the liquid applications are most usable in a production program using incorporated herbicides to avoid an additional planting step. These could be followed by systemic treatments at the time of planting. The wide band placement could be used at the time of planting but would require additional granular applicators if the systemics were being applied at the same time. The physical properties of most of the treatments would require more incorporation than is provided on a planter of this type. It is possible that an attachment could be developed for this use. The systemic treatments alone also showed activity against this wireworm population, however their efficacy on higher populations may be limited.

There were no significant differences between the plot yields that could be attributed to the treatments. There were also no differences between the specific gravities of the tubers in any of the plots. Residue samples from certain treatments (chlordane and Mocap) were submitted to analytical laboratories for residue analysis to provide data for future registrations.

Table 1. List of Treatments and Wireworm Damage Data from the Research Plot

Treatment and lb ai/A	Placement*	Mean wireworms /hill	Mean tuber rating**	Percent tubers in Class 1	2	3	4 & 5	Yield (cwt/A)
Furadan 10 G 3 lb	Band	1.04a	1.53c	64	22	10	4	536
Untreated	--	2.92	2.23	34	29	22	15	
Temik 15 G 3 lb	Band	1.88c	1.85a	54	25	12	9	605
Untreated	--	3.04	2.37	38	18	25	19	
Chlordane 8 E 4 lb	Brdcst	0.83c	1.64a	61	21	10	8	548
Untreated	--	2.75	2.24	36	25	18	21	
Chlordane 8 E 4 lb	Brdcst							
+ Furadan 10 G 3 lb	Band	0.63a	1.13b	88	9	2	1	496
Untreated	--	2.41	2.30	37	24	21	18	
Chlordane 8 E 4 lb	Brdcst							
+ Temik 15 G 3 lb	Band	0.58a	1.40b	71	18	8	3	528
Untreated	--	3.92	2.44	30	26	24	20	
Chlordane 33 G 2 lb	Wd Bnd	1.71c	2.11a	44	20	19	17	499
Untreated	--	2.67	2.59	28	26	20	26	
Chlordane 33 G 2 lb	Wd Bnd							
+ Temik 15 G 3 lb	Band	1.04c	1.43a	73	17	7	3	563
Untreated	--	1.46	1.72	53	29	12	6	
Dyfonate 4 E 4 lb	Brdcst	1.33c	1.84c	52	26	14	8	556
Untreated	--	2.54	2.33a	37	27	20	16	
Dyfonate 4 E 4 lb	Brdcst							
+ Furadan 10 G 3 lb	Band	0.21b	1.14b	91	9	0	0	585
Untreated	--	2.17	2.32	29	27	27	17	
Dyfonate 4 E 4 lb	Brdcst							
+ Temik 15 G 3 lb	Band	0.71a	1.49c	65	25	7	3	586
Untreated	--	2.75	2.13	40	27	16	17	
Dyfonate 10 G 2 lb	Wd Bnd							
+ Temik 15 G 3 lb	Band	1.29b	1.58a	60	25	10	5	587
Untreated	--	2.92	2.31	34	27	21	18	
Dasanit 15 G 5 lb	Brdcst	1.08a	1.62c	61	25	8	6	538
Untreated	--	2.42	2.41	32	26	19	23	
Dasanit 15 G 5 lb	Brdcst							
+ Furadan 10 G 3 lb	Band	0.42a	1.14b	88	9	2	1	575
Untreated	--	3.88	2.31	32	32	16	20	
Dasanit 8 SC 5 lb	Brdcst	1.79	1.80	63	18	12	7	583
Untreated	--	2.58	2.29	33	25	26	16	

Treatment and lb ai/A	Placement	Mean wireworms /hill	Mean tuber rating	Percent tubers in Class 1	2	3	4 & 5	Yield (cwt/A)
Dasanit 8 SC 5 lb	Brdcst							
+ Furadan 10 G 3 lb	Band	0.29b	1.18b	88	10	1	1	537
Untreated	--	1.79	2.19	41	26	16	17	
Dasanit 15 G 2 lb	Wd Bnd	2.04	2.37	38	21	20	21	528
Untreated	--	2.67	2.31	35	29	20	16	
Dasanit 15 G 2 lb	Wd Bnd							
+ Furadan 10 G 3 lb	Band	1.08b	1.33b	80	10	7	3	545
Untreated	--	4.04	2.66	24	30	19	27	
Dasanit 10 - Disyston 5 G								
6 lb(4 + 2 lb)	Band	0.67b	1.43b	71	18	7	4	538
Untreated	--	3.67	2.48	27	27	26	20	
Bendiocarb 76 WP 4 lb	Brdcst	1.17a	1.78c	57	21	14	8	576
Untreated	--	2.38	2.14	40	28	19	13	
Bendiocarb 76 WP 4 lb	Brdcst							
+ Temik 15 G 3 lb	Band	0.50b	1.43a	74	17	4	5	623
Untreated	--	3.46	2.23	39	28	18	15	
Isozophos 4 E 4 lb	Brdcst	0.83a	1.28b	80	14	4	2	518
Untreated	--	3.58	2.48	29	29	22	20	
Isozophos 4 E 4 lb	Brdcst							
+ Temik 15 G 3 lb	Band	0.13b	1.18b	88	8	3	1	507
Untreated	--	2.88	2.42	40	22	18	20	
Isozophos 20 G 2 lb	Wd Bnd							
+ Temik 15 G 3 lb	Band	0.33b	1.24a	83	11	3	3	521
Untreated	--	1.83	2.04	45	24	17	14	
Counter 15 G 2 lb	Wd Bnd							
+ Temik 15 G 3 lb	Band	1.04a	1.47b	71	19	7	3	555
Untreated	--	3.33	2.38	31	24	18	27	
Ethoprop 10 G 3 lb	Brdcst	0.29a	1.26a	85	10	4	1	517
Untreated	--	2.88	2.39	29	27	24	20	
Ethoprop 10 G 3 lb	Brdcst							
+ Temik 15 G 3 lb	Band	0.08a	1.25b	81	14	4	1	604
Untreated	--	2.33	2.15	43	28	15	14	
Pydrin 2.4 EC 0.5 lb	Brdcst	3.50c	2.48c	32	27	20	21	566
Untreated	--	3.08	2.29	39	21	20	20	
Pydrin 2.4 EC 0.5 lb	Brdcst							
+ Temik 15 G 3 lb	Band	2.71c	1.62b	63	22	8	6	556
Untreated	--	3.17	2.20	45	22	18	15	

Treatment and lb ai/A	Place- ment	Mean wire- worms /hill	Mean tuber rating	Percent tubers in Class 1	2	3	4 & 5	Yield (cwt/A)
Oftanol 15 G 2 lb	Wd Bnd							
+ Temik 15 G 3 lb	Band	0.46b	1.36b	74	17	7	2	599
Untreated	--	3.88	2.52	23	30	23	24	
Chlorpyrifos 15 G 2 lb	Wd Bnd							
+ Temik 15 G 3 lb	Band	1.17c	1.77a	54	22	16	8	595
Untreated	--	2.96	2.35	30	31	21	18	
Untreated	--	3.88c	2.70c	24	27	23	26	499
Untreated	--	3.96	2.20	41	25	16	18	
Untreated	--	5.08b	2.84a	21	26	22	31	522
Untreated	--	2.29	2.06	44	24	18	14	

*Placement: Broadcast = Broadcast and incorporated; Wide Band = Applied on surface in 12" band and incorporated by planter; Band = In-row with seed. Rates based on 32 in-rows (15,390 row-ft/A); Liquids applied in water at a rate of 50 gal/A.

**Statistical analysis

a = Significant from adjacent untreated plot at .01 level.
b = Significant from adjacent untreated plot at .05 level.
c = Not significant from adjacent untreated plot at .05 level.

(for damage classification refer to text).

POPULATION GROWTH AND SEASONAL DEVELOPMENT OF COLORADO POTATO BEETLE

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The primary objectives of this investigation were: 1) to assess the potential growth of a Colorado potato beetle population under Michigan field conditions, 2) to determine, according to degree days, the time at which each developmental stage peaks, 3) to ascertain what effects the Colorado potato beetle has on yield when fields are left untreated with insectidides.

A 50 by 200 ft. plot was planted with Sebagos on May 12. Sampling commenced when the first beetles were sighted on June 4; it continued twice a week thereafter. Each sample site consisted of one hill (three stalks per hill). One hundred random samples were taken each sampling date and the numbers in each stage (egg, early larvae, late larvae, and adults) were recorded. By August 12, the plot was completely defoliated and sampling was terminated. The potatoes were harvested and weighed on August 26.

The seasonal development and average population of the beetle are recorded in Figure 1. This plot yielded 51.5 CWT per acre which is significantly less then the average Sebago yield of 242 CWT per acre. Other than the beetles, factors that contributed to this reduced yield were the presence of other pests and a very dry hot summer.

These data form a foundation for continuing investigations of the beetle, its effect on yield and its control.

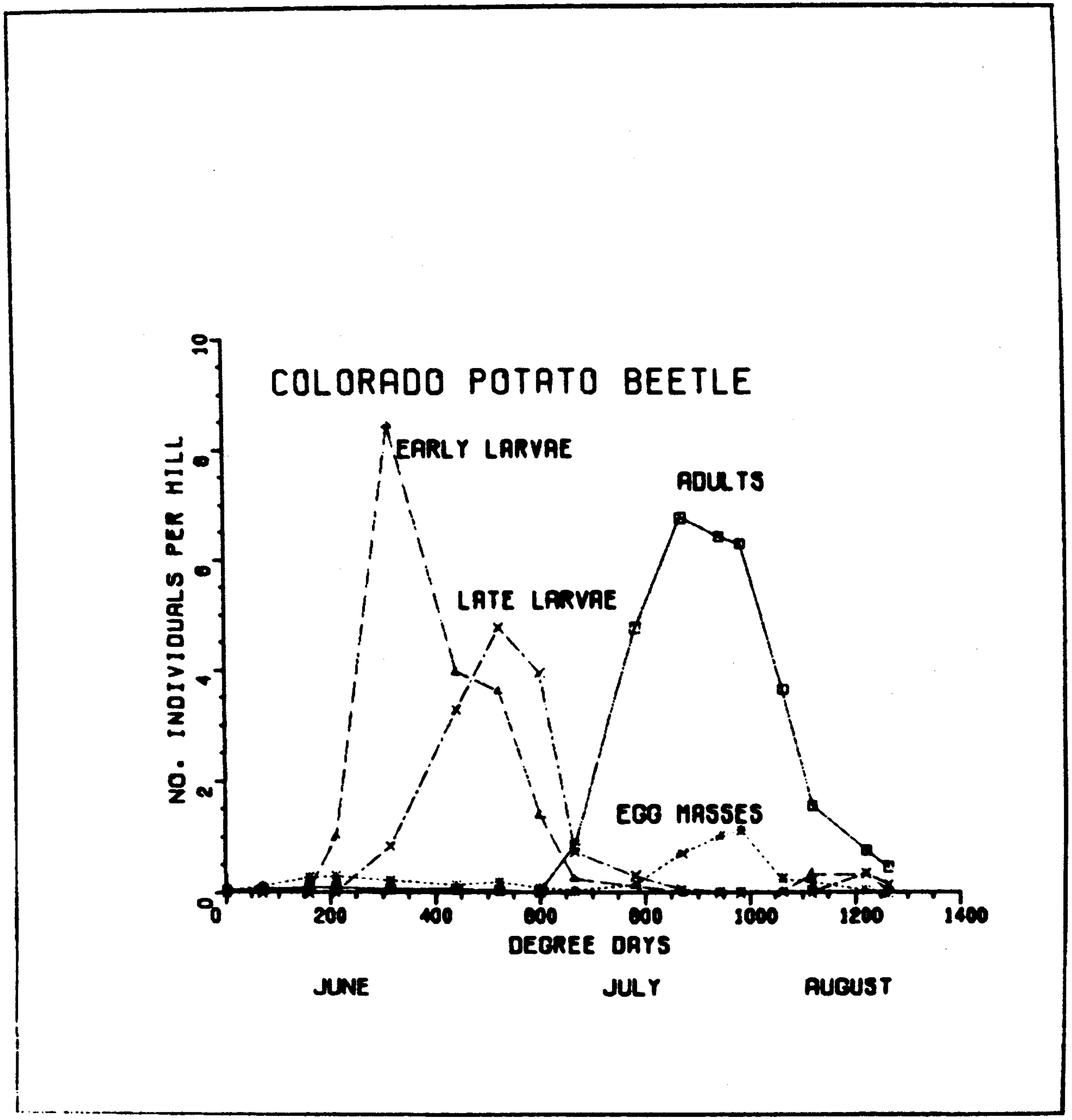
COLORADO POTATO BEETLE
EARLY LARVAE
ADULTS
LATE LARVAE
EGG MASSES
NO. INDIVIDUALS PER HILL
0
2
4
6
8
10
0
200
400
600
800
1000
1200
1400
DEGREE DAYS
JUNE
JULY
AUGUST

Fig. 1

POTATO SEED TREATMENT TRIALS

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Department of Botany and Plant Pathology

Procedure

Four chemicals alone or in combination were compared as potato seed treatment. Seed of the variety Monona was cut and treated before planting on May 10, 1977. Treatments were replicated four times and applied either by dipping the tubers for two minutes or lightly dusting the surface. Replicates of 65 treated seed pieces were planted in single row plots fifty feet long arranged in a randomized block. Row width was 34 inches with seed pieces 9 inches apart within rows.

Dysiston was used at time of planting. Additional insecticides were applied as needed in combination with fungicide sprays. Plots were irrigated periodically to maintain adequate soil moisture conditions.

Table 1. Percent Stand and Yields of Monona Potatoes with Different Chemical Seed Treatments

Treatment	% Stand	Yield cwt/A	
		U.S.#1	B Grade
Clorox (5.25% sodium hypochlorite) 1:18 w/water	86.4 b	320.4 b	7.4a
Clorox (5.25% sodium hypochlorite 1:9 w/water	87.3 b	333.7 b	6.3a
CGA 14703 (Ciba Geigy) 25WP 50 ppm	88.8 b	328.9 b	7.0a
CGA 14703 25 WP 100 ppm	90.3ab	336.2ab	6.5a
CGA 14703 25 WP 200 ppm	92.9a	338.5a	7.0a
Topsin M 2.5% dust	93.1a	353.7a	6.1a
Topsin M + Dithane M-45 1% + 5% dust	85.4 b	337.0a	6.3a
Water	74.6 d	290.0 c	4.8a
No treatment	80.0 c	302.9 c	7.4a

Results: The data summarized in Table 1 indicates that all chemical treatments had some beneficial effect on stand and that dipping cut seed in water before planting tended to increase seed piece rot. Topsin M 2½% dust treatment and CGA 14703 as a 200 ppm dip resulted in somewhat better stands than the other chemical treatments. This was reflected in the yields which tended to be higher, particularly in the case of Topsin M. None of the chemical treatments delayed germination nor were there any other indications of phytotoxicity.

DRY BEAN NEMATICIDE TRIALS

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Department of Entomology

NAVY BEANS

Five nematicides were evalutated for control of root-lesion nematodes (Pratylenchus penetrans) associated with dry bean (Sanilac) production. Each treatment was replicated five times in a randomized block design. Each plot contained four rows 50 feet in length and 34 inches apart. All materials were applied in an eight-inch band at planting on June 7, 1977. Nematode population density and yield were determined from the center two rows or each plot.

Excellent nematode control was obtained (Table 1) with all of the materials except OAC 2968. This material was also phytotoxic and not suitable for use in dry bean production. No significant (P=0.05) yield increases resulted from any of the nematicide applications (Table 1). The root-lesion nematode population densities at planting were approximately 50% lower than in early May. While the economic threshold for root-lesion nematodes associated with dry beans is not known, it appears to be higher than that for potatoes produced in mineral soils. This might result from the additional nematode mortality caused by the later planting date for dry beans. The best nematode control and highest yields in this experiment resulted from the application of Temik 15G at 2.0 lb. a.e. per acre.

KIDNEY BEANS

Three nematicides were evaluated for control of root-lesion nematodes (Pratylenchus penetrans) associated with kidney bean production (Montcalm). The experimental design and methods were the same as described for the navy bean experiment.

All of the materials resulted in good nematode control and were suitable for use in kidney bean production (Table 2). None of the pesticide treatments resulted in significant (P=0.05) increases in kidney bean yields. As in the navy bean experiment, the population densities of root-lesion nematodes were 50% lower at bean planting time than earlier in the spring. This phenomenon should result in fewer root-lesion nematode problems in dry bean production than if the crop was planted earlier. Our observations seem to indicate that navy beans are usually planted in soils less likely to have a serious root-lesion nematode problem than are kidney beans. This might indicate that the economic threshold for root-lesion nematodes associated with kidney beans is greater than that for navy beans.

Table 1. Influence of five nematicides on the control of root-lesion nematodes (*Pratylenchus penetrans*) associated with navy beans grown at the M.S.U. Montcalm Research Farm (cv Sanilac).

Treatment and rate per acre a.i.	Yield (ctw/A)	*P. penetrans*/100 cm^3 soil 6/7/77	7/21/77	8/25/77	*P. penetrans*/g root 7/21/77	8/25/77
Check	12.2a	26a	69b	40b	903a	119c
Mocap 10G (2 lb/A)	11.2a	17a	38ab	6a	56b	38bc
Furadan 10G (2 lb/A)	10.0a	8a	26a	8a	270ab	25b
Vydate 10G (3 lb/A)	12.3a	9a	38ab	1a	45b	29bc
Temik 15G (2 lb/A)	12.9a	24a	12a	3a	450ab	4a
OAC 30G (50 lb/A)	4.4b	16a	44ab	7a	1056a	97bc

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

Table 2. Influence of three nematicides on the control of root-lesion nematodes (*Pratylenchus penetrans*) associated with kidney beans grown at the M.S.U. Montcalm Research Farm.

Treatment and rate per acre a.i.	Yield (ctw/A)	*P. penetrans*/100 cm^3 soil 6/7/77	7/21/77	8/25/77	*P. penetrans*/g root 7/21/77	8/25/77
Check	14.8a[1]	20a	14a	34a	23a	90a
Furadan 10G (2 lb/A)	13.9a	15a	13a	11b	3a	5b
Temik 15G (2 lb/A)	14.5a	21a	9a	5b	5a	16b
Nemacur 15G (4 lb/A)	15.6a	20a	5a	5b	1a	5b

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

CORN HYBRIDS, PLANT POPULATION AND IRRIGATION

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

Performance data for 74 commercial corn hybrids evaluated in 1977 with irrigation and without irrigation are presented in Table 1. Thirteen inches of supplemental water were applied in 9 applications on June 17 and 24, July 6, 14, 23, 28 and August 9, 16, 26. Bouyoucous soil moisture blocks were placed at 6, 12, 18 and 24 - inch depths in both irrigated and unirrigated plot areas.

Irrigated yields averaged 51.8 bushels more than unirrigated -- 124.7 vs 72.9, an increase of 71%. Hybrids ranged from 89.4 to 158.1 irrigated and 55.5 to 88.2 bushels per acre without irrigation. Hybrids significantly better than the average yield (arranged in order of increasing moisture content at harvest) are listed below. Sixteen of the 21 hybrids were in the highest yielding group for both irrigated and unirrigated plots.

Irrigated	Not Irrigated
Pioneer 3901 (2X)	Pioneer 3901 (2X)
Michigan 4122 (2X)	Michigan 409-2X (2X)
Super Crost 2350 (2X)	Pioneer 3780 (2X)
Michigan 407-2X (2X)	Voris 2372 (2X)
Pioneer 3780 (2X)	Asgro RX 58 (2X)
Voris 2372 (2X)	Pickseed XR 44 (2X)
Asgro RX 58 (2X)	Funk G-4408 (2X)
Pickseed XR44 (2X)	Pioneer 3591 (Sp.)
Funk G-4408 (2X)	Migro M-2018X (2X)
Pioneer 3591 (Sp.)	Northrup King PX48 (2X)
Migro M-2018X (2X)	Pioneer 3535 (2X)
Northrup King PX48 (2X)	Acco UC 3002 (2X)
Pioneer 3535 (2X)	Super Crost S27 (2X)
Acco UC 3002 (2X)	ADI 197 (2X)
ADI 197 (2X)	Michigan Exp. 73-2014 (2X)
Michigan Exp. 73-2014 (2X)	Acco UC 3301 (2X)
Migro M-0301 (2X)	Northrup King PX 46 (2X)
Acco UC 3301 (2X)	
Northrup King PX 46 (2X)	
ADI 315 (2X)	

The correlation of irrigated with unirrigated yields was highly significant, .884, indicating that the hybrids tended to respond alike in both situations. During the 10-year period, 1968-1977, the correlations have ranged between .7 and .9 except for 1976 when it was .490. All have been highly significant.

Average, highest and lowest yields for corn hybrids irrigated and not irrigated for the 10-year period, 1968-1977, are given in Table 2. The average yielding hybrid has yielded 49 more bushels per acre when irrigated. The highest yielding hybrids have responded with 63 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 4.1% irrigated and 1.5% not irrigated, almost three times as much lodging on the irrigated plots. In most of the previous years, there has been less lodging when irrigated. Generally, stressed weaker plants on unirrigated plots have been more susceptible to lodging except in 1977.

Plant Population X Irrigation

Five adapted hybrids at four plant populations irrigated and not irrigated were grown in each of 10 years, 1968-1977, Table 3. Over the 10-year period, a population of 23,300 has given the highest average yield (171 bushels) when irrigated while 19,200 has given the highest yield (110 bushels) without irrigation. The 23,300 population irrigated has given the highest yield in 9 of the 10 years. The 10-year average increase due to irrigation has been 73 bushels per acre at the 23,300 population.

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

Table 1

NORTH CENTRAL MICHIGAN
Montcalm County Trial - Irrigated vs. Not Irrigated
One, Two, Three Year Averages - 1977, 1976, 1975

Zone 3

Hybrid (Brand - Variety)	% Moisture 1977	% Moisture 2 yrs.	% Moisture 3 yrs.	Bushels per acre 1977 Irrig	Bushels per acre 1977 Not Irrig	Bushels per acre 2 years Irrig	Bushels per acre 2 years Not Irrig	Bushels per acre 3 years Irrig	Bushels per acre 3 years Nor Irrig	% Stalk lodging 1977 Irrig	% Stalk lodging 1977 Not Irrig	% Stalk lodging 2 years Irrig	% Stalk lodging 2 years Not Irrig	% Stalk lodging 3 years Irrig	% Stalk lodging 3 years Not Irrig
Michigan 333-3X (3X)	24.8	22	22	109.4	66.5	127	73	133	87	1.5	0.0	2	2	2	4
Michigan 280 (4X)	25.0	22	22	100.7	62.3	117	60	119	71	9.6	2.3	8	11	9	11
Renk RK3 (2X)	25.7	--	--	104.7	62.1	---	---	---	---	3.8	4.5	--	--	--	--
Northrup King PX20 (2X)	26.0	22	22	108.4	60.0	118	59	124	77	14.5	2.3	8	3	8	4
Michigan 3093 (3X)	26.2	23	23	113.3	63.3	132	70	141	88	2.3	1.4	3	6	3	4
Northrup King PX15 (2X)	26.2	--	--	117.4	70.3	---	---	---	---	5.0	7.5	--	--	--	--
Funk G-5191 (4X)	26.5	23	--	94.7	57.6	116	64	---	---	7.5	3.2	8	5	--	--
Pride 3315 (2X)	26.8	24	--	112.8	66.9	126	63	---	---	8.0	0.7	4	1	--	--
Pioneer 3965 (3X)	26.8	--	--	108.5	63.5	---	---	---	---	0.0	0.0	--	--	--	--
Migro M-0101 (2X)	27.0	23	23	110.5	70.0	125	68	130	82	10.4	5.2	7	8	6	7
Funk G-4195 (3X)	27.2	24	23	99.9	61.4	124	63	127	78	2.5	5.0	4	16	5	12
ADI 232 (2X)	27.4	--	--	117.0	55.4	---	---	---	---	0.0	3.2	--	--	--	--
Blaney B302 (2X)	27.7	25	24	117.7	69.1	136	71	138	85	3.8	0.0	5	10	3	8
Pride 2206 (2X)	27.8	--	--	120.5	66.3	---	---	---	---	9.8	1.6	--	--	--	--
Funk G-4141 (2X)	27.9	25	24	129.4	70.3	141	73	146	87	6.9	0.8	6	7	4	5
Michigan 3102 (2X)	28.0	25	25	125.8	70.6	142	73	147	93	3.3	0.8	3	5	3	4
Super Crost S18 (2X)	28.0	--	--	108.7	64.0	---	---	---	---	1.7	0.0	--	--	--	--
Blaney B303A (2X)	28.0	25	--	110.3	61.7	136	66	---	---	9.2	5.4	10	12	--	--
Funk G-4252 (3X)	28.5	25	25	106.2	62.8	128	68	133	83	4.4	0.0	7	5	6	4
Pickseed 185 (Sp.)	28.6	23	--	110.3	60.4	121	55	---	---	10.4	3.8	11	17	--	--
Michigan 3953 (3X)	28.6	--	--	129.1	69.6	---	---	---	---	3.0	3.4	--	--	--	--
ADI 195 (2X)	28.9	--	--	89.4	55.5	---	---	---	---	6.6	1.6	--	--	--	--
Super Crost 1692 (2X)	29.0	26	25	101.6	68.3	125	68	127	80	0.0	0.0	1	5	2	5
Pioneer 3901 (2X)	29.1	--	--	148.0	82.5	---	---	---	---	3.8	0.0	--	--	--	--
Blaney B305-WX (2X)	29.1	--	--	96.9	51.5	---	---	---	---	3.4	3.6	--	--	--	--

Table 1 Continued

	Amcorn 4010 (2X)	29.2	--	--	89.2	56.5	---	---	---	---	3.4	0.0	--	--	--	--
	Pioneer 3958 (2X)	29.2	26	25	108.0	56.1	129	65	139	86	3.9	0.8	3	5	3	4
	Migro M-0105 (2X)	29.4	--	--	122.4	73.8	---	---	---	---	13.5	3.7	--	--	--	--
	Golden Harvest H-2370 (2X)	29.4	26	--	119.8	64.8	137	68	---	---	19.1	6.7	12	10	--	--
1	Michigan 4122 (2X)	29.4	26	26	136.9	75.3	158	84	165	103	3.2	3.6	3	7	3	5
	Northrup King PX32 (2X)	29.6	26	--	136.6	72.3	154	76	159	96	9.6	0.0	5	7	5	6
1	Super Crost 2350 (2X)	29.7	26	--	113.0	73.8	138	74	---	---	6.1	0.0	4	5	--	--
	Funk G-4272 (3X)	29.8	--	--	115.9	62.8	---	---	---	---	5.8	1.5	--	--	--	--
	Amcorn 4100 (2X)	29.8	27	27	119.4	73.7	139	75	139	87	6.2	6.3	7	10	7	8
	Blaney B443 (3X)	30.0	26	26	117.7	73.5	138	75	144	91	0.7	0.0	4	10	4	7
	Blaney B506 (2X)	30.0	--	--	132.3	69.1	---	---	---	---	9.3	2.3	--	--	--	--
1,2	Michigan 407-2X (2X)	30.1	27	27	142.5	84.0	160	82	163	101	2.7	0.0	2	6	2	4
	Northrup King PX34 (2X)	30.4	--	--	131.2	71.3	--	---	---	---	2.1	0.0	--	--	--	--
	Blaney EX7305 (2X)	30.6	27	27	112.8	63.6	141	71	146	92	0.0	0.0	2	6	2	6
1,2	Pioneer 3780 (2X)	30.6	27	28	150.8	88.2	165	85	165	101	1.4	0.0	3	8	3	7
1,2	Voris 2372 (2X)	30.7	--	--	143.4	82.2	---	---	---	---	3.7	0.0	--	--	--	--
	Pride 4404 (2X)	30.9	27	27	126.3	69.1	148	72	155	91	1.5	0.0	2	4	2	3
	Wolverine W166 (2X)	31.0	27	27	122.3	66.1	144	67	156	91	1.5	0.8	3	3	4	5
	Michigan 410-2X (2X)	31.0	28	27	130.5	77.4	150	78	153	96	5.3	0.0	6	5	6	5
	Trojan TXS105A (2X)	31.2	--	--	129.7	79.0	---	---	---	---	1.6	0.7	--	--	--	--
	Migro M-2022X (2X)	31.3	--	--	134.1	79.1	---	---	---	---	3.5	0.0	--	--	--	--
	Michigan 5443 (3X)	31.3	28	28	128.8	76.8	149	77	155	96	5.8	2.3	4	8	4	7
1,2	Asgro RX58 (2X)	31.4	28	--	145.2	82.1	158	79	---	---	6.4	0.0	5	8	--	--
1,2	Pickseed XR44 (2X)	31.4	29	--	136.7	80.1	158	85	---	---	3.8	2.3	3	8	--	--
1,2	Funk G-4408	31.5	--	--	136.8	86.5	---	---	---	---	0.8	0.0	--	--	--	--
	Michigan 5802 (2X)	31.5	29	29	132.7	79.0	155	84	166	106	3.0	2.8	3	9	2	6
1,2	Pioneer 3591 (Sp.)	31.6	--	--	139.1	84.8	---	---	---	---	0.0	0.0	--	---	--	--
	Golden Harvest H-2450 (2X)	31.6	28	--	125.2	77.8	148	79	---	---	3.1	6.6	2	14	--	--
	Funk G-4444 (2X)	31.6	28	28	130.2	77.1	157	78	160	97	5.4	0.7	3	11	3	8
	Acco UC2301 (2X)	31.6	27	26	122.1	67.3	142	72	147	92	3.5	3.8	3	11	4	13

Table 1 Continued

1,2	Migro M-2018X (2X)	31.7	--	--	142.3	84.5	---	---	---	---	2.2	0.0	--	--	--	--
1,2	Northrup King PX48 (2X)	31.7	--	--	143.5	87.8	---	---	---	---	5.9	0.8	--	--	--	--
1,2	Pioneer 3535 (2X)	31.8	30	30	145.8	87.4	157	81	171	106	0.0	0.0	1	1	1	1
	Voris X380 (2X)	31.8	--	--	120.5	78.3	---	---	---	---	8.4	2.3	--	--	--	--
	Michigan 575-2X (2X)	31.8	30	29	130.4	75.0	150	76	156	95	3.0	0.0	3	3	4	4
	Amcorn 7480 (2X)	32.0	--	--	131.0	77.7	---	---	---	---	0.0	0.8	--	--	--	--
1,2	Acco UC3002 (2X)	32.0	--	--	142.1	81.8	---	---	---	---	2.8	0.0	--	--	--	--
	Northrup King PX529 (3X)	32.0	--	--	121.2	76.1	---	---	---	---	0.7	0.0	--	--	--	--
2	Super Crost S27 (2X)	32.1	29	29	130.0	81.4	155	84	157	103	0.0	1.6	1	11	1	9
	Amcorn 7300 (2X)	32.1	27	27	131.1	77.9	151	81	149	95	0.8	1.5	1	13	3	11
1,2	ADI 197 (2X)	32.2	--	--	148.9	86.6	---	---	---	---	4.5	0.0	--	--	--	--
	Renk RK66 (2X)	32.2	--	--	127.6	72.8	---	---	---	---	1.5	0.0	--	--	--	--
	Funk G-4321A (2X)	32.3	30	--	129.4	78.3	151	79	---	---	0.0	0.0	0	9	--	--
1,2	Michigan EXP73-2014 (2X)	32.4	--	--	158.1	87.8	---	---	---	---	0.8	0.0	--	--	--	--
	Blaney B606 (2X)	32.4	29	28	121.0	76.7	146	84	156	104	0.9	0.0	1	2	2	2
1	Migro M-0301 (2X)	33.4	31	--	142.7	76.5	158	82	---	---	2.3	1.6	3	4	--	--
1,2	Acco UC3301 (2X)	33.5	31	31	141.7	80.0	158	80	174	31	2.2	2.4	2	10	2	7
1,2	Northrup King PX46 (2X)	33.6	--	--	140.4	80.5	---	---	---	---	2.2	0.7	--	--	--	--
1	ADI 315 (2X)	34.1	--	--	136.5	75.5	---	---	---	---	0.0	0.0	--	--	--	--
	Average	30.0	26	26	124.7	72.9	142	74	148	92	4.1	1.5	4	7	4	6
	Range	24.8 to 34.1	22 to 31	22 to 31	89.4 to 158.1	55.5 to 88.2	116 to 165	55 to 85	119 to 174	71 to 106	0.0 to 19.1	0 to 7.5	0 to 12	1 to 17	1 to 9	1 to 13
	Least significant difference	1.5	1.0	0.7	11.7	7.0	8	6	5	5						

1 Significantly better than average yield, irrigated, 1977.
2 Significantly better than average yield, not irrigated, 1977.

Table 2. Average, highest and lowest yields for corn hybrids irrigated and not irrigated for 10 years, 1968-1977.

Year	No. of Hybrids Tested	AVERAGE		HIGHEST		LOWEST	
		Irrigated	Not Irrigated	Irrigated	Not Irrigated	Irrigated	Not Irrigated
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		141	92	180	117	93	61

Table 3. Average yield at four plant populations irrigated and not irrigated for 10 years, 1968-1977.

Year	15,200		19,200		23,300		27,400	
	Irrigated	Not Irrigated	Irrigated	Not Irrigated	Irrigated	Not Irrigated	Irrigated	Not Irrigated
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	95	162	110	171	98	153	90