

PROGRESS REPORT ON HYBRID CORN GRAIN YIELDS AT OAKES

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With the coming of irrigation to the Oakes area via the Garrison Diversion project, interest in the potential of various irrigated crops has increased. The Oakes Research Site was established in 1970 by the Agricultural Experiment Station, NDSU, with support from the Garrison Conservancy District, to obtain information regarding irrigated crop culture in this area.

The Oakes site was included as one of the six testing sites for the North Dakota Hybrid Corn Performance Trials and 36 hybrids submitted by various commercial companies and county extension agents¹ were tested for grain yields in 1970 (2) and 1971 (1). Fourteen of these hybrids were

common entries for both years, and of these 14, four were single crosses, five were three-way crosses, and four were double crosses. This paper is an evaluation of these 14 hybrids.

Most corn acreage has been planted to double crosses in the past, but in recent years single crosses have become more popular as shown by the entries in the corn trials. Single crosses, three-way crosses, and double crosses are produced by crossing two inbreds, an inbred with a single cross, and two single crosses, respectively, as shown in Figures 1 and 2. Single crosses and three-way crosses are more expensive to produce than double crosses, because inbred plants generally exhibit low yields of grain (used for commercial hybrid seed) and pollen. Double crosses have been the most popular for farm production since they were cheaper to produce and also because double crosses were thought to have a wider adaptation. However, as a result primarily of better yielding inbred lines, single crosses and three-way crosses have become

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¹A fee was paid by the company or NDSU Extension Service for each hybrid entered. Mention of a specific hybrid does not imply endorsement of that variety by the North Dakota Agricultural Experiment Station.

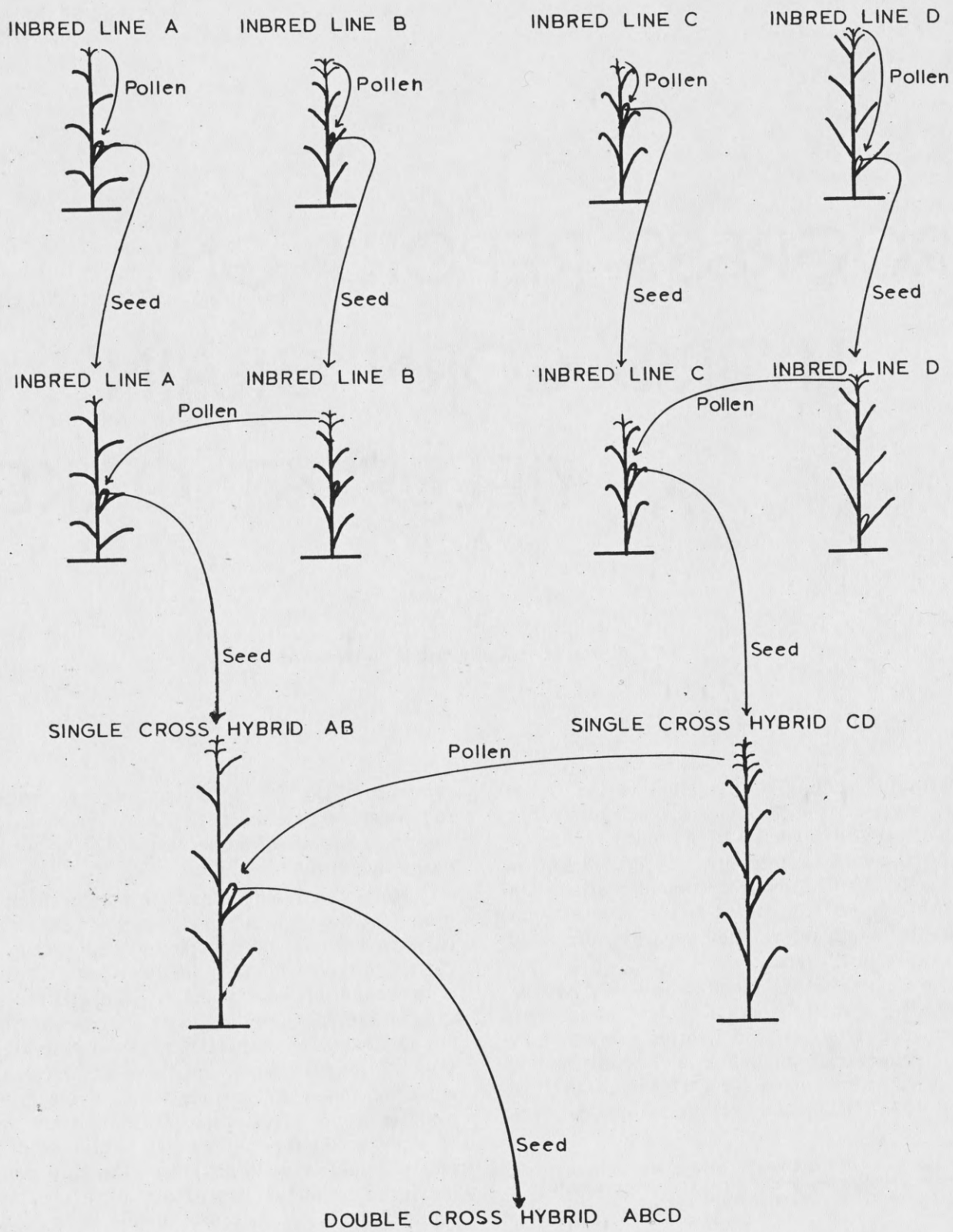


Figure 1. Crosses involved in producing inbred lines, single cross hybrids and double cross hybrids.

commercially available in the last 10 years. These single crosses or three-way crosses must yield more than double crosses to compensate for the extra cost of seed. Farmers still should choose hybrids that are adapted to their area and farming practices, since any potential advantage of these single cross and three-way cross hybrids will most likely be lost unless good farming practices are followed.

This paper reports corn grain yields obtained at Oakes, using good cultural techniques along with irrigation. The yields of the single, three-way and double cross hybrids are compared.

Procedure

The experimental designs in 1970 and 1971 were a modified randomized complete block design

and a lattice design, respectively, with four replications each. In both trials the corn was planted in 20 foot rows spaced 30 inches apart at an excessive rate, and the seedlings were thinned to 23,000 plants per acre. Weeds were controlled with herbicides. Information on previous crop, fertilizer, planting dates, harvest dates, and irrigation are presented in Table 1.

Grain yields are reported in bushels of shelled corn per acre at 15.5 per cent moisture. The ears were hand harvested, weighed, dried and reweighed to determine ear moisture percentage. The ears were then shelled to determine grain yield.

Stalk lodging counts were taken in each plot both years. These data are reported as the percent-

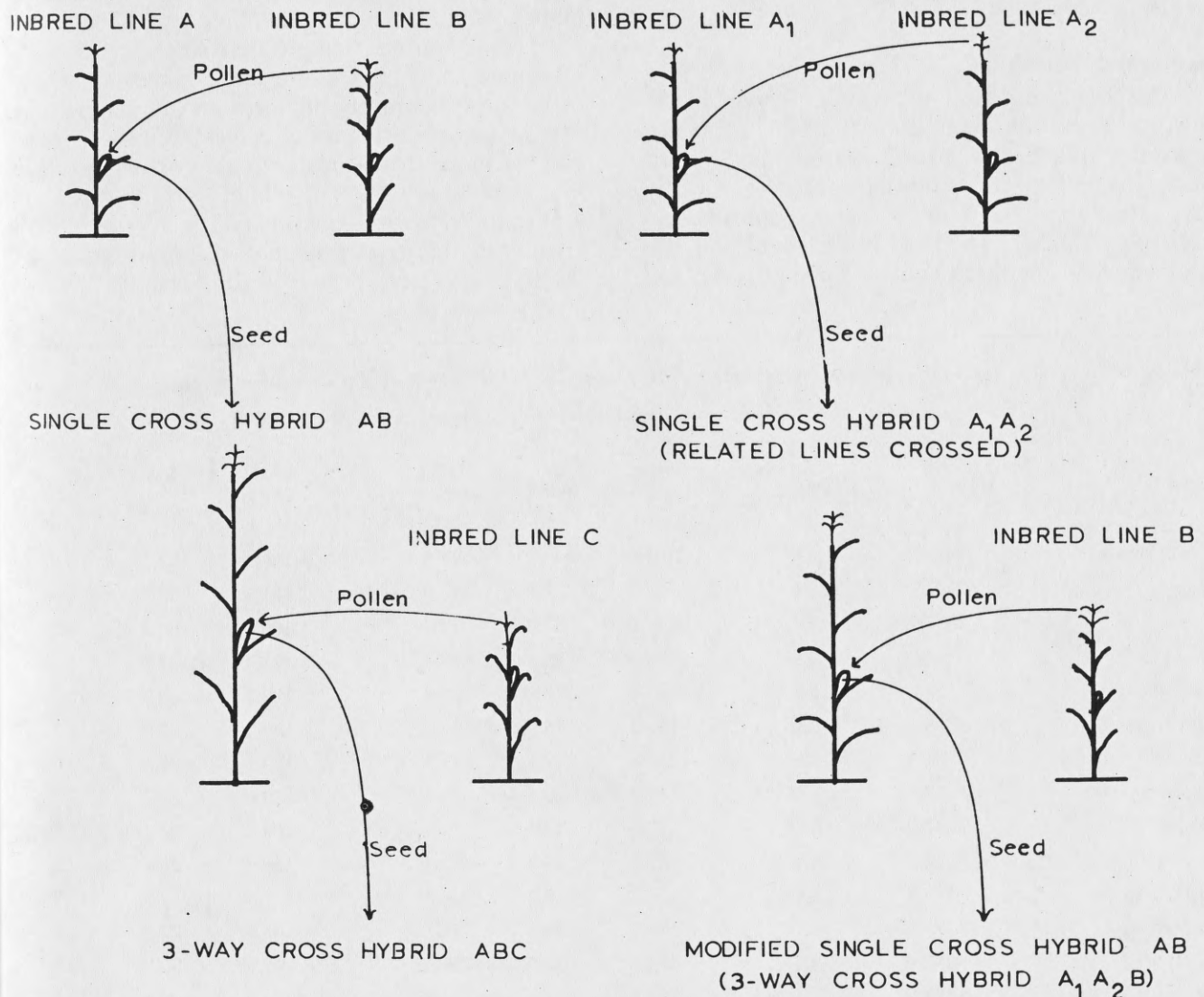


Figure 2. Crosses involved in producing two different types of 3-way cross hybrids.

Table 1. Agronomic data for the 1970 and 1971 North Dakota Hybrid Corn Performance Trial at the Oakes Research Site.

	Year	
	1970	1971
Previous crop	rye	corn
Fertilizer N-P ₂ O ₅ -K ₂ O (lb/A)	140-140-70	160-80-0
Date planted	May 5	May 5
Date harvested	Sept. 29	Sept. 27
Number of times irrigated	4	6
Total inches of irrigation water	8	10
Rainfall during growing season (in)	11	14
Degree days (planting to frost)	2255	2068
First killing frost	Sept. 13	Sept. 18

age of ear-bearing stalks which were broken below the ear before harvest.

Results and Discussion

The 1970 and 1971 data on grain yield, ear moisture, and stalk lodging for the 14 hybrids are shown in Table 2. The 1970-71 average yields were 160.5, 151.2, and 137.8 bushels per acre for the single, three-way, and double cross hybrids, respectively. Although good yields were expected, the excellent yields of these hybrids for both years ex-

ceeded our expectations. The percentages of lodged plants were much higher in 1970 than in 1971. Although higher stalk lodging was associated with lower yields, the effect would be minimal since both lodged and standing stalks were harvested. Most of the lodged plants could not be harvested with machine harvesting, therefore grain yields of the lodged varieties would be lower than yields obtained by hand harvesting. The higher stalk lodging in 1970 probably was attributable to the plants being much drier when harvested (Table 2). However, all varieties were well matured both years as shown by the per cent ear moisture values.

A yield comparison of the four single crosses (2X), five three-way crosses (3X), and five double crosses (4X) is shown in Figure 3. The data shown are 1970-71 averages. The single crosses were significantly higher yielding than the three-way crosses, while the three-way crosses were significantly higher yielding than the double crosses (.05 level). This result does not imply that single crosses are inherently higher yielding than three-ways and three-ways inherently higher than the double crosses. As shown in Figure 3, some three-way crosses yielded more than certain single crosses, and certain double crosses outyielded certain three-way and single crosses. However, on the average, single crosses in this trial produced the most grain and the double crosses produced the least.

Table 2. Grain yield, ear moisture, and stalk lodging of 14 corn hybrids grown at the Oakes Research Site in 1970 and 1971.

Brand	Hybrid	Type	1970			1971		
			Grain yield bu/A	Ear moist. %	Stalk lodg. %	Grain yield bu/A	Ear moist. %	Stalk lodg. %
Weathermaster	EPX-2A	2X	184.0	14.3	17.4	152.2	32.5	9.0
Agseo	2XB	2X	130.7	20.6	13.9	151.4	32.7	5.3
Acco	UC-1900	2X	147.9	17.6	13.9	166.8	36.4	1.9
Sokota	TS-49	2X	176.4	21.4	17.4	173.7	34.7	3.7
Acco	U-313	3X	144.1	16.0	20.8	169.3	29.5	10.7
Pioneer	3959	3X	147.3	15.9	31.2	155.2	29.6	3.7
Agseo	3XB	3X	148.3	17.4	17.4	149.1	29.3	12.6
Weathermaster	EP-20	3X	117.0	20.8	10.4	159.9	27.5	3.7
Sokota	MS-35	3X	157.6	19.4	17.4	164.0	33.2	2.6
Pioneer	3872	4X	137.7	12.5	20.8	156.8	24.7	12.2
ND Hybrid	ND307	4X	134.2	15.2	24.3	121.5	22.5	11.7
ND Hybrid	ND304	4X	138.7	14.8	34.7	141.4	27.5	5.9
ND Hybrid	ND120	4X	134.6	16.0	24.3	147.0	30.0	12.0
ND Hybrid	ND502	4X	130.6	17.0	24.3	134.7	29.3	15.5
Average			144.9	17.1	20.6	153.1	30.0	7.9

Single crosses, three-way crosses, and double crosses are abbreviated 2X, 3X and 4X, respectively.

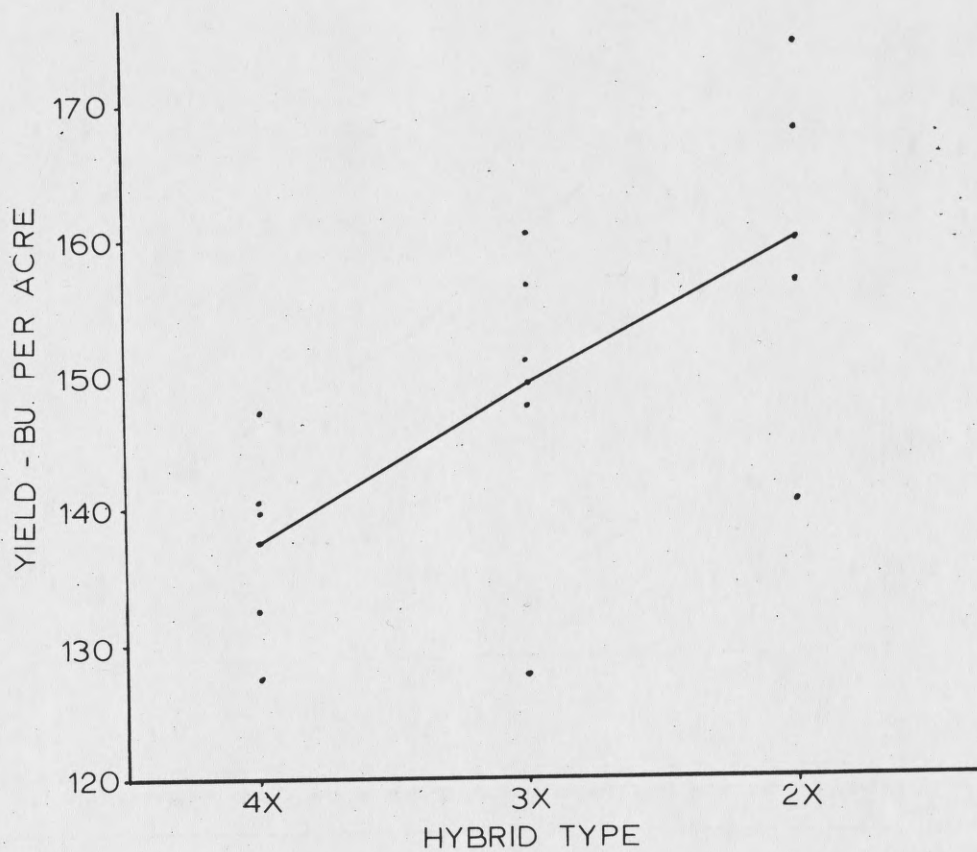


Figure 3. A comparison of the average corn grain yields of five double crosses, five three-way crosses, and four single crosses grown at the Oakes Research Site in 1970 and 1971.

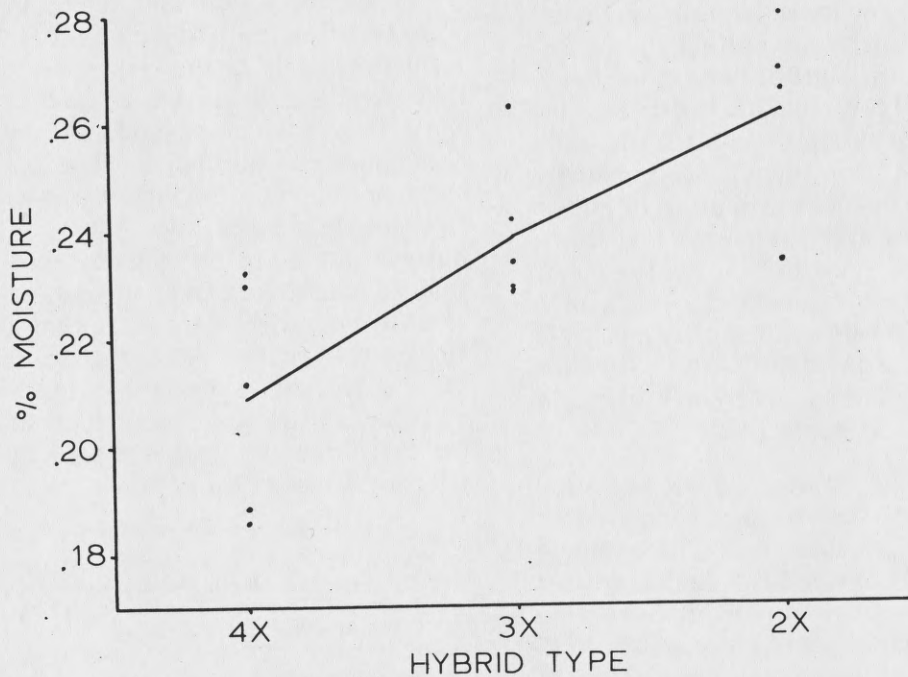


Figure 4. A comparison of the average per cent ear moisture of five double crosses, five three-way crosses, and four single crosses grown at the Oakes Site in 1970 and 1971.

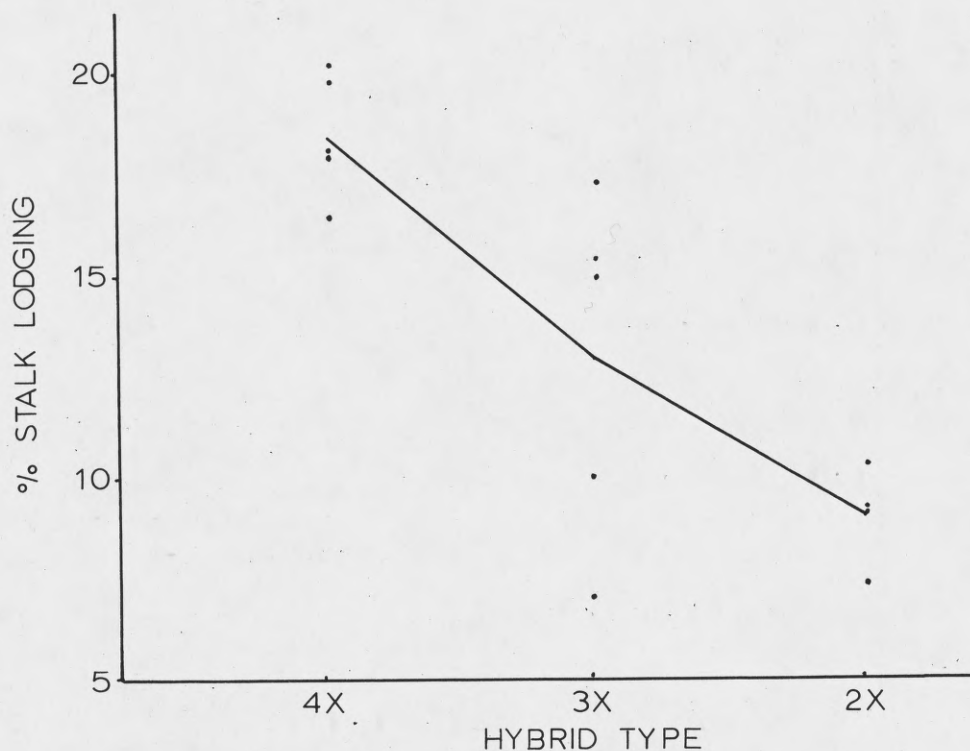


Figure 5. A comparison of the average per cent stalk lodging of five double crosses, five three-way crosses, and four single crosses grown at the Oakes Research Site in 1970 and 1971.

Data plotted in Figure 4 indicate that the single crosses were later than the three-way crosses, and the three-way crosses were later than the double crosses, since ear moisture is related to maturity. This maturity relationship should not be taken as a general trend but applied only to the particular hybrids involved in this study. Although the hybrids with highest ear moisture at harvest tended to be highest yielding, the correlation coefficient between these two characteristics was not statistically significant. Therefore, even though later maturity was possibly a minor factor contributing to higher yields of single crosses over three-ways and three-ways over double crosses, maturity is not the major reason for these yield differences. This lack of a significant relationship between maturity and yield is in agreement with a previous report (3) which indicated that, on the average, early hybrids yield as well as late hybrids in North Dakota.

Figure 5 shows the reduced amount of stalk lodging for the single crosses when compared to three-way crosses and double crosses. The single crosses were uniformly low and the double crosses were all high, while the three-ways exhibited a wide range of lodging percentages. As previously indicated, the effect of stalk lodging on grain yields in this trial was probably minimal, since all stalks were hand harvested. Therefore, with machine harvesting there probably would have been a larger

yield difference between the single crosses and three-way crosses and between the three-way crosses and double crosses than that shown in Figure 3.

Summary

The grain yields exhibited by 14 hybrids which were tested in the 1970 and 1971 Hybrid Corn Performance Trials at the Oakes Research Site show that excellent yields are possible in this area of North Dakota when irrigation and optimum cultural techniques can be applied. The average yields of the four single crosses, five three-way crosses, and five double crosses were 160.5, 151.2, and 137.8 bushels per acre, respectively. We do not imply that all single crosses yield more than three-ways and all three-ways yield more than double crosses. However, the data indicate that the increased yields of specific single cross hybrids with irrigation at Oakes justify their production in preference to the three-way and double cross hybrids tested despite higher seed cost of single cross seed.

References

1. Cross, H. Z., E. L. Deckard, H. D. Wilkins, and D. G. Kanter. 1972. *North Dakota Hybrid Corn Performance Testing 1971*. North Dakota State University Agronomy Circular 106.
2. Lund, H. R., William Wiidakas, E. L. Deckard, and L. A. Jensen. 1971. *North Dakota Hybrid Corn Performance Testing 1970*. North Dakota State University Agronomy Circular 105.
3. Wiidakas, William. 1967. *Adapted corn hybrids are more dependable*. North Dakota Farm Research 25(1): 13-15.