PERFORMANCE OF MULTIPLE-EARED INBRED LINES IN THREE-WAY HYBRIDS

Thesis for the Degree of M. S.

MICHIGAN STATE UNIVERSITY

Farrell M. Bagshaw

1959

PERFORMANCE OF MULTIPLE-EARED INBRED LINES IN THREE-WAY HYBRIDS

By

FARRELL M. BAGSHAW

A THESIS

Submitted to the School of Graduate Studies of Michigan State University of Agriculture and Applied Science in partial fulfillment of the requirements of

MASTER OF SCIENCE

Department of Farm Crops

1959

PERFORMANCE OF MULTIPLE-EARED INBRED LINES
IN
THREE-WAY HYBRIDS

ACKNOWLEDGMENT

The author wishes to express his gratitude for the guidance and inspiration of Dr. E. C. Rossman under whose supervision this study was conducted.

The author is grateful to Dr. Fred C. Elliott and Mr. Hubert M. Brown for their suggestions and constructive criticisms.

To my wife, Dottie, goes sincere thanks for her assistance and encouragement.

TABLE OF CONTENTS

INTRODUCTION

During the days of hand harvesting, Corn Belt farmers preferred single-eared corn varieties because the time and expense of harvesting was less than with two or more smaller ears per plant. This preference became so well established that the great majority of open-pollinated varieties were bred and selected with one ear per plant, and this preference still continues with the hybrids of today.

Universal success of mechanical corn harvesting and emphasis on higher yields and profits should remove prejudice against two or more ears per plant if yields are improved and efficiency of mechanical harvesting is not reduced. Preference associated with choosing hybrids for "eye appeal" where single-eared hybrids are preferred may not be overcome so easily.

Multiple-eared corn varieties have been well established in much of the southern United States. Basic germ-plasm entering into the development of these varieties was late maturing and multiple eared. Less emphasis on the economics of corn production, corn shows and eye appeal and more available labor has favored the use of the more prolific types.

There are three evident objectives for the development and evaluation of multiple-eared hybrids. (1) At a given plant population, increasing the number of ears per plant may offer an opportunity to increase corn yields. (2) Aside from the possibility of higher corn yields, a predominance of two or more ears per plant at a lower plant population may produce yields equal to those obtained with single-eared hybrids at higher plant populations. These lower plant populations might reduce stalk lodging and some mechanical harvesting difficulties. (3) At high plant populations and under adverse conditions, multiple-eared hybrids may produce fewer barren plants and consequently higher yields than single-eared hybrids.

There are few inbred lines adapted to the Corn Belt that develop two or more ears per plant consistently and the characteristic is not strongly expressed in hybrids among these lines. Southern prolific varieties, inbreds, and hybrids offer a source for this character which could be introduced into Corn Belt lines through various breeding procedures. Popcorn and sweet corn varieties and hybrids are other sources of prolificacy, but selection against pop and sweet kernel types and other weaknesses of these types would be necessary.

Little research has been done on inheritance and breeding for the multiple-eared character.

REVIEW OF LITERATURE

According to Josephson (1), Richey developed early prolific inbred lines from crosses of the Jellicourse prolific, open-pollinated variety with Corn Belt inbreds. Hybrids involving these early prolific inbreds crossed with Corn Belt inbred lines produced higher yields than standard prolific and single-eared hybrids. Correlation between the number of ears per plant and yield was positive. Populations of 12,000 plants per acre produced the highest average yields. One prolific hybrid was the highest in yield at the 16,000 rate in a test involving prolific and single-eared hybrids.

Zuber and Grogan (3) tested prolific and single-ear hybrids in Missouri. They reported that a population of 12,000 plants per acre produced the highest average yields. Prolific hybrids were consistently high in yield at all plant populations.

Lang, et al. (2) in Illinois, found that hybrids with the highest number of ears per plant at low populations produced fewer barren plants at high populations. Plant population affected percentage of barren plants more than hybrid or level of nitrogen. Barrenness affected yield more than did population or nitrogen level.

MATERIALS AND METHODS

In 1953, two early maturing single-eared inbreds (MS1341 and MS24A) were crossed with several different southern prolific inbreds, hybrids and open-pollinated varieties (see Appendix Table 17). Selfing with selection for plants with two or more ears per plant and other desired agronomic characteristics led to a group of S_3 inbreds available for test crossing in 1957 and evaluation in 1958. Expression of the multiple-eared characteristic during successive generations of selection was affected considerably by environment.

Observations from various breeding procedures in progress with these materials indicated that the inheritance of ear number was largely recessive. Thus, a multiple-eared tester appeared to be the best choice to evaluate the multiple-eared S_3 inbreds.

In 1957, S_3 plants with two or more ears per plant at pollination time were selected for selfing and crossing to the single-cross hybrid (Oh51 x Oh26). The second ear buds on some of the selected plants did not complete development and most of these plants were discarded at harvest. The tester (Oh51 x Oh26) develops a relatively high frequency of two-eared plants compared to most other available testers of similar maturity. Inbred Oh51 is typically two-eared while Oh26 is predominantly single-eared.

The three-way hybrids were evaluated at three plant populations (approximately 8,000, 12,000 and 16,000 plants per acre) at two locations - Ingham and Saginaw Counties. Eighty-one entries were included in a 9 x 9 triple lattice design with three replications for each population at each location.

Plots were hand harvested after recording the number of plants that developed two or more ears, stalk and root lodging. Plants broken below the ear were counted as "stalk lodged". Plants leaning more than 30^{o} from the vertical were counted as "root lodged".

Moisture samples at harvest were taken by cutting a one-inch cross section from ten representative ears from each plot. The samples were weighed, oven-dried, weighed again and moisture percentages computed.

Parental inbred lines were grown in two adjacent Ingham County nurseries designed for about 6,500 and 13,000 plants per acre. Stands in some of the nursery rows were not uniform and these were discarded.

EXPERIMENTAL RESULTS

Cultural and weather data are given in Tables 1, 2 and 3. Both locations were dry and cool during May, and continued cool during May and June. Degree day totals for the growing season showed that Saginaw County was cooler than Ingham County. Total rainfall was slightly greater for Saginaw County but 0.30 inch more rainfall occurred at Ingham County, May through July. Distribution of rainfall was similar for both locations for the period May through July. In mid-August, the Ingham County location received 0.75 inch of rain that the Saginaw County location did not get.

Table 4 presents means and range in performance for the six experiments. Mean yield at each location was highest with 12,000 plants per acre and lowest with 8,000 plants per acre (Table 4). The mean percentage of two-eared plants decreased as plant population was increased. Stalk and root lodging increased slightly as population increased. Yields and percentages of two-eared plants were higher and lodging was lower in the Ingham County experiments than in Saginaw. Percentage of two-eared plants ranged from 77.8 to zero depending on the particular hybrid, plant population and location. The S_3 lines included in these hybrids had not been previously evaluated in hybrid combinations and were therefore, relatively unselected for combining ability. Pedigrees of the inbred lines

TABLE 1

CULTURAL INFORMATION FOR THE INGHAM
AND SAGINAW COUNTY LOCATIONS OF TESTING

County	Soil type	Previous crop	pH	Pounds per acre P_2O_5	Pounds per acre K_2O	Fertilizer	Date planted	Date harvested
Ingham	Conover	Corn	6.4	26	50	250 lbs. 15-15-15*	April 28	October 9
Saginaw	Brookston	Alfalfa	6.7	93	34	260 lbs. 6-12-12**	May 1	October 21

Row width was 36 inches for all tests.

* plus 60 pounds nitrogen, side dressed

** plus manure

TABLE 2

WEATHER DATA FOR THE INGHAM AND SAGINAW COUNTY LOCATIONS*

	Temperature								Precipitation - inches					
	Ave. max.		Ave. min.		Average		Degree days		Total		Greatest day		Date	
Month	Ing.	Sag.	Ing.	Sag.	Ing.	Sag.	Ing.	Sag.	Ing.	Sag.	Ing.	Sag.	Ing.	Sag.
April	59.0	59.4	35.0	32.6	47.0	46.0	515	563	1.54	2.80	0.53	0.89	7	6
May	71.0	70.0	42.0	39.0	56.0	55.0	270	324	0.41	0.94	0.13	0.38	22	31
June	73.0	73.0	50.0	48.0	61.0	61.0	132	149	3.38	3.28	1.44	1.02	1	8
July	79.5	80.8	59.5	56.6	69.5	68.7	9	14	4.44	3.71	1.40	1.61	3	4
Aug.	80.4	81.0	56.6	54.2	68.5	67.6	32	36	3.37	2.77	1.95	1.42	21	7
Sept.	71.6	72.3	51.2	48.2	61.4	60.3	154	169	2.02	2.67	1.20	1.48	18	17
Oct.	63.4	62.9	42.0	39.5	52.7	51.2	376	420	2.07	2.23	1.15	1.00	9	9

*From Climatological Data, U.S.D. Commerce, Volumes LXXIII, No. 4-10

Degree days were computed by subtracting the mean of the highest and lowest daily temperatures from a base of 65° F. If the mean was 65°F. or below, no degree days were recorded.

TABLE 3

COMPARISON OF DEGREE DAY AND PRECIPITATION TOTALS, APRIL THROUGH OCTOBER AND MAY THROUGH JULY INGHAM AND SAGINAW COUNTIES. 1958

Location	Total degree days**		Total precipitation	
	Apr.-Oct.	May-July	Apr.-Oct.	May-July
Ingham Co.	1488	411	17.23	8.23
Saginaw Co.	1675	487	18.40	7.93
Difference	187	76	1.17	0.30

**Degree days were computed by subtracting the mean of the highest and lowest daily temperatures from a base of 65°F. If the mean was 65° F. or below, no degree days were recorded.

TABLE 4

MEAN AND RANGE IN PERFORMANCE FOR 81 HYBRIDS AT THREE PLANT POPULATIONS GROWN IN INGHAM COUNTY (EXPERIMENTS 91,93,95) AND SAGINAW COUNTY (EXPERIMENTS 92,94,96) 1958

Plant population	Exp. number		Yield bushels per acre	Two-eared plants %	Lodging Stalk %	Lodging Root %	Moisture in ears %
Location: Ingham County							
8,000	91	Mean	92.4	29.3	0.7	22.4	36.6
		Low	63.9	0.0	0.0	0.0	26.5
		High	141.1	77.8	4.1	60.3	48.1
	Tester	Mean	69.8	17.3	1.0	2.3	40.7
12,000	93	Mean	108.4	14.7	2.1	26.0	35.1
		Low	81.3	0.0	0.0	2.9	22.9
		High	136.0	51.2	12.0	73.3	45.6
	Tester	Mean	101.7	3.0	5.4	4.7	33.0
16,000	95	Mean	102.5	10.1	2.2	30.8	36.9
		Low	80.0	0.0	0.0	1.3	26.4
		High	128.6	35.4	16.3	68.8	45.4
	Tester	Mean	94.1	2.6	12.6	17.5	35.3
Location: Saginaw County							
8,000	92	Mean	70.2	14.2	3.4	39.3	30.2
		Low	57.2	1.7	0.0	0.0	20.1
		High	85.3	37.3	10.3	76.7	40.0
	Tester	Mean	72.9	19.5	9.3	17.0	28.5
12,000	94	Mean	79.6	6.4	4.5	38.4	31.3
		Low	61.1	0.0	0.0	8.8	24.6
		High	104.5	21.4	17.8	85.9	41.1
	Tester	Mean	94.7	12.6	12.3	15.4	31.2
16,000	96	Mean	76.5	3.6	6.8	44.3	30.9
		Low	64.5	0.0	0.0	6.0	24.4
		High	96.0	20.0	21.7	86.7	39.9
	Tester	Mean	75.2	3.0	17.7	13.9	29.6

and their performance data in three-way hybrids are given in Tables 17-27 of the Appendix.

Mean yields at the Saginaw County location were 22.2 to 28.8 bushels lower, depending on population, than at Ingham County for the same 81 hybrids. This reduction in yield indicated that some factor or factors in the environment - temperature, moisture, fertility, etc. - had become limiting earlier at Saginaw County for the same hybrids. These limitations apparently interfered with development of second ears.

Analysis of variance for yield (Table 5) showed highly significant differences due to hybrids, plant populations and locations. Interactions of locations x populations and locations x hybrids were highly significant. Hybrid x population and location x population x hybrid interactions were not significant. Effects of hybrids and plant populations on yields were not similar at each location but the hybrids did respond in a similar manner at each population. When components of variance were determined, hybrids and location were found to have the greatest effects on yield.

Correlation of yields for the two locations at each plant population (Table 6) showed that the high yielding hybrids at Ingham County at the 8,000 population tended to be among the high yielding ones at Saginaw County also. The correlation was low but significant. At 12,000 and 16,000 populations, yields were not significantly correlated for the two locations.

These low correlations and the highly significant hybrid x location interaction (Table 5) indicates that, in general the relative performance of the hybrids was not the same at each location.

Significant interactions, hybrid x location, are common when evaluating yield of selected or unselected lines from corn belt germ-plasm in hybrid combinations. This population of untested lines involved approximately 25% unadapted southern germ-plasm and could be expected to react differently with the environment at the two locations.

Correlations for yields at various populations in Ingham County were highly significant while those at Saginaw County were lower and only one was significant. Although the interactions, hybrid x population (Table 5), were not significant, the correlations (Table 6) showed that the response of hybrids to population in Saginaw County was not nearly as consistent as it was in Ingham County. Considering average yields from both locations, the correlation was highly significant and the interaction, hybrid x population, was not significant. Relative performance of the hybrids tended to be consistent at each population.

These correlations and first order interactions indicate that testing at several locations seems to be more important than testing at several plant populations. More precise evaluations may be obtained by including more locations and reducing the number of plant populations.

TABLE 5

ANALYSES OF VARIANCE FOR YIELDS
EXPERIMENTS 91-96, INGHAM AND SAGINAW COUNTIES

Source	d.f.	M.S.	F	Components of variance
Total	1457			
Hybrids	80	458.6	82.3**	73.4
Populations	2	798.0	143.3**	4.7
Locations	1	16,268.7	2920.8**	66.8
H x P	160	4.7	N.S. ↓	0.0
L x P	2	33.1	5.9**	0.34
L x H	80	18.3	3.29**	4.2
L x P x H	160	5.0	N.S. ↓	0.0
Error	972	5.6		5.6

Source	d.f.	Ingham County Exps. 91,93,95		Saginaw County Exps. 92,94,96	
		M.S.	F	M.S.	F
Total	728				
Populations	2	569.6	94.9**	261.5	70.5**
Hybrids	80	50.1	8.4**	14.1	3.8**
H x P	160	6.0	N.S.	3.7	N.S.
Error	486	6.0		5.1	

** Significant at the 1% level

↓ Not significant

TABLE 6

CORRELATION OF YIELDS WITH PLANT POPULATIONS FOR EACH LOCATION

Characteristic correlated	Location and population correlated			r
	Ingham County Exp. 91,93,95		Saginaw County Exp. 92,94,96	
Yield	8,000	with	8,000	0.25*
"	12,000	"	12,000	0.01
	16,000	"	16,000	0.12
	Means - all populations	"	Means - all populations	0.25*
	Ingham County, Exps. 91,93,95			
Yield	8,000		12,000	0.56**
"	8,000		16,000	0.57**
"	12,000		16,000	0.48**
	Saginaw County, Exps. 92,94,96			
Yield	8,000		12,000	0.16
"	8,000		16,000	0.28*
"	12,000		16,000	0.19
	Combined Locations			
Yield	8,000		12,000	0.53**
"	8,000		16,000	0.50**
"	12,000		16,000	0.86**

n = 70, r = 0.23 at the 5% level and 0.30 at the 1% level
Ingham and Saginaw Counties, Experiments 91-96

For each population, hybrids with high percentages of two ears at one location tended to be high in ear number at the other location as indicated by highly significant correlations (Table 7). Number of ears per plant were lower at Saginaw County but correlations were still highly significant indicating that, although environment did affect development of the second ears, a useful portion of the variation in ear number was inherited.

Highly significant correlations were obtained between percentage of two-eared plants at the various populations, (Table 7). While the percentage of two-eared plants was lower at the higher populations, those hybrids with the highest ear number at the lower populations also tended to be higher in ear number as population increased. Expression of the two-eared characteristic was reduced at the higher populations but selection for multiple ears could be effective at either population.

Correlations of yield with percent of two-eared plants were significant at 8,000 and 12,000 populations and highly significant at the 16,000 population in Ingham County (Table 8), but only five to 19 percent of the variation in yield was associated with ear number. Correlations of yield and ear number for the other experiments were not significant. Yield was not very dependent on ear number.

Correlations of percentage of two-eared plants with stalk and root lodging were low, generally not significant, and were

TABLE 7

CORRELATION OF PERCENT TWO-EARED PLANTS
AT THREE PLANT POPULATIONS FOR EACH LOCATION

Characteristic correlated	Population and locations correlated			r
	Ingham County Exp. 91,93,95		Saginaw County Exp. 92,94,96	
% two ears	8,000	with	8,000	0.82**
"	12,000	"	12,000	0.66**
"	16,000	"	16,000	0.49**
	Ingham County - Exps. 91,93,95			
% two ears	8,000	with	12,000	0.76**
"	8,000	"	16,000	0.73**
"	12,000	"	16,000	0.78**
	Saginaw County -Exps. 92,94,96			
% two ears	8,000	with	12,000	0.62**
"	8,000	"	16,000	0.54**
"	12,000	"	16,000	0.56**

n = 70, r = 0.23 at the 5% level and 0.30 at the 1% level
Ingham and Saginaw Counties, Experiments 91-96

TABLE 8

CORRELATION OF PERCENT TWO-EARED PLANTS WITH YIELD, STALK LODGING, ROOT LODGING AND WITH PERCENT EAR MOISTURE

Location and plant population	Percent two ears correlated with			
	Yield r	% stalk lodging r	% root lodging r	% ear moisture r
Ingham County - Exps. 91, 93, 95				
8,000 population	0.24*	0.24*	-0.12	-0.20
12,000 "	0.26*	-0.13	-0.02	0.09
16,000 "	0.44**	-0.04	0.02	0.09
Saginaw County -Exps. 92, 94, 96				
8,000 population	-0.04	0.05	-0.24*	0.27*
12,000 "	0.17	0.09	-0.15	0.04
16,000 "	0.02	0.22	-0.12	0.05

n = 70 r = 0.23 at the 5% level and 0.30 at the 1% level
Ingham and Saginaw Counties, Experiments 91-96

not consistent. There was no consistent evidence that hybrids with higher percentage of two ears were any more or less susceptible to lodging than hybrids with lower ear number.

Only two of the nine correlations of percentage of two-eared plants with percentage ear moisture were significant. In general, there was little evidence that hybrids with higher percentages of two ears were later or earlier in maturity than hybrids with lower percentages of two ears. Late maturity and prolificacy from the southern prolific sources did not appear to be closely linked since some relatively early maturing lines contributing high percentages of two-eared plants were obtained.

Correlations of yield with ear moisture, a measure of maturity, were low and generally not significant (Table 9). Some of the high yielding entries were relatively early in maturity while others were later in maturity. Even when testing highly selected adapted hybrids in Michigan, there is generally little correlation between yield and maturity since some early maturing hybrids yield as much or more than later maturing hybrids. Both early and late maturing lines possessing high combining ability with the tester could be selected from the population of S_3 lines evaluated (Appendix Table 17).

Low, non-significant correlations of moisture content for S_3 lines between locations (Table 10) show that relative maturity was not consistent for both locations. Low correlations between locations and significant hybrid x location

TABLE 9

CORRELATION OF YIELD WITH
PERCENT EAR MOISTURE AT EACH LOCATION

Character correlated	Population and location	r
	Ingham County - Exps. 91,93,95	
Yield with % ear moisture	8,000 population	- 0.14
"	12,000 "	- 0.10
"	16,000 "	- 0.04
	Saginaw County -Exps. 92,94,96	
"	8,000 population	- 0.18
"	12,000 "	- 0.29*
"	16,000 "	- 0.04

n = 70 r = 0.23 at the 5% level, Ingham and Saginaw Counties, Experiments 91-96

TABLE 10

CORRELATIONS OF PERCENT MOISTURE
AT THREE PLANT POPULATIONS FOR EACH LOCATION

Characteristic correlated	Population and locations correlated			S_3 lines r [1]	Adapted Corn Belt lines r
	Ingham County Exp. 91,93,95		Saginaw County Exp. 92,94,96		
% moisture	8,000	with	8,000	0.05	0.43
"	12,000	"	12,000	0.14	0.62*
"	16,000	"	16,000	0.07	0.40
"	Mean - all populations	"	Mean - all populations	0.44**	0.75**
	Ingham County - Exps. 91,93,95				
% moisture	8,000	with	12,000	0.38**	0.66*
"	8,000	"	16,000	0.49**	0.41
"	12,000	"	16,000	0.37**	0.12
	Saginaw County -Exps. 92,94,96				
% moisture	8,000	with	12,000	0.48**	0.61
"	8,000	"	16,000	0.50**	0.64*
"	12,000	"	16,000	0.45**	0.53

[1] n = 70 r = 0.23 at 5% level, 0.30 at 1% level
n = 8 r = 0.63 at 5% level, 0.76 at 1% level

interactions for yield could be due in part to the relatively high proportion of southern unadapted germ-plasm in these lines. One of the parents for all lines was a late maturing southern prolific source. Interactions with day length as southern germ-plasm is moved north is often striking, especially for time of flowering. While the Saginaw County location is only about fifty miles north of the Ingham County location, lack of correlation in moisture content between the two locations seems to indicate a maturity interaction with environment. This is not common when testing more adapted germ-plasm since correlations of maturity with location are usually quite high. Correlations between locations for moisture content of entries involving only Corn Belt germ-plasm were generally higher than those for S_3 lines with the southern germ-plasm (Table 10). Hybrids with only Corn Belt germ-plasm appeared to be more consistent in maturity.

Percentages of two-eared plants for the inbred lines were correlated with similar data for the hybrids (Table 11). Inbreds stands were not as uniform as hybrid stands and plant population for the inbreds represents more of a range in population pressures. Inbreds with extremely low stands in the nursery were omitted from the correlations.

All correlations were significant for both locations, (Table 11). Inbreds, in the nursery, with more two-eared plants tended to develop more second ears in hybrids at all populations at both locations. The correlations of the per-

TABLE 11

CORRELATION OF PERCENT TWO-EARED PLANTS FOR INBREDS WITH PERCENT TWO-EARED PLANTS IN THREE-WAY HYBRIDS

Inbred population 1/		Hybrid population	r
Ingham County - Exps. 91,93,95			
13,000	with	8,000	0.39**
13,000	"	12,000	0.39**
13,000	"	16,000	0.48**
6,500	"	8,000	0.45**
6,500	"	12,000	0.41**
6,500	"	16,000	0.44**
Saginaw County -Exps. 92,94,96			
13,000	With	8,000	0.37**
13,000	"	12,000	0.31*
13,000	"	16,000	0.26*
6,500	"	8,000	0.36**
6,500	"	12,000	0.30*
6,500	"	16,000	0.31*

n = 63 r = 0.24 at 5% level, 0.32 at 1% level
Ingham and Saginaw Counties, Exps. 91-96

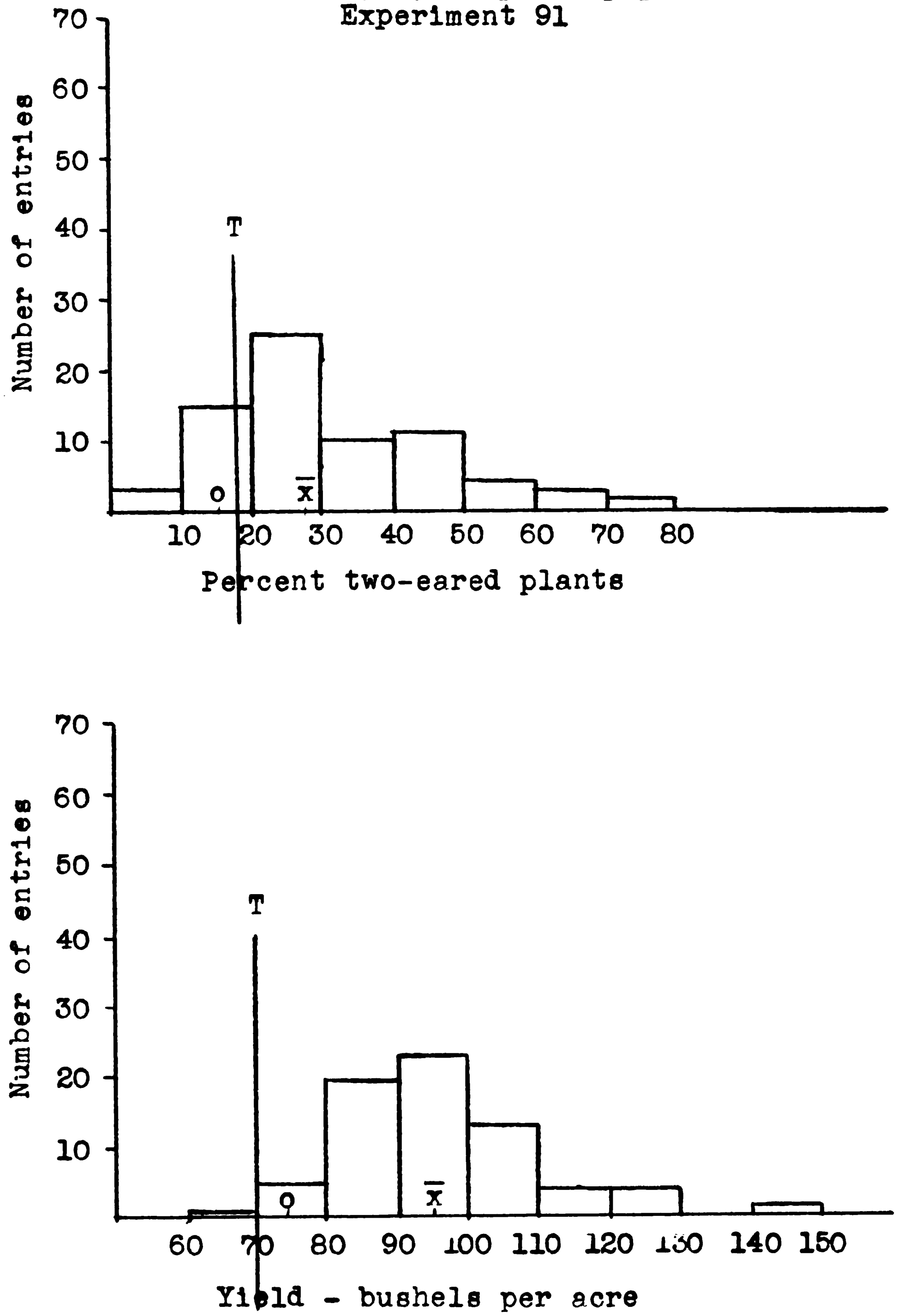
1/ Inbreds grown only in Ingham County nurseries formance of the inbred with that of its S_3 test-cross hybrid while useful to the plant breeder for selection in the nursery, were not close enough to rule out the necessity of evaluating prolificacy of the inbreds in hybrids.

The correlation of percentage of two-eared plants at 6,500 plant population with percentage of two-eared plants at the 13,000 population of inbreds grown in Ingham County nurseries was 0.75** (n = 63, r = 0.32 at the 1% level). Classification of lines for the two-eared characteristic was effective at either population in the nursery.

Frequency distributions for percentage of two-eared plants and yield by population and location are presented in Figures 1-6. In general, some of these S_3 lines were contributing markedly, more so at Ingham County than at Saginaw County, to increased ear number and higher yields in crosses with the tester. Some environmental factor or factors were limiting development of second ears and also yields in the Saginaw County location more than in Ingham County. The double-cross hybrid Ohio M15, included in all of these trials, is an older, widely used and adapted hybrid in central Michigan. It has a reputation for more second ears than most other adapted hybrids for this area although it did not possess a high degree of prolificacy in these trials. The tester, Oh51 x Oh26, is one of its single cross parents. A number of the three-way hybrids were superior in ear number and yield compared to Ohio M15. Again, this was more evident at the Ingham

Figure 1

Ingham County, 8,000 plant population
Experiment 91



Legend:

o = Ohio M15 T = Tester $\bar{x}$ = Mean of S3 hybrids

Figure 2

Saginaw County, 8,000 population
Experiment 92

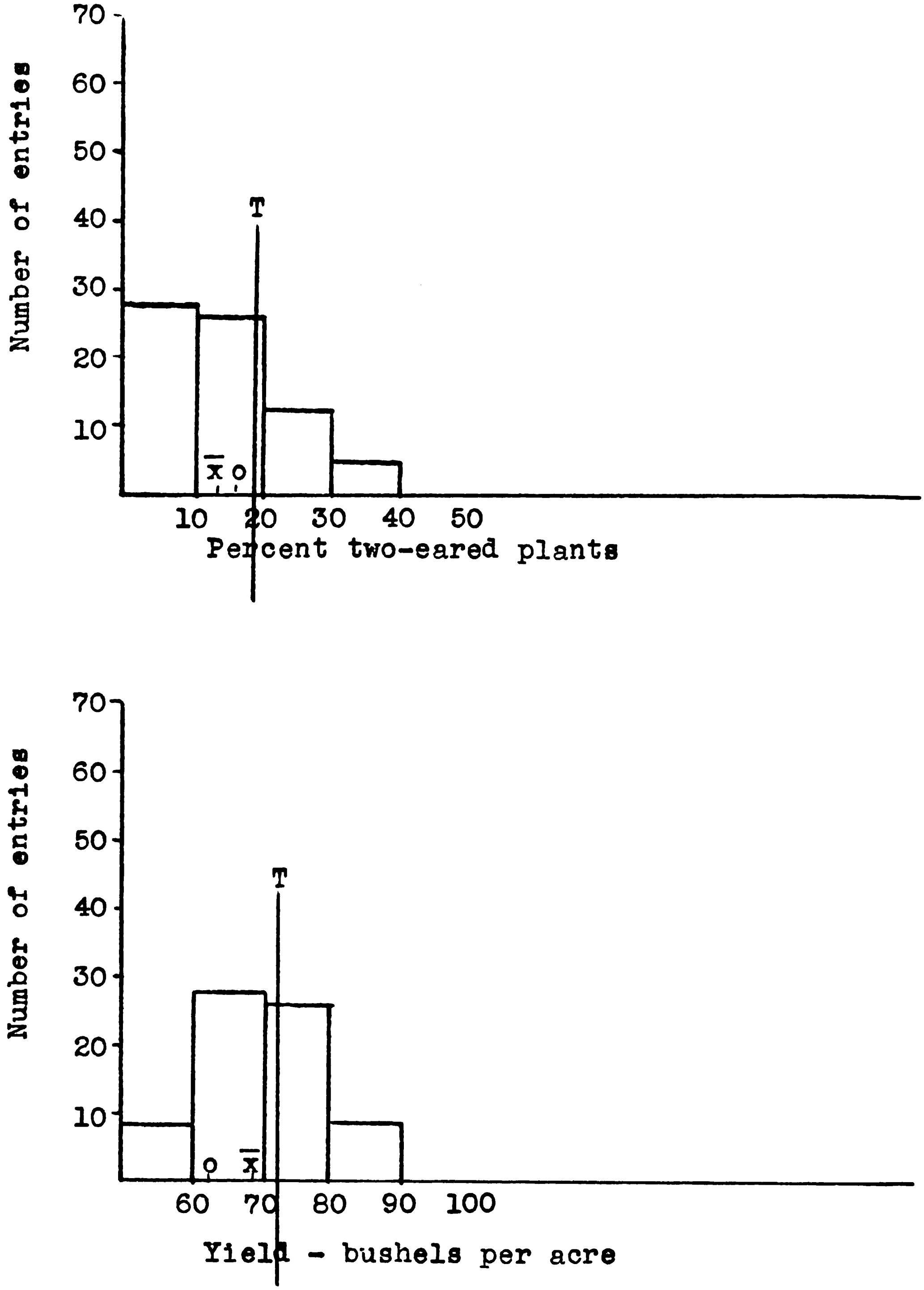
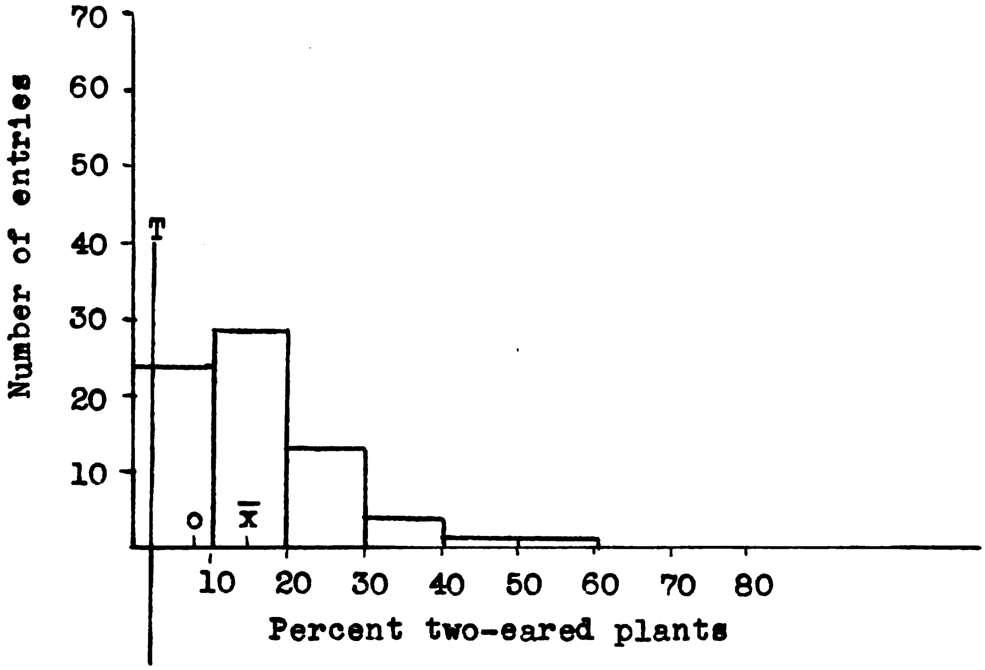


Figure 3

Ingham County, 12,000 plant population
Experiment 93



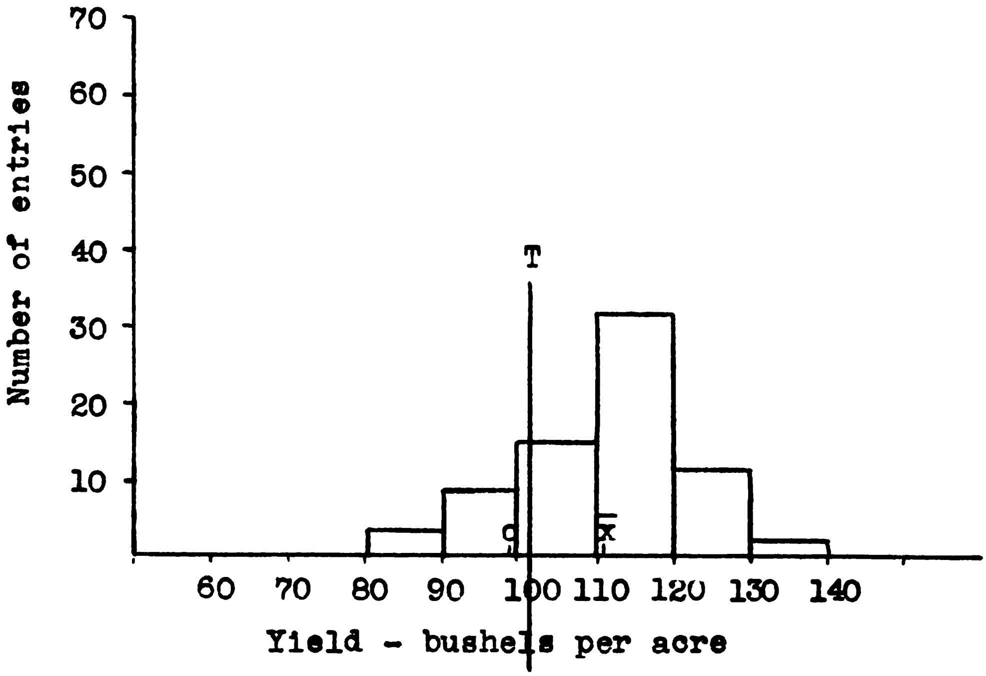
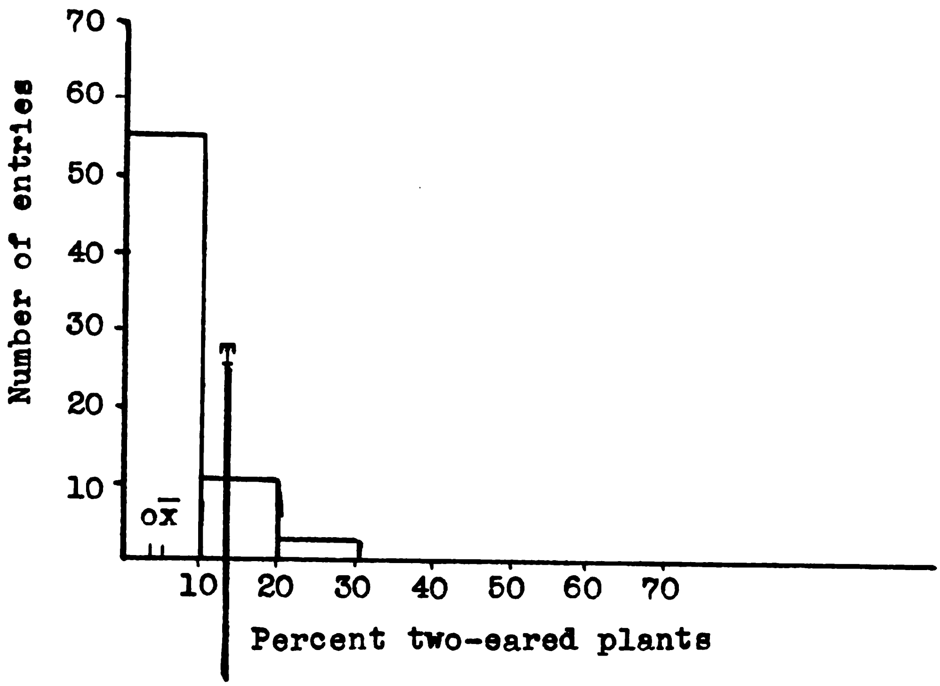


Figure 4

Saginaw County, 12,000 plant population
Experiment 94



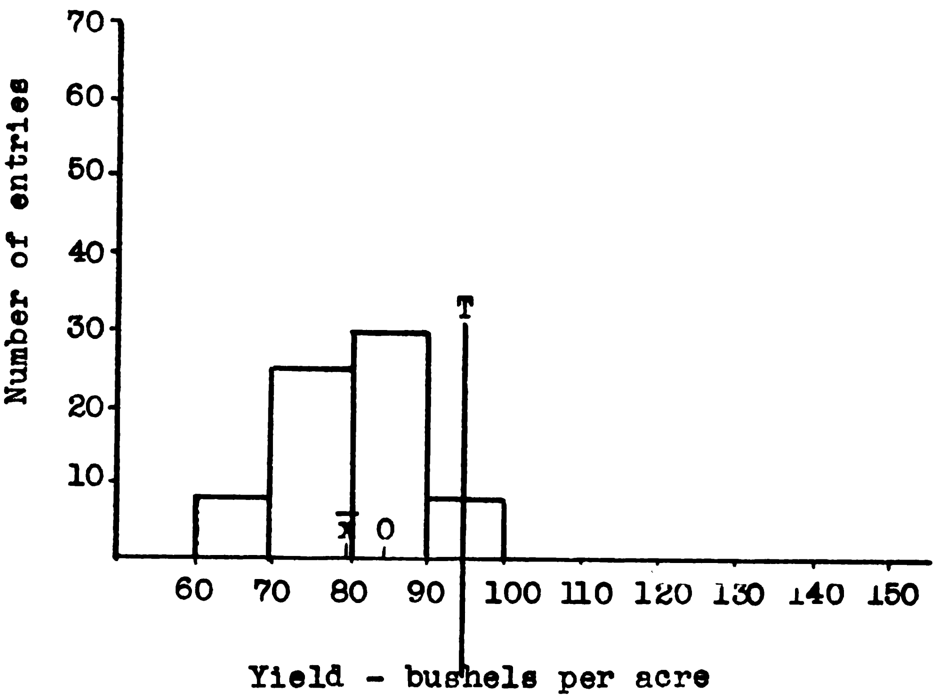
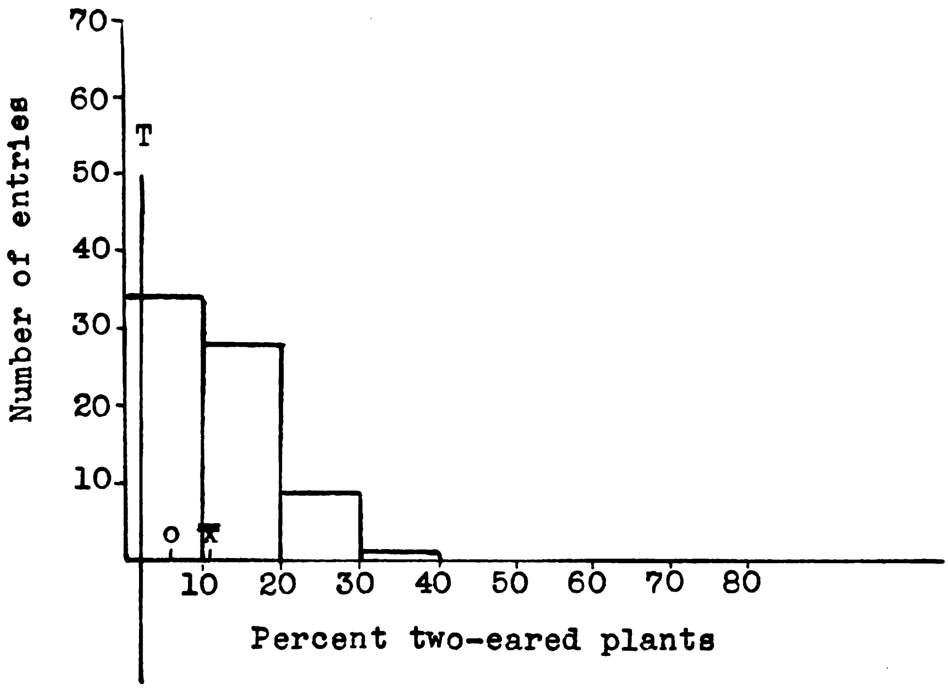


Figure 5

Ingham County, 16,000 plant population
Experiment 95



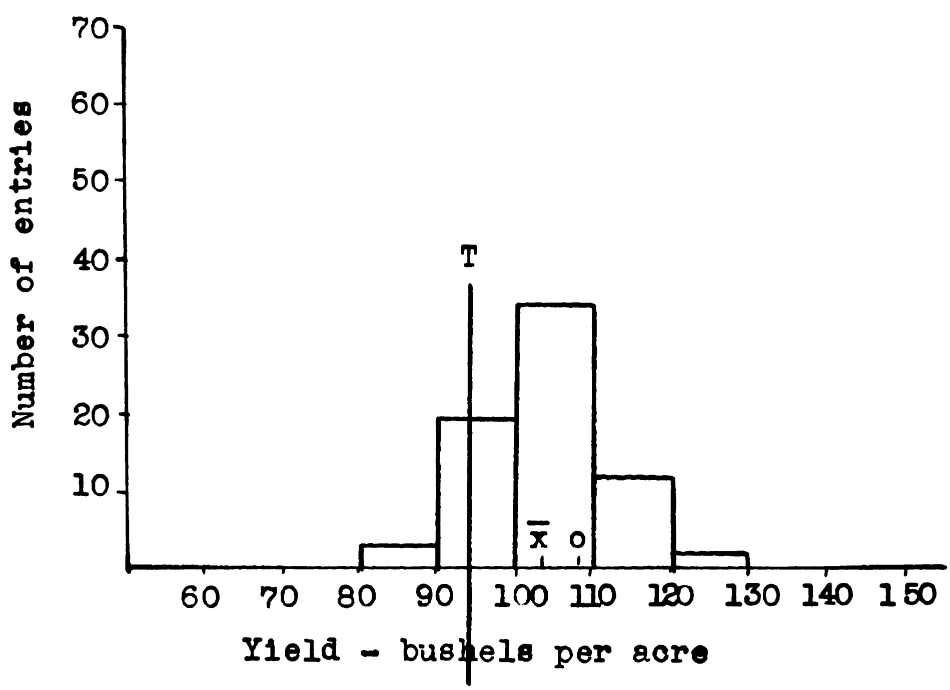
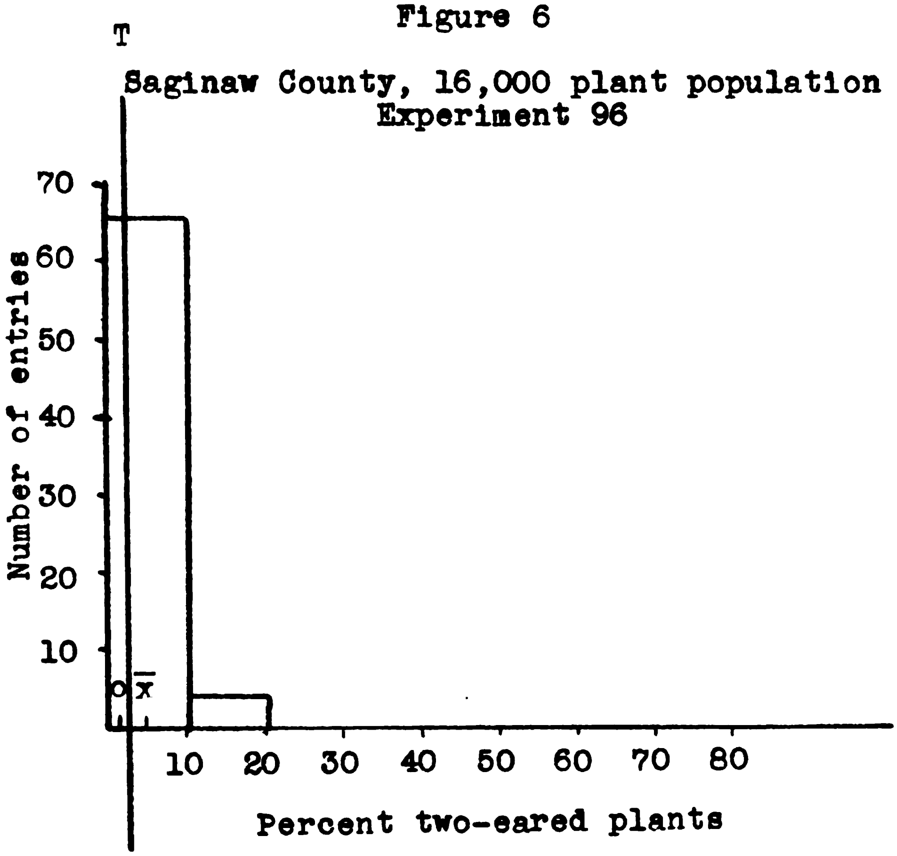
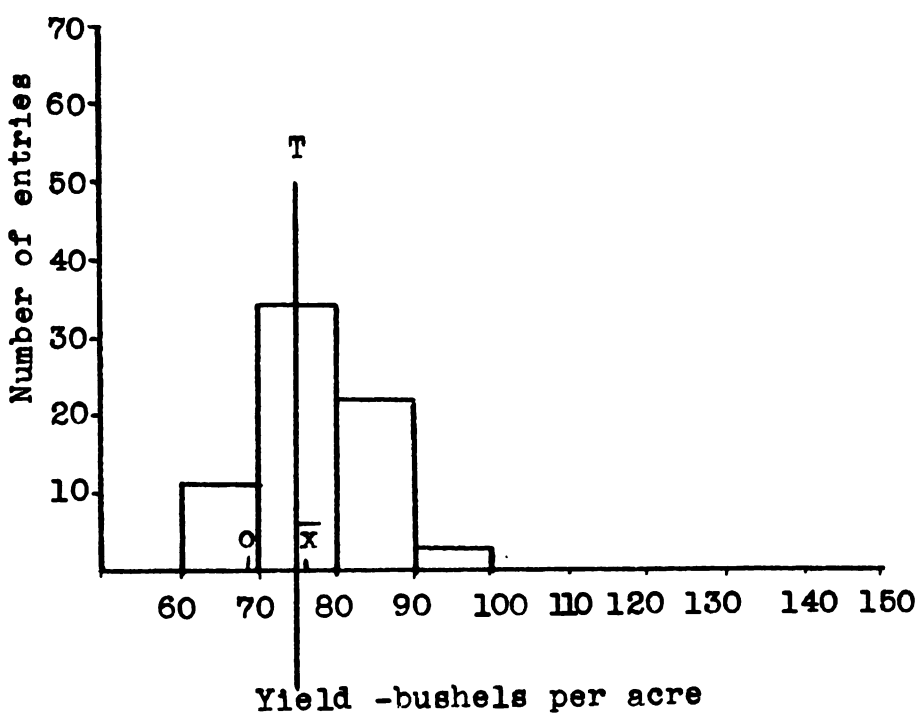


Figure 6

Saginaw County, 16,000 plant population
Experiment 96





County location than at Saginaw County. Maturity (Table 10) of some of these hybrids was comparable to that of Ohio M15 indicating that they could be expected to mature in central Michigan.

Hybrids significantly higher in yield than the tester at the 1, 5 and 10% level of significance are shown by plant population and location (Tables 12-14). None of the hybrids yielded significantly more than the tester at any plant population at Saginaw County. While a majority of those yielding better than the tester in Ingham County were also higher in percentage of two-eared plants, some of the higher yielding entries had fewer two-eared plants than the tester. These tables show that two-eared hybrids were not significantly higher yielding than single-eared hybrids. Average performance at both locations and all populations (Table 14) showed that about one-half of the entries yielding significantly higher than the tester were equal to or lower than the tester in ear number.

Classifying the 70 hybrids involving S_3 lines into three classes based on percentage of two-eared plants (Table 15) shows that the most prolific group averaged higher than the intermediate or least prolific groups in yield at all populations in Ingham County. The most prolific group exceeded the other two groups only at the 12,000 population for Saginaw County. While the most prolific hybrids were not consistently superior in yield, the results warrant continued testing and evaluation of the better entries.

TABLE 12

HYBRIDS SIGNIFICANTLY HIGHER THAN TESTER IN YIELD AT THREE PLANT POPULATIONS AND TWO LOCATIONS

Tester		1% L.S.D.		5% L.S.D.		10% L.S.D.			
mean yield	% 2-ears	En-try no.	% two ears	En-try no.	% two ears	En-try no.	% two ears	En-try no.	% two ears
Ingham County, 8,000 population, Experiment 91									
69.8	(17.3)	66	(67.2)	66	(67.2)	66	(67.2)	59	(49.1)
		1	(16.7)	1	(16.7)	1	(16.7)	11	(25.5)
		76	(8.3)	76	(8.3)	76	(8.3)	52	(11.7)
		69	(72.9)	69	(72.9)	69	(72.9)	42	(29.3)
		35	(63.3)	35	(63.3)	35	(63.3)	47	(41.8)
		73	(33.3)	73	(33.3)	73	(33.3)	25	(25.0)
		14	(18.5)	LSD 14	(18.5)	14	(18.5)	48	(5.2)
		64	(39.0)	64	(39.0)	64	(39.0)	40	(14.0)
		10	(28.3)	10	(28.3)	10	(28.3)	38	(67.9)
		46	(30.0)	46	(30.0)	46	(30.0)	29	(54.2)
				2	(33.3)	2	(33.3)	44	(31.4)
				58	(13.3)	58	(13.3)	17	(46.6)
				71	(12.3)	71	(12.3)	51	(41.4)
				41	(24.6)	41	(24.6)	3	(37.5)
						15	(49.0)	74	(46.9)
						39	(24.1)	75	(35.1)
						65	(38.3)	21	(41.1)
						LSD 6	(56.9)	28	(21.7)
						16	(49.1)		
Ingham County, 12,000 population, Experiment 93									
101.7	(3.0)	39	(19.5)	39	(19.5)	39	(19.5)		
				1	(14.9)	1	(14.9)		
				6	(36.8)	6	(36.8)		
				66	(51.2)	66	(51.2)		
				46	(19.5)	46	(19.5)		
						69	(35.3)		
						64	(25.3)		
						14	(11.6)		
						35	(27.8)		
						10	(10.2)		
						42	(4.7)		
						58	(0.0)		
						20	(14.6)		

Table 12 continued

Tester		1% L.S.D.		5% L.S.D.		10% L.S.D.			
mean yield	% 2-ears	En-try no.	% two ears	En-try no.	% two ears	En-try no.	% two ears	En-try no.	% two ears
Ingham County, 16,000 population, Experiment 95									
94.1	(2.6)	69	(35.4)	69	(35.4)	69	(35.4)		
		66	(27.2)	66	(27.2)	66	(27.2)		
				76	(5.6)	76	(5.6)		
				64	(10.0)	64	(10.0)		
				67	(13.8)	67	(13.8)		
				52	(1.0)	52	(1.0)		
				55	(26.4)	55	(26 .4)		
						47	(12.4)		
						14	(9.3)		
						44	(11.0)		
Saginaw County, 8,000 population, Experiment 92									
72.9	(19.5)	None		None		None			
Saginaw County, 12,000 population, Experiment 94									
94.7	(12.6)	None		None		None			
Saginaw County, 16,000 population, Experiment 96									
75.2	(3.0)	None		None		None			

TABLE 13

HYBRIDS SIGNIFICANTLY HIGHER THAN TESTER IN YIELD
AT THREE POPULATIONS AVERAGED FOR BOTH LOCATIONS

Tester		1% L.S.D.		5% L.S.D.		10% L.S.D.	
mean yield	% 2-ears	Entry no.	% two ears	Entry no.	% two ears	Entry no.	% two ears
Ingham and Saginaw Counties, 8,000 population Experiments 91-92							
71.3	(8.4)	66	(52.2)	66	(52.2)	LSD 66	(52.2)
		1	(10.0)	LSD 1	(10.0)	1	(10.0)
		14	(11.0)	14	(11.0)	14	(11.0)
		69	(52.0)	69	(52.0)	69	(52.0)
		10	(15.0)	10	(15.0)	10	(15.0)
		LSD 76	(6.6)	76	(6.6)	76	(6.6)
		73	(17.6)	73	(17.6)	73	(17.6)
		35	(46.2)	35	(46.2)	35	(46.2)
		2	(21.6)	2	(21.6)	2	(21.6)
		11	(16.2)	11	(16.2)	11	(16.2)
		52	(9.2)	52	(9.2)	52	(9.2)
		65	(27.5)	65	(27.5)	65	(27.5)
		16	(36.4)	16	(36.4)	16	(36.4)
						64	(28.2)
						21	(31.8)
						20	(38.0)
						71	(7.0)
						25	(21.0)
						40	(12.0)
						6	(38.1)
						41	(20.6)
						74	(30.8)
						15	(29.5)
						47	(28.4)
						59	(29.4)
						39	(19.6)
						17	(40.0)
						29	(45.2)
						19	(18.3)
						51	(24.2)
						18	(15.0)
						48	(6.0)
						46	(20.2)
						38	(51.8)
						58	(12.5)

Table 13 continued

Tester mean yield	Tester % 2-ears	1% L.S.D. Entry no.	1% L.S.D. % two ears	5% L.S.D. Entry no.	5% L.S.D. % two ears	10% L.S.D. Entry no.	10% L.S.D. % two ears
Ingham and Saginaw Counties, 12,000 population Experiments 93-94							
98.2	(7.8)	None		None		None	
Ingham and Saginaw Counties, 16,000 population Experiments 95-96							
84.6	(2.8)	69	(22.6)	69	(22.6)	69	(22.6)
		47	(10.4)	47	(10.4)	47	(10.4)
		52	(1.5)	52	(1.5)	52	(1.5)
		14	(6.1)	14	(6.1)	14	(6.1)
		64	(8.5)	64	(8.5)	64	(8.5)
		41	(4.4)	41	(4.4)	41	(4.4)
				66	(18.8)	66	(18.8)
				54	(12.6)	54	(12.6)
				10	(5.6)	10	(5.6)
				44	(6.0)	44	(6.0)
				55	(16.4)	55	(16.4)
				57	(6.1)	57	(6.1)
				42	(1.9)	42	(1.9)
				2	(10.0)	2	(10.0)
						36	(5.4)
						67	(7.5)
						76	(3.4)
						11	(5.8)
						60	(13.8)

TABLE 14

HYBRIDS SIGNIFICANTLY HIGHER THAN TESTER IN YIELD
AVERAGE OF THREE POPULATIONS AND TWO LOCATIONS

Tester		1% L.S.D.		5% L.S.D.		10% L.S.D.	
mean yield	% two-ears	Entry no.	% two ears	Entry no.	% two ears	Entry no.	% two ears
Ingham and Saginaw Counties, Experiments 91-96							
84.7	(9.7)	66	(35.6)	66	(35.6)	66	(35.6)
		69	(33.5)	69	(33.5)	69	(33.5)
		1	(7.8)	LSD 1	(7.8)	LSD 1	(7.8)
		LSD 14	(7.6)	14	(7.6)	14	(7.6)
		10	(9.7)	10	(9.7)	10	(9.7)
		52	(3.6)	52	(3.6)	52	(3.6)
		35	(27.6)	35	(27.6)	35	(27.6)
		76	(4.5)	76	(4.5)	76	(4.5)
		2	(14.0)	2	(14.0)	2	(14.0)
		64	(17.1)	64	(17.1)	64	(17.1)
		11	(9.8)	11	(9.8)	11	(9.8)
		47	(16.9)	47	(16.9)	47	(16.9)
		71	(4.2)	71	(4.2)	71	(4.2)
		42	(7.3)	42	(7.3)	42	(7.3)
		73	(12.3)	73	(12.3)	73	(12.3)
		41	(11.0)	41	(11.0)	41	(11.0)
		54	(23.2)	54	(23.2)	54	(23.2)
		51	(14.5)	51	(14.5)	51	(14.5)
		34	(16.6)	34	(16.6)	34	(16.6)
		20	(19.5)	20	(19.5)	20	(19.5)
		46	(11.6)	46	(11.6)	46	(11.6)
		6	(24.7)	6	(24.7)	6	(24.7)
		39	(13.5)	39	(13.5)	39	(13.5)
		29	(29.8)	29	(29.8)	29	(29.8)
		16	(20.2)	16	(20.2)	16	(20.2)
		40	(7.5)	40	(7.5)	40	(7.5)
		25	(10.9)	25	(10.9)	25	(10.9)
		17	(21.8)	17	(21.8)	17	(21.8)
				55	(31.5)	55	(31.5)
				67	(11.8)	67	(11.8)
						44	(12.3)
						58	(4.7)
						21	(14.9)
						27	(13.0)
						19	(8.2)
						18	(9.8)
						15	(14.3)
						33	(18.6)
						74	(20.6)
						59	(14.9)
						65	(12.6)
						28	(13.2)

TABLE 15

MEAN YIELD AND PERCENT TWO-EARED PLANTS
AT EACH POPULATION AND LOCATION FOR HYBRIDS
DIVIDED INTO THREE GROUPS ACCORDING TO PROLIFICACY

Location and population	Most prolific		Intermediate		Least Prolific	
	No. of hybrids	mean yield	No. of hybrids	Mean yield	No. of hybrids	Mean yield
Ingham County - Exps. 91,93,95						
8,000	12	102.4 (59.8) [1]	33	95.0 (35.1)	25	92.2 (15.9)
12,000	5	120.1 (40.6)	22	111.2 (22.4)	43	108.2 (9.7)
16,000	4	117.5 (28.5)	23	105.3 (16.1)	43	101.6 (6.7)
Saginaw County -Exps. 92,94,96						
8,000	9	71.8 (31.2)	30	69.7 (17.6)	31	70.8 (6.5)
12,000	8	87.4 (18.1)	16	78.0 (9.7)	46	79.3 (3.4)
16,000	1	66.3 (20.0)	10	79.0 (9.2)	59	77.2 (2.7)

[1] Mean percent of two-eared plants

Table 16 shows that a number of the S_3 lines contributed significantly more yield to the tester than WF9 (Entry 19, Appendix Table 17) which is one of the most widely used inbreds with high combining ability in the Corn Belt. All of the highest yielding hybrids involved S_3 lines. The increase in yield appears to have been contributed by the southern germ-plasm in these S_3 lines since neither of the two parental lines, MS24A and MS1341, added significantly to the tester yield. Other Corn Belt lines, W70, MS12 and MS130, did not contribute significantly to the tester.

TABLE 16

MEAN YIELDS OF ADAPTED INBREDS CROSSED TO TESTER FOR THREE POPULATIONS AND TWO LOCATIONS

Inbred	Population 8,000	Population 12,000	Population 16,000	Population 8,000	Population 12,000	Population 16,000
	Ingham County			Saginaw County		
W70	78	118	93	64	82	79
WF9	86	111	111	82	76	69
MS24A	68	88	80	64	69	66
MS12	66	96	91	67	76	72
MS130	85	95	92	70	61	75
MS1341	73	87	95	67	65	66
Tester	70	102	94	73	95	75
Ohio M15	74	100	108	63	84	69
Mean of S_3 lines	95	110	104	70	80	77

DISCUSSION

When the highest yielding prolific hybrids were compared with the highest yielding single ear hybrids at each plant population and location, there was no significant yield advantage for the multiple-ear hybrids. Further breeding, selection, and testing of these lines and others involving different sources of prolificacy and adapted germ-plasm appears necessary to determine the possibilities of increasing corn yields by increasing number of ears per plant.

The degree of adaptation of the hybrids using S_3 inbreds from one cross to adapted material was encouraging. Further recombination of the genes for the multiple-eared character with early maturity should result from the use of recurrent selection techniques.

The size of the F_2 population should be increased to enable selection to include segregates possessing as many of the possible different prolific genes, and perhaps modifying genes, as well as the genes for early maturity. Selfing in a small F_2 population fixes the genes so rapidly that the opportunity for the recombination of the genes for multiple ear, adaptation and high combining ability is severely limited.

At both locations, the yields of the highest yielding prolific hybrids at either the 8,000 or the 12,000 populations were not significantly different from the yields of the highest yielding single-ear hybrids at either the 12,000 or the 16,000 plant populations. However, there were single-eared hybrids at all populations that were as high yielding as the best multiple-eared hybrids. The performance of this group of multiple-eared hybrids did not indicate that plant populations could be reduced with multiple-eared hybrids while maintaining corn yields equal to single-eared hybrids at higher populations.

Multiple-eared hybrids may be better adapted to high plant population, particularly under adverse conditions, and less subject to developing barren plants even though the number of two-eared plants may be reduced. In these trials, barren plants were not observed at any population. Multiple-eared hybrids showed no less barrenness than single-eared hybrids at the highest population, 16,000 plants per acre. Tests at higher populations, 20,000 or more plants per acre, may be necessary to determine if multiple-eared hybrids are more resistant to barrenness under population pressure.

These evaluations demonstrated that inbreds contributing higher yields, increased ear number, improved resistance to lodging and early maturity to the tester, Oh51 x Oh26, could be obtained from crosses of southern prolifics with two early Michigan inbreds, MS1341 and MS24A. Several lines contributed significantly more yielding ability to the tester than WF9, a widely used Corn Belt inbred with outstanding combining ability. The added contribution in yield appeared to come from the southern germ-plasm since the two parental lines MS1341 and MS24A did not contribute significantly to the tester.

While there was no consistent superiority in yield for the best two-eared hybrids compared to the best single-eared hybrids, further breeding, selection and evaluation of these lines and others from different sources may eventually lead to higher yielding two-eared hybrids for the northern Corn Belt. Intercrossing the best lines to form a population for recurrent selection procedures may lead to improvement in yield, ear number and adaption to the area.

Although the 70 S_3 lines, chosen for crossing to the tester in 1957, exhibited two ears per plant, the characteristic was not universally exhibited in all of the three-way hybrids in 1958. The selected lines as S_4 plants in the 1958 nursery were not all two-eared which shows that environment was a factor in selection. Correlations for ear number in inbreds with ear number in hybrids were generally significant indicating that selection was partially effective. Highly significant correlations for percentage of two-eared plants at various populations and for both locations indicated further that the characteristic was heritable.

Observations from backcross populations not reported in this study indicated that ear number was largely recessive and multi-genic in inheritance. While the tester, Oh51 x Oh26, develops as many as or more two-eared plants than any other adapted tester available, it was not outstanding in ear number. One of its parents, Oh51, is typically a two-eared inbred while the other, Oh26, is predominantly single-eared. Failure of some selected lines to add to ear number of the tester was probably due to greater lack of dominance for ear number, fewer genes affecting ear number, and errors in classification of lines due to the effects of the environment. Since few, if any, single crosses, double crosses and open-pollinated varieties adapted to the Corn Belt, are multiple-eared, one of the few adapted two-eared inbreds, such as Oh51, may be a better choice of a tester.

Significant hybrid x location interaction and low or non-significant correlations between locations for yield are frequently encountered when evaluating previously untested breeding materials. Lack of consistent responses in yield at both locations were not surprising with these three-way hybrids in which 25 percent of the germ-plasm originated outside of the region.

Low correlations for moisture content between the two locations indicate a maturity interaction with environment for those hybrids involving S_3 inbreds. If maturity proves to be inconsistent over several locations, the utilization of southern sources for prolificacy in hybrids for the northern Corn Belt should be seriously questioned. The use of recurrent selection may lead to lines more consistent in maturity and more adapted to northern environments.

Hybrid interactions with plant population were not significant. Future evaluations of similar materials should emphasize testing at more locations and only one plant population, preferably 16,000 or more plants per acre.

Ratings of inbred lines for multiple-eared plants in the nursery at 6,500 and 13,000 populations were significantly correlated. Nurseries at higher populations may prove more effective in identifying lines with stronger development of second ears.

SUMMARY

Seventy S_3 inbred lines, selected for multiple ears during three segregating generations of inbreeding in crosses of several southern prolific sources with two early maturing single ear Michigan inbreds (MS1341 and MS24A) were crossed with the single cross (Oh51 x Oh26). These three-way hybrids were tested at three populations (8,000, 12,000 and 16,000 plants per acre) at two locations in 1958.

With this group of previously untested lines, yields and percentage of two-eared plants varied depending upon hybrid, plant population and location. Mean yields were lowest and percentages of two-eared plants were highest at the 8,000 plant population. Highest mean yields were at the 12,000 population. Stalk and root lodging increased at higher populations.

One of the best two-eared hybrids (Entry 66, Appendix Table 17) averaged 52, 36 and 19 percent two-eared plants and 112, 105 and 100 bushels per acre at the three populations, respectively. One of the best single-eared hybrids (Entry 1, Appendix Table 17) averaged 10, 10 and 3 percent two-eared plants and 106, 108 and 93 bushels per acre.

Several inbreds developed from these "exotic" crosses contributed higher yields (significantly more than WF9), increased ear number, improved resistance to lodging, and early

maturity when compared to the tester, Oh51 x Oh26. The added contributions in yield came from the southern germ-plasm.

Although affected by environment, a usable portion of the variation in ear number was heritable.

Hybrid x location interaction for yield was significant while hybrid x population interactions were not significant, suggesting that future tests could be conducted at one population (16,000 plants) but should include more locations.

The best multiple-eared hybrids showed no consistent superiority in ability to yield more than the best single-eared hybrids at any of the three populations. There were no examples to illustrate the possibility that the best two-eared hybrids could be planted at lower plant populations with less lodging and harvest losses and that their yields would exceed the best single-eared hybrids at the lower population and still equal or exceed the yields of the best single-eared hybrids at the higher populations. At the high population, barren plants did not occur and the best two-eared hybrids showed no ability to yield more than the best single-eared hybrids.

While these evaluations did not identify any superior two-eared hybrids, further breeding, selection and evaluation of these lines and others from different sources may eventually lead to two-eared hybrids that would exceed the performance of the best single-eared hybrids in the northern Corn Belt.

LITERATURE CITED

(1) Josephson, L. M. Breeding for early prolific hybrids. Proceedings Twelfth Hybrid Corn Industry-Research Conference: 71-79. 1957

(2) Lang, A. L., Pendleton, J. W., and Dungan, G. H. Influence of population and nitrogen levels on yield and protein and oil contents of nine corn hybrids. Agron. Jour. 48:284-289. 1956

(3) Zuber, M. S. and Grogan, C. O. Rate of planting studies with corn. Missouri Agric. Exp. Sta. Bul. 610. 1956

APPENDIX

Tables 17 to 27 inclusive

Means and ranges for Tables 18 to 23 are given in Table 4 of the text.

TABLE 17

ENTRY NUMBER AND PEDIGREE OF HYBRIDS IN EXPERIMENTS 91 THROUGH 96, INGHAM AND SAGINAW COUNTIES. 1958

Entry number	Pedigree
1	(Jellicorse x M14) x MS1341
2	"
3	"
4	W70
5	(Jellicorse x M14) x MS24A
6	(Jellicorse x Ky106) x MS1341
7	"
8	(Dixie 22 x MS24A)
9	" "
10	(Dixie 22 x MS1341)
11	(Dixie 22 x MS24A)
12	(Dixie 22 x MS1341)
13	" "
14	" "
15	(Jellicorse x M14) x MS24A
16	" "
17	" "
18	(Jellicorse x Ky106) x MS24A
19	WF9
20	(Short stalk Prolific O.P. x MS24A)
21	" "
22	(Jarvis Golden Prolific O.P. x MS1341)
23	MS24A-1
24	(Weekleys 21 x MS24A)
25	" "
26	(Jellicorse x MS24A)
27	" "
28	(Dixie 33 x MS24A)
29	" "
30	(Oh51 x Oh26)
31	MS24A-2
32	MS12-1
33	(Dixie 22 x MS24A)
34	" "
35	" "
36	(Dixie 22 x MS1341)
37	(Jellicorse x M14) x MS24A
38	" "
39	(Bests Prolific x MS1341)
40	(Jellicorse x Ky106) x MS1341

Table 17 continued

Entry number	Pedigree
41	(Dixie 17 x MS1341)
42	(Jarvis Golden Prolific x MS1341)
43	MS130
44	(Thompson Prolific x MS24A)
45	(NC18 x MS1341)
46	(Kls143 x MS24A)
47	(Dixie 22 x MS24A)
48	(Dixie 33 x MS24A)
49	(B2 x Mo.21A) B2 MS24A
50	" "
51	(B2 x Mo. 21A) B2 MS24A
52	" "
53	(Jellicorse x MS24A)
54	(Thompsons Prolific x MS24A)
55	" " "
56	(Dixie 22 x MS1341)
57	" "
58	" "
59	(Jellicorse x M14) x MS24A
60	(Dixie 22 x MS24A)
61	MS12-2
62	(Dixie 22 x MS24A)
63	" "
64	" "
65	(Dixie 33 x MS24A)
66	(Miss. 1123 x MS24A)
67	(Jarvis Golden Prolific O.P. x MS24A)
68	(Miss. 1123 x MS24A)
69	(C.I.21 x NC7) x MS24A
70	(Dixie 18 x MS24A)
71	(Jellicorse x MS24A)
72	" "
73	(Dixie 22 x MS24A)
74	" "
75	(Dixie 17 x MS1341)
76	(Jarvis Golden Prolific x MS24A)
77	MS1341
78	(NC18 x MS1341)
79	(Jellicorse x Ky106) MS1341
80	Oh10 M15
81	Oh51 x Oh26

TABLE 18

Agronomic data from Experiment 91
Population:8,000 plants per acre, Ingham County

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
1	66	141.1	26.5	5.2	60.3	67.2
2	1	128.4	35.6	-	26.7	16.7
3	76	123.8	39.9	-	45.0	8.3
4	69	121.3	38.7	-	15.3	72.9
5	35	120.1	40.2	-	20.0	63.3
6	73	116.9	38.6	-	26.7	33.3
7	14	112.3	34.1	1.9	37.0	18.5
8	64	112.1	27.9	1.7	42.4	39.0
9	10	110.9	36.3	-	51.7	28.3
10	46	107.8	37.0	-	45.0	30.0
11	2	107.2	37.1	1.7	46.7	33.3
12	58	106.1	42.5	-	51.7	13.3
13	71	105.3	31.6	-	26.3	12.3
14	41	103.3	35.7	-	47.4	24.6
15	15	103.0	36.5	4.1	24.5	49.0
16	39	102.5	36.2	-	24.1	24.1
17	65	102.1	42.1	-	23.3	38.3
18	6	101.9	41.7	-	29.3	56.9
19	16	101.0	39.1	-	7.3	49.1
20	59	100.9	35.4	1.9	35.8	49.1
21	11	100.2	39.3	1.8	9.1	25.5
22	52	100.1	36.8	-	5.0	11.7
23	42	99.4	36.7	3.4	20.7	29.3
24	47	99.1	38.9	-	25.5	41.8
25	25	98.6	37.5	3.3	16.7	25.0
26	48	98.4	36.4	-	24.1	5.2
27	40	97.8	37.7	-	15.8	14.0
28	38	97.4	35.2	-	22.6	67.9
29	29	97.3	33.6	1.7	8.5	54.2
30	44	97.2	38.1	2.0	29.4	31.4
31	17	96.6	35.4	1.7	-	46.6
32	51	96.1	36.7	-	12.1	41.4
33	3	95.9	37.4	-	8.9	37.5
34	74	95.9	38.3	-	8.2	46.9
35	75	94.6	36.7	-	56.1	35.1
36	21	94.1	31.6	-	1.8	41.1
37	28	94.1	36.1	-	23.3	21.7
38	12	92.4	36.0	1.7	35.0	18.3
39	7	91.9	35.0	-	7.0	42.1
40	13	91.4	31.0	-	17.0	32.1

Table 18 continued

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
41	20	90.8	29.0	7.1	10.7	57.1
42	57	90.6	41.7	1.8	46.4	21.4
43	68	90.6	40.0	-	30.5	25.4
44	37	90.5	32.8	-	20.8	13.2
45	50	90.3	37.4	-	36.7	18.3
46	18	89.8	37.1	1.7	20.0	21.7
47	34	89.6	36.3	-	49.2	16.9
48	26	89.3	35.8	-	36.4	29.1
49	70	88.1	38.0	-	9.3	35.2
50	60	87.5	38.1	-	52.8	37.7
51	53	87.4	35.8	-	23.3	25.0
52	36	86.6	33.5	-	39.0	27.1
53	67	86.2	36.7	-	26.3	28.1
54	8	86.1	35.7	1.8	18.2	16.4
55	19	86.1	48.1	-	12.7	23.6
56	27	84.8	36.7	-	13.6	20.3
57	43	84.8	35.2	-	46.3	11.1
58	72	84.1	33.9	-	3.8	40.4
59	55	83.4	35.4	-	13.0	77.8
60	49	82.4	37.1	-	21.7	21.7
61	5	82.2	36.1	1.8	5.5	23.6
62	54	82.1	35.8	-	8.5	53.2
63	9	82.0	37.4	-	14.3	28.6
64	78	81.6	40.7	-	25.0	30.0
65	63	81.4	36.0	-	31.0	22.4
66	24	80.3	43.8	-	14.3	25.0
67	45	80.0	39.6	-	19.0	12.1
68	22	78.5	37.2	-	28.3	18.3
69	33	78.5	36.4	-	8.1	40.3
70	4	78.2	36.3	-	-	19.0
71	79	75.1	37.7	-	4.0	12.0
72	62	74.9	35.9	-	2.0	6.1
73	80	74.0	35.0	1.9	11.1	16.7
74	77	73.2	29.2	-	10.3	-
75	31	71.8	34.8	1.7	8.5	18.6
76	81	71.2	39.8	2.1	2.1	25.0
77	56	69.7	36.7	-	17.2	12.1
78	30	68.3	41.5	-	2.4	9.5
79	32	67.9	29.2	3.3	3.3	3.3
80	61	64.4	36.3	-	7.1	5.4
81	23	63.9	33.4	-	-	29.4

Standard error of means = 10.4 bu.

Least significant difference at 5% level = 28.8 bu.

Least significant difference at 1% level = 37.8 bu.

Coefficient of variation = 11.3

TABLE 19

Agronomic data from Experiment 92
Population:8,000 plants per acre, Saginaw County

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
1	20	85.3	24.1	10.3	5.2	19.0
2	1	82.9	29.5	1.7	35.0	3.3
3	11	82.7	33.8	6.9	20.7	6.9
4	21	82.6	25.5	-	13.2	22.6
5	14	82.2	33.0	6.8	37.3	3.4
6	19	81.8	29.5	-	30.4	13.0
7	52	81.8	31.7	3.3	28.3	6.7
8	54	81.8	25.7	3.3	43.3	23.3
9	66	81.4	35.6	3.4	50.8	37.3
10	10	81.1	30.1	-	53.3	1.7
11	16	78.9	33.3	3.6	18.2	23.6
12	65	78.6	22.9	1.7	56.7	16.7
13	18	77.9	26.8	-	28.3	8.3
14	33	77.2	31.3	8.5	33.9	13.6
15	25	76.2	29.4	-	39.0	16.9
16	74	76.2	29.8	5.6	3.7	14.8
17	81	76.2	28.9	2.7	-	16.2
18	2	76.0	30.5	1.7	71.7	10.0
19	40	76.0	30.0	1.7	38.3	10.0
20	63	75.5	30.5	7.4	44.4	3.7
21	45	75.1	32.7	8.3	31.7	5.0
22	34	73.9	33.8	1.8	42.1	24.6
23	27	73.4	30.5	3.3	28.3	16.7
24	24	73.2	30.7	-	32.8	20.7
25	22	73.1	31.8	1.7	61.7	25.0
26	50	72.7	30.7	3.4	55.9	22.0
27	17	72.4	36.8	1.8	7.0	33.3
28	47	72.0	34.2	1.7	50.0	15.0
29	51	71.9	32.9	-	43.1	6.9
30	78	71.8	25.8	1.8	47.3	1.8
31	9	71.7	28.1	10.0	28.3	8.3
32	61	71.6	23.0	8.6	25.9	1.7
33	29	71.5	25.5	8.6	19.0	36.2
34	69	71.4	34.7	9.8	19.7	31.1
35	73	71.1	32.7	1.8	14.3	1.8
36	6	70.7	34.0	-	61.4	19.3
37	7	70.5	27.6	5.7	62.3	13.2
38	43	70.2	28.0	3.9	49.0	19.6
39	53	70.1	30.7	-	60.0	13.3
40	71	70.0	33.7	5.5	36.4	1.8

Table 19 continued

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
41	8	69.9	28.3	8.3	35.0	11.7
42	30	69.5	28.1	15.9	34.1	22.7
43	59	69.5	31.8	3.9	60.8	9.8
44	12	69.3	31.0	1.8	56.1	1.8
45	38	69.1	35.5	3.8	34.0	35.8
46	41	69.0	27.0	-	76.7	16.7
47	13	68.9	24.1	1.8	50.0	19.6
48	48	68.9	27.1	3.4	37.9	6.9
49	15	68.7	28.4	1.7	33.3	10.0
50	37	68.5	26.9	1.9	20.8	7.5
51	67	67.7	28.9	-	46.7	6.7
52	3	67.4	31.4	-	20.0	28.3
53	26	67.2	30.0	-	29.1	10.9
54	57	67.2	29.4	8.3	76.7	6.7
55	31	67.0	26.2	5.5	30.9	20.0
56	39	66.8	28.7	10.0	43.3	15.0
57	77	66.6	24.8	1.8	60.0	1.8
58	49	66.3	32.5	-	48.1	17.3
59	35	66.1	40.0	6.5	32.3	29.0
60	76	65.6	31.1	1.6	56.5	4.8
61	75	65.5	29.6	1.7	37.3	13.6
62	64	65.1	33.2	3.8	55.8	17.3
63	42	64.9	30.2	1.7	63.3	5.0
64	4	64.2	29.2	-	36.5	9.6
65	28	64.2	30.4	3.5	29.8	17.5
66	56	64.2	20.1	1.7	69.5	3.4
67	70	63.2	34.6	3.9	33.3	21.6
68	60	62.9	33.4	5.3	35.1	14.0
69	55	62.8	27.8	-	61.4	19.3
70	80	62.8	29.7	6.1	14.3	16.3
71	32	62.1	25.5	5.7	41.5	3.8
72	5	61.1	29.8	1.8	26.8	12.5
73	23	61.0	30.5	4.0	8.0	16.0
74	68	59.9	33.5	1.6	26.2	18.0
75	58	59.8	38.2	1.7	73.3	11.7
76	79	59.8	30.7	-	37.7	20.8
77	72	59.0	35.0	4.2	22.9	22.9
78	46	59.0	30.4	1.7	43.1	10.3
79	44	58.1	34.9	6.7	36.7	6.7
80	36	57.6	28.0	-	50.0	6.7
81	62	57.2	32.5	2.1	33.3	12.5

Standard error of means = 9.3 bu.

Least significant difference at 5% level = 25.8 bu.

Least significant difference at 1% level = 33.8 bu.

Coefficient of variation = 13.2

TABLE 20

Agronomic data from Experiment 93
Population:12,000 plants per acre, Ingham County

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
1	39	136.0	34.0	3.7	42.7	19.5
2	1	130.8	34.4	-	28.7	14.9
3	6	127.1	35.3	-	46.1	36.8
4	66	126.5	39.5	1.2	42.7	51.2
5	46	125.3	34.7	-	20.7	19.5
6	69	124.9	39.4	3.5	22.4	35.3
7	64	124.4	32.3	1.3	44.3	25.3
8	14	123.5	38.3	1.2	73.3	11.6
9	35	122.3	38.2	3.3	16.7	27.8
10	10	122.2	34.0	1.1	50.0	10.2
11	42	122.2	36.1	7.1	15.3	4.7
12	58	122.1	39.2	-	67.0	-
13	20	121.6	22.9	5.6	22.5	14.6
14	68	120.2	36.9	3.6	25.3	20.5
15	71	119.4	31.7	-	18.3	2.4
16	40	119.2	37.9	1.2	26.8	11.0
17	4	118.1	25.1	6.8	5.4	9.5
18	52	116.9	36.1	-	16.3	2.3
19	34	116.8	35.4	3.4	46.1	21.3
20	29	116.8	32.3	-	5.6	42.2
21	51	116.6	29.1	-	36.6	14.6
22	67	114.8	36.5	-	29.1	17.7
23	36	113.6	31.8	-	42.9	14.3
24	26	113.5	32.2	-	24.4	15.1
25	47	113.2	38.4	2.6	32.1	19.2
26	73	112.8	33.5	1.2	6.2	21.0
27	18	112.1	33.6	1.1	40.4	6.7
28	45	112.0	37.8	4.9	16.0	14.8
29	22	111.8	35.2	1.1	32.6	19.1
30	11	111.6	37.2	4.7	20.0	3.5
31	19	111.2	38.7	1.3	16.3	2.5
32	63	111.2	36.9	1.2	22.4	16.5
33	57	110.7	35.3	-	50.6	9.2
34	2	110.6	34.2	-	50.0	19.3
35	24	110.6	37.0	-	37.6	7.1
36	44	110.6	34.5	-	15.9	14.6
37	25	110.4	35.2	3.3	25.6	7.8
38	54	110.4	37.4	1.3	23.4	27.3
39	76	109.0	41.4	2.4	52.9	7.1
40	75	108.2	37.6	-	40.5	27.4

Table 20 continued

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
41	78	108.1	37.9	1.2	19.8	9.3
42	37	108.0	32.5	2.4	8.5	7.3
43	79	107.6	37.4	1.3	13.8	11.3
44	16	107.5	38.0	3.6	22.9	22.9
45	65	107.4	37.8	2.2	43.8	12.4
46	17	107.3	35.6	-	5.8	18.6
47	28	106.5	36.9	3.6	28.9	16.9
48	50	106.5	36.8	4.7	30.2	7.0
49	59	106.2	39.0	9.5	46.4	11.9
50	15	105.6	35.5	1.2	13.4	15.9
51	55	105.1	37.5	1.3	18.8	37.5
52	81	104.8	31.3	3.2	4.8	1.6
53	7	104.1	34.3	2.4	15.9	24.4
54	27	104.0	37.0	2.5	15.0	15.0
55	53	103.2	30.6	3.4	34.8	15.7
56	33	102.7	34.9	1.2	20.7	20.7
57	48	102.5	32.1	12.0	25.3	4.8
58	72	102.5	34.4	4.3	15.9	30.4
59	74	102.4	37.4	-	7.5	23.8
60	60	102.1	38.2	1.2	31.3	26.5
61	49	101.4	35.4	3.6	13.1	7.1
62	13	101.2	28.8	-	22.5	11.3
63	41	101.2	39.3	-	49.4	8.4
64	3	101.0	34.4	1.3	10.3	9.0
65	80	99.7	34.0	1.6	8.1	9.7
66	61	99.4	28.9	3.7	21.0	3.7
67	30	98.5	34.8	7.5	4.5	4.5
68	56	97.7	34.3	2.4	27.4	1.2
69	70	95.5	45.6	1.4	26.4	18.1
70	43	95.0	32.8	2.9	45.7	8.6
71	5	94.5	33.5	-	9.0	9.0
72	32	94.0	28.2	1.1	6.9	2.3
73	38	93.9	35.6	-	34.2	23.3
74	21	93.7	40.0	-	6.4	9.0
75	62	93.7	36.7	-	5.2	-
76	8	93.3	34.3	8.1	12.8	8.1
77	23	88.9	33.2	-	2.9	16.2
78	12	87.4	37.5	-	44.3	8.9
79	31	87.0	33.2	3.5	3.5	19.8
80	77	86.9	28.8	-	34.2	-
81	9	81.3	31.7	-	11.3	16.1

Standard error of means = 8.4 bu.

Least significant difference at 5% level = 23.4 bu.

Least significant difference at 1% level = 30.8 bu.

Coefficient of variation = 7.8

TABLE 21

Agronomic data from Experiment 94
Population: 12,000 plants per acre, Saginaw County

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
1	81	104.5	29.4	8.2	14.3	14.3
2	35	95.9	28.8	7.4	39.5	14.8
3	55	95.6	27.4	7.1	47.1	21.4
4	69	93.3	33.3	7.1	32.1	16.7
5	48	92.6	25.0	17.8	27.8	1.1
6	71	92.6	33.8	-	46.2	-
7	27	92.2	30.8	6.4	17.9	6.4
8	52	90.1	31.6	2.2	53.9	-
9	14	88.8	32.9	3.6	45.8	-
10	76	88.7	30.7	3.9	48.1	-
11	17	88.6	32.3	2.7	20.3	10.8
12	2	88.5	30.8	4.7	44.7	1.2
13	38	88.5	30.0	3.7	24.7	6.2
14	34	87.8	33.7	3.6	33.7	12.0
15	22	87.7	33.8	-	72.0	2.4
16	72	86.7	29.8	8.0	22.0	18.0
17	1	86.3	29.7	3.6	24.1	6.0
18	11	86.2	34.5	5.0	15.0	11.3
19	33	86.1	33.9	5.6	31.9	16.7
20	49	86.1	31.9	6.0	25.3	8.4
21	37	85.9	27.8	2.4	13.3	-
22	29	85.2	28.0	3.8	25.3	20.3
23	30	84.9	32.9	16.4	16.4	10.9
24	21	84.8	26.9	2.5	8.8	3.8
25	80	84.2	29.3	11.8	11.8	4.4
26	3	83.7	26.9	2.3	17.4	14.0
27	5	83.7	30.1	6.8	51.4	5.4
28	54	83.7	29.2	10.4	37.7	10.4
29	45	83.6	36.5	8.3	36.9	4.8
30	66	83.2	35.7	1.3	57.7	20.5
31	42	82.7	30.1	4.5	62.5	1.1
32	4	82.5	28.9	3.4	63.8	1.7
33	51	82.3	31.7	9.3	48.8	5.8
34	41	82.2	31.8	3.8	85.9	7.7
35	24	82.0	34.0	1.4	41.7	6.9
36	47	81.7	35.0	6.0	25.0	4.8
37	62	81.1	33.1	-	31.5	5.5
38	9	80.7	25.2	5.4	17.6	4.1
39	28	80.6	30.5	5.9	17.6	4.4
40	67	80.6	29.2	1.2	45.2	3.6

Table 21 continued

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging		Two-eared plants %
				Stalk %	Root %	
41	25	80.4	31.2	1.2	52.9	7.1
42	10	79.9	30.7	-	64.0	7.0
43	79	78.9	33.7	2.6	36.4	2.6
44	15	78.8	31.2	5.2	15.6	2.6
45	36	78.3	30.3	2.2	31.5	2.2
46	32	78.2	29.0	2.6	60.5	-
47	26	78.1	31.4	7.2	39.1	8.7
48	56	77.7	31.3	1.3	46.7	1.3
49	13	77.5	26.1	3.6	34.5	2.4
50	44	77.3	32.1	6.6	34.2	9.2
51	19	76.0	32.3	-	44.1	2.9
52	50	76.0	30.5	6.2	50.6	4.9
53	6	75.9	31.5	5.2	45.5	6.5
54	8	75.6	32.2	13.5	29.7	2.7
55	74	75.6	30.4	6.8	13.7	9.6
56	18	75.5	28.0	1.4	16.7	1.4
57	53	75.1	31.3	2.2	30.0	5.6
58	40	74.8	28.7	2.5	22.5	2.5
59	59	74.2	32.6	2.9	51.4	2.9
60	61	74.0	27.4	2.5	55.6	-
61	46	73.9	31.0	4.8	59.5	4.8
62	63	73.6	32.2	4.1	61.6	4.1
63	70	73.3	36.4	-	30.3	16.7
64	16	72.8	35.6	6.4	35.9	9.0
65	75	72.2	35.3	5.2	42.9	2.6
66	73	72.1	33.6	4.0	5.3	1.3
67	31	71.2	30.1	1.4	24.3	4.3
68	64	71.1	34.1	8.2	50.7	4.1
69	20	71.0	28.2	10.5	10.5	7.9
70	7	70.7	29.1	1.1	52.9	3.4
71	78	69.5	34.7	5.7	36.8	4.6
72	58	68.7	38.0	5.0	70.0	-
73	12	68.6	30.1	7.1	39.3	4.8
74	68	66.7	32.6	1.4	38.9	8.3
75	65	66.3	34.0	2.4	37.3	1.2
76	23	66.2	29.4	2.6	22.4	15.8
77	39	65.6	29.4	5.0	41.3	10.0
78	77	65.1	24.6	2.3	41.4	3.4
79	60	62.7	41.1	1.3	54.5	10.4
80	57	62.6	32.1	-	78.4	6.8
81	43	61.1	31.0	3.1	66.2	3.1

Standard error of means = 9.3 bu.

Least significant difference at 5% level = 25.8 bu.

Least significant difference at 1% level = 33.8 bu.

Coefficient of variation = 11.7

TABLE 22

Agronomic data from Experiment 95
Population:16,000 plants per acre, Ingham County

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
1	69	128.6	38.7	3.0	29.3	35.4
2	66	122.0	39.7	2.2	63.0	27.2
3	76	118.4	39.5	-	50.6	5.6
4	64	118.3	26.4	1.1	44.4	10.0
5	67	117.7	36.7	1.1	34.5	13.8
6	52	116.1	37.3	2.0	19.2	1.0
7	55	115.3	37.0	-	33.0	26.4
8	47	113.8	38.8	1.9	25.7	12.4
9	14	112.4	40.5	10.2	50.0	9.3
10	44	111.8	36.6	2.4	15.9	11.0
11	60	111.4	28.0	3.2	36.6	15.1
12	10	111.1	37.5	3.1	59.2	10.2
13	19	111.0	36.5	-	7.8	4.4
14	2	110.8	36.1	1.1	68.8	14.0
15	35	110.7	41.2	2.1	39.2	20.6
16	71	109.8	37.7	4.9	29.6	8.6
17	75	109.6	38.1	2.2	47.3	20.4
18	6	109.4	37.7	-	41.9	23.3
19	73	109.0	36.3	3.4	10.3	13.8
20	57	108.4	36.1	-	60.2	11.2
21	21	108.1	30.8	3.0	5.1	9.1
22	80	108.0	34.9	2.3	20.7	3.4
23	7	107.8	35.3	-	37.9	12.6
24	20	107.3	32.3	9.3	13.0	13.9
25	36	107.0	34.6	-	32.4	7.8
26	16	106.8	38.1	-	40.6	14.2
27	58	106.8	42.1	1.0	59.4	-
28	68	106.6	39.0	1.0	22.3	21.4
29	12	105.8	37.1	1.1	58.5	5.3
30	34	105.8	38.4	1.0	41.4	15.2
31	59	105.7	38.2	15.2	68.5	8.7
32	39	105.3	37.1	-	48.6	10.3
33	54	105.2	36.6	1.3	25.0	18.8
34	33	105.1	37.2	2.9	23.5	11.8
35	46	104.9	37.6	1.9	53.8	3.8
36	11	104.7	40.1	4.2	34.4	7.3
37	41	104.6	36.1	1.0	45.6	5.8
38	40	104.5	39.2	2.2	29.0	6.5
39	15	104.4	34.4	2.2	27.5	5.5
40	50	104.4	36.8	1.9	41.7	10.7

Table 22 continued

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
41	24	104.0	45.4	4.1	40.2	10.3
42	74	103.9	39.8	1.1	18.2	25.0
43	38	103.6	37.8	4.5	30.3	13.5
44	51	103.3	38.0	2.2	33.0	15.4
45	28	102.8	36.3	1.9	17.0	11.3
46	63	101.9	38.0	3.5	31.8	7.1
47	70	101.5	39.1	1.2	10.6	21.2
48	26	101.1	35.9	4.2	20.8	6.3
49	27	100.8	38.1	1.1	17.2	12.6
50	62	100.3	37.0	-	10.0	2.5
51	18	99.5	38.1	-	41.2	18.6
52	1	99.2	37.1	1.0	35.6	5.8
53	42	98.7	38.0	1.0	22.1	3.8
54	25	98.4	36.4	-	20.8	5.0
55	49	97.3	38.3	2.1	19.8	4.2
56	65	97.1	38.7	1.0	48.0	7.0
57	22	97.0	44.3	-	30.3	7.9
58	72	96.7	35.3	3.3	22.0	13.2
59	48	96.6	36.0	5.2	24.7	2.1
60	29	96.5	34.8	1.9	18.1	20.0
61	78	96.5	39.4	-	30.0	11.0
62	17	95.8	37.5	-	9.5	13.7
63	37	95.6	34.4	-	6.5	2.2
64	77	94.9	29.5	-	23.5	3.7
65	13	94.7	34.7	1.1	37.2	4.3
66	30	94.7	34.6	8.8	15.0	3.8
67	81	93.5	35.9	16.3	20.0	1.3
68	4	93.3	40.3	-	12.5	4.5
69	56	93.3	35.7	-	46.9	3.1
70	3	93.2	36.1	-	12.0	13.0
71	45	92.8	39.7	-	22.2	6.7
72	43	91.5	35.9	-	43.8	1.1
73	53	91.3	36.4	3.1	26.0	3.1
74	79	90.9	38.3	-	25.8	5.4
75	61	90.2	31.1	1.1	31.6	-
76	32	89.8	31.8	-	25.6	-
77	8	87.7	37.3	2.2	24.4	2.2
78	9	86.9	32.5	3.8	7.6	7.6
79	5	85.9	43.4	1.0	9.2	9.2
80	31	80.5	39.9	7.2	30.1	9.6
81	23	80.0	32.8	1.3	1.3	13.3

Standard error of means = 7.5 bu.

Least significant difference at 5% level = 20.7 bu.

Least significant difference at 1% level = 27.2 bu.

Coefficient of variation = 7.3

TABLE 23

Agronomic data from Experiment 96
Population:16,000 plants per acre, Saginaw County

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
1	41	96.0	27.9	7.0	35.0	3.0
2	42	94.5	28.6	6.4	53.2	-
3	54	92.2	27.1	9.8	29.3	6.5
4	47	89.6	32.3	8.4	45.3	8.4
5	14	88.4	32.5	1.0	49.5	2.9
6	1	86.9	27.9	3.9	35.3	-
7	52	85.9	31.3	5.9	45.5	2.0
8	10	85.7	30.6	5.2	62.5	1.0
9	57	85.4	27.3	1.0	76.0	1.0
10	36	85.1	29.4	3.8	41.3	2.9
11	45	85.0	32.0	2.0	48.0	2.0
12	11	84.9	34.0	9.9	19.7	4.2
13	44	83.4	28.6	9.2	41.4	1.1
14	79	83.0	30.7	4.6	47.1	3.4
15	64	82.4	31.6	11.6	52.3	7.0
16	33	82.2	35.0	9.5	30.5	8.4
17	51	82.2	32.6	7.4	44.2	3.2
18	2	82.0	32.0	6.1	60.2	6.1
19	49	81.6	31.9	5.0	56.0	-
20	3	81.3	30.4	3.3	40.7	6.6
21	28	81.3	30.4	11.4	40.5	7.6
22	27	81.2	30.9	7.9	16.9	6.7
23	17	80.6	29.2	7.0	20.9	8.1
24	46	80.6	28.7	6.3	41.1	1.1
25	22	80.2	34.3	10.3	69.0	3.4
26	55	79.2	28.5	9.7	63.4	6.5
27	18	78.9	28.8	7.4	16.8	2.1
28	4	78.6	27.1	2.4	43.4	2.4
29	24	78.4	29.7	3.2	35.8	3.2
30	65	78.1	31.4	15.7	34.9	-
31	34	78.0	34.9	9.4	57.6	9.4
32	60	78.0	33.2	4.6	58.6	12.6
33	25	77.8	30.7	3.5	62.4	3.5
34	78	77.5	34.9	8.8	37.4	1.1
35	66	77.4	32.4	4.7	61.6	10.5
36	7	77.2	27.9	4.5	52.3	-
37	74	77.1	28.0	11.9	9.5	3.6
38	81	76.3	28.8	15.9	21.7	2.9
39	9	76.2	26.8	19.5	26.8	2.4
40	13	76.2	26.8	1.1	86.7	2.2

Table 23 continued

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
41	29	76.2	30.8	4.6	44.8	5.7
42	69	75.9	32.9	17.3	17.3	9.9
43	16	75.8	30.7	9.3	33.7	2.3
44	37	75.5	28.5	1.1	10.5	-
45	43	75.4	26.6	4.9	56.1	1.2
46	20	75.3	27.2	21.7	6.0	4.8
47	73	75.3	31.6	4.7	16.3	2.3
48	59	74.2	33.5	4.7	56.5	7.1
49	30	74.0	30.4	19.4	6.0	3.0
50	32	73.9	25.9	-	46.6	1.1
51	38	73.8	37.2	7.5	36.6	3.2
52	58	73.6	37.4	6.1	82.8	3.0
53	39	73.5	29.4	6.1	59.6	2.0
54	21	73.3	25.9	5.1	26.6	3.8
55	75	73.1	30.3	12.1	58.2	5.5
56	67	72.9	28.5	1.2	43.0	1.2
57	35	72.3	36.9	9.1	42.9	10.4
58	15	72.1	28.7	10.5	22.4	2.6
59	76	72.1	30.3	2.3	65.5	1.1
60	61	71.3	26.8	6.2	51.9	-
61	5	71.1	29.2	9.4	37.6	1.2
62	40	70.8	34.4	1.1	80.2	1.1
63	26	70.6	39.9	3.3	39.6	2.2
64	53	70.4	35.2	8.9	41.6	1.0
65	71	70.4	33.4	1.2	40.7	-
66	48	69.8	34.4	11.5	50.6	2.3
67	8	69.7	32.1	20.8	42.9	5.2
68	63	69.5	33.7	7.4	71.6	1.2
69	19	69.4	29.3	2.5	37.5	2.5
70	80	69.0	27.5	5.9	24.7	2.4
71	56	68.4	30.9	1.1	81.6	-
72	50	67.7	32.6	5.4	53.8	5.4
73	12	67.6	29.0	6.7	57.3	1.1
74	68	67.4	30.8	1.1	27.6	4.6
75	72	66.3	28.7	4.6	38.5	20.0
76	6	66.0	37.5	15.6	45.5	5.2
77	23	65.8	29.8	1.2	23.5	4.7
78	31	65.8	27.5	9.5	42.9	-
79	77	65.8	24.4	6.3	63.5	-
80	70	65.4	39.4	-	53.3	-
81	62	64.5	36.7	4.7	35.3	-

Standard error of means = 7.9 bu.

Least significant difference at 5% level = 21.8 bu.

Least significant difference at 1% level = 28.6 bu.

Coefficient of variation = 10.3

TABLE 24

Mean agronomic data for 81 corn hybrids grown at three plant populations: 8,000, 12,000 and 16,000 plants per acre, grown at Ingham and Saginaw Counties. Experiments 91-96, 1958.

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
1	66	105.3	34.9	3.0	56.0	35.6
2	69	102.6	36.3	6.8	22.7	33.5
3	1	102.4	32.4	1.7	30.9	7.8
4	14	101.3	35.2	4.1	48.8	7.6
5	10	98.5	33.2	1.6	56.8	9.7
6	52	98.5	34.1	2.2	28.0	3.6
7	35	97.9	37.6	4.7	31.8	27.6
8	76	96.3	35.5	1.7	53.1	4.5
9	2	95.8	33.4	2.6	57.0	14.0
10	64	95.6	30.9	4.6	48.3	17.1
11	11	95.1	36.5	5.4	19.8	9.8
12	47	94.9	36.3	3.4	33.9	16.9
13	71	94.6	33.6	1.9	32.9	4.2
14	42	93.7	33.3	4.0	39.5	7.3
15	73	92.9	34.4	2.5	13.2	12.3
16	41	92.7	33.0	2.0	56.7	11.0
17	54	92.5	32.0	4.4	28.9	23.2
18	51	92.1	33.5	3.2	36.3	14.5
19	34	92.0	35.4	3.2	45.0	16.6
20	20	91.9	27.3	10.8	11.3	19.5
21	46	91.9	33.2	2.4	43.9	11.6
22	6	91.8	36.3	3.5	45.0	24.7
23	39	91.6	32.5	4.1	43.3	13.5
24	29	90.6	30.8	3.4	20.2	29.8
25	16	90.5	35.8	3.8	26.4	20.2
26	40	90.5	34.6	1.4	35.4	7.5
27	25	90.3	33.4	1.9	36.2	10.9
28	17	90.2	34.5	2.2	10.6	21.8
29	55	90.0	32.3	3.0	39.4	31.5
30	67	90.0	32.7	0.6	37.5	11.8
31	44	89.7	34.1	4.5	28.9	12.3
32	58	89.5	39.6	2.3	67.4	4.7
33	21	89.4	30.1	1.8	10.3	14.9
34	27	89.4	34.0	3.5	18.2	13.0
35	19	89.2	35.7	0.6	24.8	8.2
36	18	89.0	32.1	1.9	27.2	9.8
37	15	88.8	32.4	4.2	22.8	14.3
38	33	88.6	34.8	4.6	24.8	18.6
39	74	88.5	34.0	4.2	10.1	20.6
40	59	88.4	35.1	6.4	53.2	14.9

Table 24 continued

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
41	65	88.3	34.5	3.8	40.7	12.6
42	28	88.2	33.4	4.4	26.2	13.2
43	24	88.1	36.8	1.4	33.7	12.2
44	45	88.1	36.4	3.9	29.0	7.6
45	48	88.1	31.8	8.3	31.7	3.7
46	22	88.0	36.1	2.2	49.0	12.7
47	36	88.0	31.3	1.0	39.5	10.2
48	81	87.8	32.3	8.1	10.5	10.2
49	38	87.7	35.2	3.2	30.4	25.0
50	57	87.5	33.6	1.9	64.7	9.4
51	37	87.3	30.5	1.3	13.4	5.0
52	75	87.2	34.6	3.5	47.1	17.4
53	3	87.1	32.8	1.2	31.6	18.1
54	7	87.0	31.5	2.3	38.0	16.0
55	26	86.6	34.2	2.4	31.6	12.1
56	50	86.2	34.1	3.6	44.8	11.4
57	4	85.8	31.2	2.1	26.9	7.8
58	49	85.8	34.5	2.8	30.7	9.8
59	63	85.5	34.5	3.9	43.8	9.2
60	68	85.2	35.5	1.5	28.5	16.4
61	13	85.0	28.6	1.3	41.3	12.0
62	78	84.2	35.6	2.9	32.7	9.6
63	60	84.1	35.3	2.6	44.8	19.4
64	80	83.0	31.7	4.9	15.1	8.8
65	53	82.9	33.3	2.9	36.0	10.6
66	72	82.5	31.2	4.1	20.8	24.2
67	79	82.5	34.8	1.4	27.5	9.2
68	12	81.8	33.4	3.1	48.4	6.7
69	30	81.6	33.7	11.3	13.1	9.1
70	70	81.2	38.8	1.1	27.2	18.8
71	8	80.4	33.3	9.1	27.2	7.7
72	5	79.8	33.7	3.5	23.2	10.2
73	9	79.8	30.3	6.4	17.6	11.2
74	43	79.7	31.6	2.5	51.2	7.4
75	62	78.6	35.3	1.1	19.5	4.4
76	56	78.5	31.5	1.1	48.2	3.5
77	61	78.5	28.9	3.7	32.2	1.8
78	32	77.6	28.3	2.1	30.7	1.8
79	77	75.4	26.9	1.7	38.8	1.5
80	31	73.9	32.0	4.8	23.4	12.0
81	23	71.0	31.5	1.5	9.7	15.9

Standard error of means = 1.5 bu.

Least significant difference at 5% level = 4.2 bu.

Least significant difference at 1% level = 5.5 bu.

Table 24 continued

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
41	65	88.3	34.5	3.8	40.7	12.6
42	28	88.2	33.4	4.4	26.2	13.2
43	24	88.1	36.8	1.4	33.7	12.2
44	45	88.1	36.4	3.9	29.0	7.6
45	48	88.1	31.8	8.3	31.7	3.7
46	22	88.0	36.1	2.2	49.0	12.7
47	36	88.0	31.3	1.0	39.5	10.2
48	81	87.8	32.3	8.1	10.5	10.2
49	38	87.7	35.2	3.2	30.4	25.0
50	57	87.5	33.6	1.9	64.7	9.4
51	37	87.3	30.5	1.3	13.4	5.0
52	75	87.2	34.6	3.5	47.1	17.4
53	3	87.1	32.8	1.2	31.6	18.1
54	7	87.0	31.5	2.3	38.0	16.0
55	26	86.6	34.2	2.4	31.6	12.1
56	50	86.2	34.1	3.6	44.8	11.4
57	4	85.8	31.2	2.1	26.9	7.8
58	49	85.8	34.5	2.8	30.7	9.8
59	63	85.5	34.5	3.9	43.8	9.2
60	68	85.2	35.5	1.5	28.5	16.4
61	13	85.0	28.6	1.3	41.3	12.0
62	78	84.2	35.6	2.9	32.7	9.6
63	60	84.1	35.3	2.6	44.8	19.4
64	80	83.0	31.7	4.9	15.1	8.8
65	53	82.9	33.3	2.9	36.0	10.6
66	72	82.5	31.2	4.1	20.8	24.2
67	79	82.5	34.8	1.4	27.5	9.2
68	12	81.8	33.4	3.1	48.4	6.7
69	30	81.6	33.7	11.3	13.1	9.1
70	70	81.2	38.8	1.1	27.2	18.8
71	8	80.4	33.3	9.1	27.2	7.7
72	5	79.8	33.7	3.5	23.2	10.2
73	9	79.8	30.3	6.4	17.6	11.2
74	43	79.7	31.6	2.5	51.2	7.4
75	62	78.6	35.3	1.1	19.5	4.4
76	56	78.5	31.5	1.1	48.2	3.5
77	61	78.5	28.9	3.7	32.2	1.8
78	32	77.6	28.3	2.1	30.7	1.8
79	77	75.4	26.9	1.7	38.8	1.5
80	31	73.9	32.0	4.8	23.4	12.0
81	23	71.0	31.5	1.5	9.7	15.9

Standard error of means = 1.5 bu.

Least significant difference at 5% level = 4.2 bu.

Least significant difference at 1% level = 5.5 bu.

Table 24 continued

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
41	65	88.3	34.5	3.8	40.7	12.6
42	28	88.2	33.4	4.4	26.2	13.2
43	24	88.1	36.8	1.4	33.7	12.2
44	45	88.1	36.4	3.9	29.0	7.6
45	48	88.1	31.8	8.3	31.7	3.7
46	22	88.0	36.1	2.2	49.0	12.7
47	36	88.0	31.3	1.0	39.5	10.2
48	81	87.8	32.3	8.1	10.5	10.2
49	38	87.7	35.2	3.2	30.4	25.0
50	57	87.5	33.6	1.9	64.7	9.4
51	37	87.3	30.5	1.3	13.4	5.0
52	75	87.2	34.6	3.5	47.1	17.4
53	3	87.1	32.8	1.2	31.6	18.1
54	7	87.0	31.5	2.3	38.0	16.0
55	26	86.6	34.2	2.4	31.6	12.1
56	50	86.2	34.1	3.6	44.8	11.4
57	4	85.8	31.2	2.1	26.9	7.8
58	49	85.8	34.5	2.8	30.7	9.8
59	63	85.5	34.5	3.9	43.8	9.2
60	68	85.2	35.5	1.5	28.5	16.4
61	13	85.0	28.6	1.3	41.3	12.0
62	78	84.2	35.6	2.9	32.7	9.6
63	60	84.1	35.3	2.6	44.8	19.4
64	80	83.0	31.7	4.9	15.1	8.8
65	53	82.9	33.3	2.9	36.0	10.6
66	72	82.5	31.2	4.1	20.8	24.2
67	79	82.5	34.8	1.4	27.5	9.2
68	12	81.8	33.4	3.1	48.4	6.7
69	30	81.6	33.7	11.3	13.1	9.1
70	70	81.2	38.8	1.1	27.2	18.8
71	8	80.4	33.3	9.1	27.2	7.7
72	5	79.8	33.7	3.5	23.2	10.2
73	9	79.8	30.3	6.4	17.6	11.2
74	43	79.7	31.6	2.5	51.2	7.4
75	62	78.6	35.3	1.1	19.5	4.4
76	56	78.5	31.5	1.1	48.2	3.5
77	61	78.5	28.9	3.7	32.2	1.8
78	32	77.6	28.3	2.1	30.7	1.8
79	77	75.4	26.9	1.7	38.8	1.5
80	31	73.9	32.0	4.8	23.4	12.0
81	23	71.0	31.5	1.5	9.7	15.9

Standard error of means = 1.5 bu.

Least significant difference at 5% level = 4.2 bu.

Least significant difference at 1% level = 5.5 bu.

TABLE 25

Mean agronomic data for 81 corn hybrids grown at 8,000 plants per acre at two locations - Ingham and Saginaw Counties. Experiments 91 and 92, 1958.

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
1	66	112.5	31.1	4.3	55.6	52.2
2	1	105.6	32.6	0.9	30.9	10.0
3	14	97.2	33.6	4.4	37.2	11.0
4	69	96.4	36.7	4.9	17.5	52.0
5	10	96.0	33.2	-	52.5	15.0
6	76	94.7	35.5	0.8	50.8	6.6
7	73	94.0	35.7	0.9	20.5	17.6
8	35	93.1	40.1	3.3	26.2	46.2
9	2	91.6	33.8	1.7	59.2	21.6
10	11	91.4	36.6	4.4	14.9	16.2
11	52	91.0	34.3	1.7	16.7	9.2
12	65	90.4	32.5	0.9	40.0	27.5
13	16	90.0	36.2	1.8	12.8	36.4
14	64	88.6	30.6	2.8	49.1	28.2
15	21	88.4	28.6	-	7.5	31.8
16	20	88.0	26.6	8.7	8.0	38.0
17	71	87.6	32.7	2.8	31.4	7.0
18	25	87.4	33.5	1.7	27.9	21.0
19	40	86.9	33.9	0.9	27.1	12.0
20	6	86.3	37.9	-	45.4	38.1
21	41	86.2	31.4	-	62.1	20.6
22	74	86.0	34.1	2.8	6.0	30.8
23	15	85.8	32.5	2.9	28.9	29.5
24	47	85.6	36.6	0.9	37.8	28.4
25	59	85.2	33.6	2.9	48.3	29.4
26	39	84.6	32.5	5.0	33.7	19.6
27	17	84.5	36.1	1.8	3.5	40.0
28	29	84.4	29.6	5.2	13.8	45.2
29	19	84.0	38.8	-	21.6	18.3
30	51	84.0	34.8	-	27.6	24.2
31	18	83.8	32.0	0.9	24.2	15.0
32	48	83.6	31.8	1.7	31.0	6.0
33	46	83.4	33.7	0.9	44.1	20.2
34	38	83.2	35.4	1.9	28.3	51.8
35	58	83.0	40.4	0.9	62.5	12.5
36	42	82.2	33.5	2.6	42.0	17.2
37	54	82.0	30.8	1.7	25.9	38.2
38	34	81.8	35.1	0.9	45.7	20.8
39	3	81.6	34.4	-	14.5	32.9
40	50	81.5	34.1	1.7	46.3	20.2

Table 25 continued

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
41	7	81.2	31.2	2.9	34.7	27.6
42	12	80.8	33.5	1.8	45.6	10.0
43	13	80.2	27.6	0.9	33.5	25.8
44	75	80.0	33.2	0.9	46.7	24.4
45	37	79.5	29.9	1.0	20.8	10.4
46	28	79.2	33.3	1.8	26.6	19.6
47	27	79.1	33.6	1.7	21.0	18.5
48	57	78.9	35.6	5.1	61.6	14.0
49	53	78.8	33.3	-	41.7	19.2
50	63	78.4	33.3	3.7	37.7	13.0
51	26	78.2	32.9	-	32.8	20.0
52	8	78.0	32.0	5.1	26.6	14.0
53	33	77.8	33.9	4.3	21.0	27.0
54	44	77.6	36.5	4.4	33.1	19.0
55	45	77.6	36.2	4.2	25.4	8.6
56	43	77.5	31.6	2.0	47.7	15.4
57	67	77.0	32.8	-	36.5	17.4
58	9	76.8	32.8	5.0	21.3	18.4
59	24	76.8	37.3	-	23.6	22.8
60	78	76.7	33.3	0.9	36.2	15.9
61	22	75.8	34.5	0.9	45.0	21.6
62	70	75.7	36.3	2.0	21.3	28.4
63	60	75.2	35.8	2.7	44.0	25.8
64	68	75.2	36.8	0.8	28.4	21.7
65	49	74.4	34.8	-	34.9	19.5
66	81	73.7	34.4	2.4	1.1	20.6
67	55	73.1	31.6	-	37.2	48.6
68	36	72.1	30.8	-	44.5	16.9
69	5	71.6	33.0	1.8	16.2	18.0
70	72	71.6	34.5	2.1	13.4	31.6
71	4	71.2	32.8	-	18.3	14.3
72	77	69.9	27.0	0.9	35.2	0.9
73	31	69.4	30.5	3.6	19.7	19.3
74	30	68.9	34.8	8.0	18.3	16.1
75	80	68.4	32.4	4.0	12.7	16.5
76	61	68.0	29.7	4.3	16.5	3.6
77	79	67.4	34.2	-	20.9	16.4
78	56	67.0	28.4	0.9	43.4	7.8
79	62	66.1	34.2	1.1	17.7	9.3
80	32	65.0	27.4	4.5	22.4	3.6
81	23	62.4	32.0	2.0	4.0	22.7

Standard error of means = 5.0 bu.

Least significant difference at 5% level = 13.8 bu.

Least significant difference at 1% level = 18.2 bu.

TABLE 26

Mean agronomic data for 81 corn hybrids grown at 12,000 plants per acre at two locations -Ingham and Saginaw Counties. Experiments 93 and 94, 1958.

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
1	35	109.1	33.5	5.4	28.1	21.3
2	69	109.1	36.4	5.3	27.3	26.0
3	1	108.5	32.1	1.8	26.4	10.4
4	14	106.2	35.6	2.4	59.6	5.8
5	71	106.0	32.8	-	32.3	1.2
6	66	104.8	37.6	1.3	50.2	35.8
7	81	104.6	30.4	5.7	9.6	8.0
8	52	103.5	33.9	1.1	35.1	1.2
9	42	102.4	33.1	5.8	38.9	2.9
10	34	102.3	34.6	3.5	39.9	16.6
11	6	101.5	33.4	2.6	45.8	21.6
12	10	101.0	32.4	0.6	57.0	8.6
13	29	101.0	30.2	1.9	15.5	31.2
14	39	100.8	31.7	4.4	42.0	14.8
15	55	100.4	32.5	4.2	33.0	29.4
16	4	100.3	27.0	5.1	34.6	5.6
17	22	99.8	34.5	0.6	52.3	10.8
18	46	99.6	32.9	2.4	40.1	12.2
19	2	99.5	32.5	2.4	47.4	10.3
20	51	99.4	30.4	4.7	42.7	10.2
21	11	98.9	35.9	4.9	17.5	7.4
22	76	98.8	36.1	3.2	50.5	3.5
23	27	98.1	33.9	4.5	16.5	10.7
24	17	98.0	34.0	1.4	13.1	14.7
25	45	97.8	37.2	6.6	26.5	9.8
26	64	97.8	33.2	4.8	47.5	14.7
27	67	97.7	32.9	-	37.2	10.6
28	48	97.6	28.6	14.9	26.6	3.0
29	47	97.4	36.7	4.3	28.6	12.0
30	37	97.0	30.2	2.4	10.9	3.6
31	40	97.0	33.3	1.9	24.7	6.8
32	54	97.0	33.3	5.9	30.6	18.8
33	20	96.3	25.6	8.1	16.5	11.2
34	24	96.3	35.5	0.7	39.7	7.0
35	36	96.0	31.1	1.1	37.2	8.2
36	26	95.8	31.8	3.6	31.8	11.9
37	25	95.4	33.2	2.3	39.3	7.4
38	58	95.4	38.6	2.5	68.5	-
39	72	94.6	32.1	6.2	19.0	24.2
40	33	94.4	34.4	3.4	26.3	18.7

Table 26 continued

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
41	44	94.0	33.3	3.3	25.1	11.9
42	18	93.8	30.8	1.3	28.6	4.0
43	49	93.8	33.7	4.8	19.2	7.8
44	19	93.6	35.5	0.7	30.2	2.7
45	28	93.6	33.7	4.8	23.3	10.6
46	68	93.4	34.8	2.5	32.1	14.4
47	79	93.3	35.6	2.0	25.1	7.0
48	3	92.4	30.7	1.8	13.9	11.5
49	63	92.4	34.6	2.7	42.0	10.2
50	73	92.4	33.6	2.6	5.8	11.2
51	15	92.2	33.4	3.2	14.5	9.2
52	80	92.0	31.7	6.7	10.0	7.0
53	30	91.7	33.9	12.0	10.5	7.7
54	41	91.7	35.6	1.9	67.7	8.0
55	38	91.2	32.8	1.9	29.5	14.8
56	50	91.1	33.7	5.5	40.4	6.0
57	16	90.2	36.8	5.0	29.4	16.0
58	59	90.2	35.8	6.2	48.9	7.4
59	75	90.2	36.5	2.6	41.7	15.0
60	13	89.4	27.5	1.8	28.5	6.8
61	21	89.2	33.5	1.3	7.6	6.4
62	53	89.2	31.0	2.8	32.4	10.6
63	5	89.1	31.8	3.4	30.2	7.2
64	74	89.0	33.9	3.4	10.6	16.7
65	78	88.8	36.3	3.5	28.3	7.0
66	56	87.7	32.8	1.9	37.1	1.2
67	7	87.4	31.7	1.8	34.4	13.9
68	62	87.4	34.9	-	18.4	2.8
69	65	86.8	35.9	2.3	40.6	6.8
70	57	86.7	33.7	-	64.5	8.0
71	61	86.2	28.2	3.1	38.3	1.9
72	32	86.1	28.6	1.9	33.7	1.2
73	8	84.4	33.3	10.8	21.3	5.4
74	70	84.4	41.0	0.7	28.4	17.4
75	60	82.4	39.7	1.3	42.9	18.4
76	9	81.0	28.5	2.7	14.5	10.1
77	31	79.1	31.7	2.5	13.9	12.0
78	12	78.0	33.8	3.6	41.8	6.8
79	43	78.0	31.9	3.0	56.0	5.8
80	23	77.6	31.3	1.3	12.7	16.0
81	77	76.0	26.7	1.2	37.8	1.7

Standard error of means = 5.4 bu.

Least significant difference at 5% level = 15.0 bu.

Least significant difference at 1% level = 19.7 bu.

TABLE 27

Mean agronomic data for 81 corn hybrids grown at 16,000 plants per acre at two locations -Ingham and Saginaw Counties. Experiments 95 and 96, 1958.

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
1	69	102.2	35.8	10.2	23.3	22.6
2	47	101.7	35.6	5.2	35.5	10.4
3	52	101.0	34.3	4.0	32.4	1.5
4	14	100.4	36.5	5.6	49.8	6.1
5	64	100.4	29.0	6.4	48.4	8.5
6	41	100.3	32.0	4.0	40.3	4.4
7	66	99.7	36.1	3.5	62.3	18.8
8	54	98.7	31.9	5.6	27.2	12.6
9	10	98.4	34.1	4.2	60.9	5.6
10	44	97.6	32.6	5.8	28.7	6.0
11	55	97.2	32.8	4.9	48.2	16.4
12	57	96.9	31.7	0.5	68.1	6.1
13	42	96.6	33.3	3.7	37.7	1.9
14	2	96.4	34.1	3.6	64.5	10.0
15	36	96.0	32.0	1.9	36.9	5.4
16	67	95.3	32.6	1.2	38.8	7.5
17	76	95.2	34.9	1.2	58.1	3.4
18	11	94.8	37.1	7.1	27.1	5.8
19	60	94.7	30.6	3.9	47.6	13.8
20	33	93.6	36.1	6.2	27.0	10.1
21	46	92.8	33.2	4.1	47.5	2.4
22	51	92.8	35.3	4.8	38.6	9.3
23	1	93.0	32.5	2.5	35.5	2.9
24	7	92.5	31.6	2.3	45.1	6.3
25	73	92.2	34.0	4.1	13.3	8.0
26	28	92.0	33.4	6.7	28.8	9.4
27	34	91.9	36.7	5.2	49.5	12.3
28	35	91.5	39.1	5.6	41.1	15.5
29	75	91.4	34.2	7.2	52.8	13.0
30	16	91.3	34.4	4.7	37.2	8.2
31	20	91.3	29.8	15.5	9.5	9.4
32	24	91.2	37.6	3.7	38.0	6.8
33	27	91.0	34.5	4.5	17.1	9.7
34	21	90.7	28.4	4.1	15.9	6.4
35	74	90.5	33.9	6.5	13.9	14.3
36	19	90.2	32.9	1.3	22.7	3.4
37	58	90.2	39.8	3.6	71.1	1.5
38	71	90.1	35.6	3.1	35.2	4.3
39	59	90.0	35.9	10.0	62.5	7.9
40	39	89.4	33.3	3.1	54.1	6.2

Table 27 continued

Rank by yield	Entry number	Yield bushels per acre	Moisture in ears %	Lodging Stalk %	Lodging Root %	Two-eared plants %
41	49	89.4	35.1	3.6	37.9	2.1
42	18	89.2	33.5	3.7	29.0	10.4
43	45	88.9	35.9	1.0	35.1	4.4
44	38	88.7	37.5	6.0	33.5	8.4
45	22	88.6	39.3	5.2	49.7	5.6
46	80	88.5	31.2	4.1	22.7	2.9
47	15	88.2	31.6	6.4	25.0	4.0
48	17	88.2	33.4	3.5	15.2	10.9
49	25	88.1	33.6	1.8	41.6	4.2
50	6	87.7	37.6	7.8	43.7	14.3
51	40	87.6	36.8	1.7	54.6	3.8
52	65	87.6	35.1	8.4	41.5	3.5
53	3	87.2	33.3	1.7	26.4	9.8
54	68	87.0	34.9	1.1	25.0	13.0
55	78	87.0	37.2	4.4	33.7	6.0
56	79	87.0	34.5	2.3	36.5	4.4
57	12	86.7	33.1	3.9	57.9	3.2
58	29	86.4	32.8	3.3	31.5	12.8
59	4	86.0	33.7	1.2	28.0	3.4
60	50	86.0	34.7	3.7	47.8	8.0
61	26	85.8	37.9	3.8	30.2	4.2
62	63	85.7	35.9	5.5	51.7	4.2
63	37	85.6	31.5	0.6	8.5	1.1
64	13	85.4	30.8	1.1	62.0	3.2
65	81	84.9	32.4	16.1	20.9	2.1
66	30	84.4	32.5	14.1	10.5	3.4
67	43	83.4	31.3	2.5	50.0	1.2
68	70	83.4	39.3	0.6	32.0	10.6
69	48	83.2	35.2	8.4	37.7	2.2
70	62	82.4	36.9	2.4	22.7	1.2
71	32	81.8	28.9	-	36.1	0.6
72	9	81.6	29.7	11.7	17.2	5.0
73	72	81.5	32.0	4.0	30.3	16.6
74	53	80.8	35.8	6.0	33.8	2.0
75	56	80.8	33.3	0.6	64.3	1.6
76	61	80.8	29.0	3.7	41.8	-
77	77	80.4	27.0	3.2	43.5	1.9
78	8	78.7	34.7	11.5	33.7	3.7
79	5	78.5	36.3	5.2	23.4	5.2
80	31	73.2	33.7	8.4	36.5	4.8
81	23	72.9	31.3	1.3	12.4	9.0

Standard error of means = 4.2 bu.

Least significant difference at 5% level = 11.6 bu.

Least significant difference at 1% level = 15.3 bu.

PERFORMANCE OF MULTIPLE-EARED INBRED LINES

IN

THREE-WAY HYBRIDS

By

Farrell M. Bagshaw

AN ABSTRACT

Submitted to the Graduate School of Michigan State University of Agriculture and Applied Science in partial fulfilment of the requirements for the degree of

MASTER OF SCIENCE

Department of Farm Crops

1959

Approved E. C. Rossman

ABSTRACT

Seventy S_3 inbred lines, selected for multiple ears during three segregating generations of inbreeding in crosses of several southern prolific sources with two early maturing single ear Michigan inbreds (MS1341 and MS24A) were crossed with the single cross (Oh51 x Oh26). These three-way hybrids were tested at three populations (8,000, 12,000 and 16,000 plants per acre) at two locations in 1958. The objectives were to evaluate the performance and adaptation of these lines in hybrids and to obtain information concerning the potential of multiple-eared hybrids in northern corn production.

With this group of previously untested lines, yields and percentage of two-eared plants varied depending upon hybrid, plant population and location. Mean yields were lowest and percentages of two-eared plants were highest at the 8,000 plant population. Highest mean yields were at the 12,000 population. Stalk and root lodging increased at higher populations.

One of the best two-eared hybrids averaged 52, 36 and 19 percent two-eared plants and 112, 105 and 100 bushels per acre at the three populations, respectively. One of the best single-eared hybrids averaged 10, 10 and 3 percent two-eared plants and 106, 108 and 93 bushels per acre.

Several inbreds developed from these "exotic" crosses contributed higher yields (significantly more than WF9), increased ear number, improved resistance to lodging, and early maturity when compared to the tester, Oh51 x Oh26. The added contributions in yield came from the southern germ-plasm.

Although affected by environment, a usable portion of the variation in ear number was heritable.

Hybrid x location interaction for yield was significant while hybrid x population interactions were not significant, suggesting that future tests could be conducted at one population (16,000 plants) but should include more locations.

The best multiple-eared hybrids showed no consistent superiority in ability to yield more than the best single-eared hybrids at any of the three populations. There were no examples to illustrate the possibility that the best two-eared hybrids could be planted at lower plant populations with less lodging and harvest losses and that their yields would exceed the best single-eared hybrids at the lower population and still equal or exceed the yields of the best single-eared hybrids at the higher populations. At the high population, barren plants did not occur and the best two-eared hybrids showed no ability to yield more than the best single-eared hybrids.

While these evaluations did not identify any superior two-eared hybrids, further breeding, selection and evaluation of these lines and others from different sources may eventually lead to two-eared hybrids that would exceed the performance of the best single-eared hybrids in the northern Corn Belt.