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Outline.
Introduction.
The Immediate Effect of Crossing
"
Varieties of Corn on Size of Seed Produced.

A THESIS PRESENTED TO THE GRADUATE COMMITTEE OF THE VIRGINIA
POLYTECHNIC INSTITUTE IN APPLICATION FOR THE DEGREE OF
MASTER OF SCIENCE

by

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May 1915.

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Outline.

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THE IMMEDIATE EFFECT OF CROSSING VARIETIES OF CORN
ON SIZE OF SEED PRODUCED.

Introduction.

It has been the general opinion that the immediate effect of crossing varieties of corn is to increase the yield. Corn differs from most other plants in that the effect of crossing may be seen the current year due to the hybridization of the endosperm as well as the embryo.

There have been many experiments to prove that cross breeding corn increases the yield. Collins¹ found when pollen was mixed and used to pollinate the same ear that there was an increase of the crossed seed over the uncrossed, varying from 3 to 21 per cent. In an experiment at the Virginia Experiment Station², the results show that in all crosses the immediate effect was to increase the yield. When different strains of Boone County White were crossed there was an increase of 31.7%. Collins³ also found that the immediate effect was to increase the yield. McCluer⁴ shows that yields obtained from planting crossed seed were more important than those of the immediate cross. Montgomery⁵ finds that corn is restored at once to its full vigor by crossing, but the yield seems to decrease in the second generation. Hartley⁶ found that cross pollinated seed proved 20% more productive than either parent.

Owing to Mendelian splitting, it cannot be expected that the yield of hybrid ^{corn} will continue to increase in future generations, therefore, it is best to cross corn every year for next year's planting, that is, progeny from the same cross should not be used for more than one generation.

Statement of Problem.

The purpose of this experiment is to determine the immediate effect of crossing varieties of corn on the size of the seed produced and to determine whether this method of cross pollination is advisable from a practical standpoint. Mixed pollen was used to pollinate each ^{ear} ~~x~~ so as to eliminate error as far as possible.

Material and Methods Used.

Eight varieties of corn were used in this work: namely, Collier's Excelsior, Casey's Pure Bred, Boone County Special, Columbian Beauty, Hickory King, Gold Standard, Improved Golden Dent, and Improved Leaming. The first five are white dents and the last three yellow dents. Due to the dominance of yellow over white and double fertilization in maize, called xenia, when white corn is crossed with pollen from a yellow variety, the yellow color appears ^{white} the current year. Thus in each case when both ^{white} and yellow pollen are used, we can detect the crossed seed.

In crossing yellow varieties with pollen from white varieties, at least in some varieties, the yellow color is diluted and the kernels produced leave a paler color than those fertilized with pollen from a yellow variety.

In making the crosses, paraffined manila paper bags were used for covering tassels and silks. The ears were bagged before or as soon as the silks appeared, and the tassels bagged before any of the pollen had begun to shed.

The ears were pollinated when the silks were about three inches long and the pollination was repeated in one to three days afterwards. Each ear was pollinated with pollen from another plant of the same variety as well as pollen from the variety to be crossed on it, the pollen being mixed in application. The

Ear No. 1. Hickory King (white dent) & Improved Leaning
bags were left on the ears until all danger of pollination was
over.

The crosses obtained are given in the description of
the ears and in the tables.

Ear No. 2. Hickory King (white dent) & Improved Leaning
(yellow dent). Grains medium, same as ear No. 1. Number of
crossed grains, 52. Number of un-crossed grains, 52. Length, 3
inches; diameter, 1 1/2 inches.

Ear No. 3. Hickory King (white dent) & Improved Leaning
(yellow dent). Grains medium, typically Hickory King, evidence of cross
in color. Length, 3 inches; diameter, 2 inches. Number of crossed
grains, 3; number of un-crossed grains, 300. Grains white, un-
crossed grains pure white, crossed grains pure white.

Ear No. 4. Boone County Special (white dent) & Improved
Leaning (yellow dent). Grains medium, shows evidence of cross in
color and color. Length, 3 inches; diameter, 2 inches. Number of
crossed grains, 484; number of un-crossed grains, 3. Grains well
filled, all - white. Crossed grain yellow with white dent, and
un-crossed grains pure white.

Ear No. 5. Boone County Special (white dent) & Improved
Leaning (yellow dent). Grains medium, characteristic of Boone
County Special, evidence of a cross in color. Length, 3 inches;
diameter, 1 2/3 inches. Number of un-crossed grains, 47; number
of crossed grains, 12. Grains well filled, all - white. Crossed
grains yellow with white dent, un-crossed grains pure white.

Description of Ears.

Ear No. 1. Hickory King (white dent) X Improved Leaming (yellow dent). Grains shallow, characteristic Hickory King type; evidence of cross in color. Length, $6\frac{3}{4}$ inches; circumference, 6 inches; diameter, 2 inches. Number of crossed grains, 91; number of uncrossed grains, 231. Well filled. Cob, white. Crossed grains yellow with white caps, uncrossed grains pure white.

Ear No. 2. Hickory King (white dent) X Improved Leaming (yellow dent). Grains shallow, same as ear No. 1. Number of crossed grains, 245. Number of uncrossed grains, 62. Length, $7\frac{1}{2}$ inches; diameter, $1\frac{3}{4}$ inches.

Ear No. 3. Hickory King (white dent) X Gold Standard (Yellow dent). Grains medium, typically Hickory King, evidence of cross in color. Length, 6 inches; diameter, 2 inches. Number of crossed grains, 3; number of uncrossed grains, 300. Well filled, cob - white. Uncrossed grains pure white, crossed grains pale yellow.

Ear No. 4. Boone County Special (white dent) X Improved Leaming (yellow dent). Grains medium, shows evidence of cross in grain and color. Length, $6\frac{1}{2}$ inches; diameter, 2 inches. Number of crossed grains, 484; number of uncrossed grains, 3. Fairly well filled, cob - white. Crossed grains yellow with white caps, and uncrossed grains pure white.

Ear No. 5. Boone County Special (white dent) X Improved Golden Dent (yellow dent). Grains medium, characteristic of Boone County Special, evidence of cross in color. Length, $6\frac{3}{4}$ inches; diameter, $2\frac{1}{8}$ inches. Number of uncrossed grains, 416; number of crossed grains, 108. Well filled except $\frac{3}{4}$ inch at the tip. Cob - white. Uncrossed grains pure white, crossed grains yellow with

Ear No. 6. Boone County Special (white dent) X Gold Standard (yellow dent). Grains long, characteristic of Boone County Special. Evidence of cross in color. Length, 5 inches; diameter, $2\frac{1}{4}$ inches. Number of uncrossed grains, 20; number of crossed grains, 351. Well filled, cob, white. Crossed grains are yellow with white caps, uncrossed grains are pure white.

Ear No. 7. Casey's Pure Bred (white dent) X Gold Standard (yellow dent). Grains deep, rows irregular, evidence of cross in color. Length, $5\frac{1}{2}$ inches; diameter, $2\frac{1}{8}$ inches. Number of crossed grains, 24; number of uncrossed grains, 325. Well filled, cob - white. Crossed grains yellow and uncrossed grains pure white

Ear No. 8. Boone County Special (white dent) X Gold Standard (yellow dent). Grains medium, characteristic of Boone County Special type, evidence of cross in color. Length, 5 inches; diameter, $2\frac{1}{8}$ inches. Number of uncrossed grains, 258; number of crossed grains, 196. Well filled except one side, grains irregular, Cob, white. Crossed grains are yellow with whitish caps, and the uncrossed grains are pure white.

Ear No. 9. Casey's Pure Bred (white dent) X Gold Standard (yellow dent). Grains medium, characteristic of Casey's Pure Bred. Length, 4 inches; diameter, $1\frac{1}{5}\frac{1}{8}$ inches. Number of crossed grains, 1, number of uncrossed grains, 171. Not filled on one side, curved, evidence of cross in color. Cob - white, crossed grains are yellow, uncrossed grains pure white.

Ear No. 10. Collier's Excelsior (white dent) X Gold Standard (yellow dent). Grains short, characteristic of Collier Excelsior, evidence of cross in color. Length, 7 inches; diameter, $1 \frac{7}{8}$ inches. Number of crossed grains, 68; number of uncrossed grains, 169. Not well filled on one side or above middle, curved. Crossed grains are yellow with white caps and uncrossed grains are pure yellow *white.*

Ear No. 11. Collier's Excelsior (white dent) X Gold Standard (yellow dent). Grains medium, characteristic of Collier's Excelsior. Length, $5 \frac{3}{4}$ inches. Diameter, $1 \frac{3}{4}$ inches. Number of crossed grains, 21. Number of uncrossed grains, 163. Not well filled on one side, rows irregular, tip not filled for $\frac{3}{4}$ of an inch, ear curved. Cob, white. Crossed grains are yellow with whitish caps, and uncrossed grains are pure white. Evidence of cross in color.

Ear No. 12. Columbian Beauty (white dent) X Improved Leaming (yellow dent). Grains deep, characteristic of Columbian Beauty. Length, 6 inches. Diameter, 2 inches. Number of crossed grains, 219. Number of uncrossed grains, 83. Not well filled on one side, curved. Cob red. Uncrossed grains are white, crossed yellow with whitish caps. Evidence of cross in color.

Ear No. 13. Hickory King (white dent) X Improved Leaming (yellow dent). Grains shallow, characteristic of Hickory King. Length, $5 \frac{1}{2}$ inches. Diameter, 2 inches. Number of crossed grains, 31. Number of uncrossed grains, 142. Well filled. Cob white, crossed grains are yellow with whitish caps, and uncrossed are pure white. Evidence of cross in color.

Ear No. 14. Boone County Special (white dent) X Gold Standard (yellow dent). Grains shallow. Length, 7 inches. Diameter, $2 \frac{1}{8}$ inches. Evidence of cross in color. Number of crossed grains, 23. Number of uncrossed grains, 219. Rows irregular. Ear fairly well filled except $1 \frac{3}{4}$ inches at tip. Cob white. Crossed grains are yellow with white caps. Uncrossed are pure ~~yellow~~ ^{white}.

Ear No. 15. Casey's Pure Bred (white dent) X Gold Standard. (yellow dent). Grains medium. Length 7 inches. Diameter $2 \frac{1}{4}$ inches. Evidence of cross in color. Number of crossed grains, 115, number of uncrossed, 164. Well filled, rows irregular. Cob white. Crossed grains are yellow with white caps, and uncrossed are pure white.

Ear No. 16. Hickory King (white dent) X Improved Leaming (yellow dent). Grains shallow, characteristic of Hickory King. Length $6 \frac{1}{2}$ inches, diameter 2 inches. Evidence of cross in color. Number of crossed grains, 249. Number of uncrossed grains, 37. Well filled. Crossed grains are yellow with white caps. Uncrossed grains are pure white.

Ear No. 17. Collier's Excelsior (white dent) X Gold Standard (yellow dent). Grains pointed. Length, 8 inches. Diameter $2 \frac{1}{8}$ inches. Evidence of cross in color. Number of crossed grains, 157. Number of uncrossed grains, 15. Grains scattering, at tip 3 inches not filled. Uncrossed grains are pure white. Crossed grains are yellow with white caps.

Ear No. 18. Gold Standard (yellow dent) X Hickory King (white dent). Grains deep, characteristic of Gold Standard. Length, $6 \frac{1}{2}$ inches. Diameter $2 \frac{1}{4}$ inches. Number of crossed grains, 388. Number of uncrossed grains, 32. Well filled. Cob - red.

Crossed grains are yellow with white cap. Uncrossed grains are pure yellow.

Ear No. 191 Gold Standard (yellow dent) X Hickory King (white dent). Grains medium. Characteristic of Gold Standard. Length 9 inches, diameter 2 1/8 inches. Number of crossed grains, 487; number of uncrossed grains, 226. Well filled, cob red. Crossed grains are yellow and white capped. Uncrossed grains are pure yellow.

Ear No. 20. Gold Standard (yellow dent) X Colliers Excelsior (white dent). Grains deep, characteristic of Gold Standard. Length, 6 1/2 inches, diameter, 1 7/8 inches. Number of crossed grains, 342. Number of uncrossed grains, 210. Well filled, cob - red. Crossed grains are yellow with whitish caps. Uncrossed grains are pure yellow.

Ear No. 21. Improved Golden Dent (yellow dent) X Collier Excelsior (white dent). Grains thick, narrow, and deep. Characteristic of Improved Golden Dent. Length 5 1/2 inches. Diameter 2 1/8 inches. Evidence of cross in color. Well filled. Cob red. Crossed grains are yellow with whitish caps. Uncrossed grains are pure yellow. Number of crossed grains 350. Number of uncrossed grains, 228.

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Ear No. 22. Improved Golden~~y~~ X Colliers Excelsior (white dent). Grains deep, characteristic of Improved Golden Dent. Length, 6 inches. Diameter, 2 inches. Evidence of cross in color. Well filled. Cob red. Crossed grains yellow with whitish caps. Uncrossed grains are pure yellow. Number of crossed grains 319~~x~~. Number of uncrossed grains, 76.

Ear No. 23. Improved Leaming (yellow dent) X Boone County Special (white dent). Grains deep, characteristic of Improved Leaming. Length, $6\frac{1}{4}$ inches. Diameter $2\frac{1}{4}$ inches. Evidence of cross in color. Well filled. Cob red. Number of crossed grains 75, Number of uncrossed grains, 421. Crossed grains are yellow with whitish cap, and uncrossed grains are pure yellow.

Ear No. 24. Improved Golden Dent (yellow dent) X Collier's Excelsior (white dent). Grains deep, characteristic of Improved Golden Dent. Length, $5\frac{1}{2}$ inches. Diameter $2\frac{1}{8}$ inches. Evidence of cross in color. Well filled. Cob red. Crossed grains are yellow with whitish caps, and uncrossed grains are pure yellow. Number of crossed grains 127. Number of uncrossed grains 265.

Ear No. 25. Improved Golden Dent X Collier's Excelsior (white dent). Grains medium, characteristic of Improved Golden Dent. Length 6 inches, diameter 2 inches. Evidence of cross in color. Well filled except at tip. Cob red. Crossed grains are yellow with white caps. Uncrossed grains are pure yellow. Number of crossed grains, 23. Number of uncrossed grains, 342.

Ear No. 26. Gold Standard (yellow dent) X Casey's Pure Bred (white dent). Grains medium, characteristic of Gold Standard. Length, $5\frac{3}{4}$ inches. Diameter, $1\frac{7}{8}$ inches. Evidence of cross in color. Well filled. Cob red. Crossed grains are yellow with whitish caps. Uncrossed grains are pure yellow. Number of crossed grains, 54. Number of uncrossed grains, 321.

Ear No. 27. Improved Leaming (Yellow dent) X Boone County Special (white dent). Grains medium, characteristic of Improved Leaming. Length 6 inches, diameter 2 inches. Evidence of cross in color. Cob red. Crossed grains are yellow with whitish caps.

Uncrossed grains pure yellow. Number of crossed grains, 210.
Number of uncrossed grains, 32. Only fairly well filled, missing on one side.

Ear No. 28. Improved Leaming (yellow dent) X Boone County Special (White dent). Grains medium, characteristic of Improved Leaming. Length, 6 inches. Diameter, $2\frac{1}{4}$ inches. Evidence of cross in the color. Cob red. Crossed grains are yellow with whitish caps. Uncrossed grains are yellow. Number of crossed grains 217. Number of uncrossed grains, 33. Well filled near tip, scattering from middle to butt.

Ear No. 29. Improved Leaming (yellow dent) X Columbian Beauty (white dent). Grains deep. Length $5\frac{1}{4}$ inches. Diameter 2 inches. Evidence of cross in color. Cob red. Crossed grains are yellow with white caps. Uncrossed grains are pure yellow. Not well filled on one side. Number of crossed grains 172, Number of uncrossed grains, 50.

Ear No. 30. Improved Leaming (yellow dent) X Boone County Special. Grains medium. Evidence of cross in color. Length 7 inches. Diameter 2 inches. Cob red. No grains for 14 inches at tip, scattering on one side. Crossed grains are yellow with whitish caps. Uncrossed grains are pure yellow. Number of crossed grains, 160. Number of uncrossed grains, 89.

Ear No. 31. Improved Golden Dent X Collier's Excelsior (white dent). Grains deep. Evidence of cross in color. Length $4\frac{7}{8}$ inches. Diameter, $2\frac{1}{4}$ inches. Cob red. $1\frac{1}{2}$ inches at tip not filled, grains scattering. Crossed grains yellow with whitish tips. Uncrossed grains are pure yellow. Number of crossed grains, 147. Number of uncrossed grains, 15.

Ear No. 32. Gold Standard (yellow dent) X Casey's Pure Bred (white dent). Grains medium, characteristic of Gold Standard. Evidence of cross in color. Length 8 inches. Diameter $2 \frac{1}{8}$ inches. Color red. $2 \frac{1}{2}$ inches at tip not filled, grains scattering. Crossed grains are yellow with whitish caps. Uncrossed are pure yellow. Number of uncrossed grains, 87. Number of crossed grains, 160,

Ear No. 33. Improved Golden Dent X Collier's Excelsior (white dent). Grains medium. Evidence of cross in color. Length $5 \frac{1}{4}$ inches. Diameter $1 \frac{7}{8}$ inches. Cob red. Well filled. Crossed grains are yellow with whitish caps. Uncrossed grains are pure yellow. Number of crossed grains, 25. Number of uncrossed grains, 322.

Ear No. 34. Improved Leaming, (yellow dent) X Boone County Special (white dent). Grains small. Evidence of cross in color. Length, 6 inches. Diameter, $1 \frac{7}{8}$ inches. Poorly filled and curved. Crossed grains are yellow with whitish caps. Uncrossed grains are pure yellow. Number of crossed grains, 110. Number of uncrossed grains, 117.

Ear No. 35. Improved Leaming (yellow dent) X Boone County Special X Columbian Beauty (white dents). Grains narrow and deep. Evidence of cross in color. Length, 6 inches. Diameter 2 inches. Well filled. Crossed grains are yellow with whitish caps. Uncrossed grains are pure yellow. Number of crossed grains, 244. Number of uncrossed grains, 128.

Ear No. 36. Improved Leaming (yellow dent) X Casey's Pure Bred. Grains medium broad. Evidence of cross in color. Length 6 inches. Diameter 1 7/8 inches. Well filled but rows wide apart. Crossed grains are yellow with whitish caps. Uncrossed grains are pure yellow. Number of uncrossed grains, 197. Number of crossed grains, 191. Evidence of cross in color.

Ear No. 37. Gold Standard (yellow dent) X Boone County Special, (White dent). Grains roundish, evidence of cross in color. Length, 6 1/2 inches. Diameter, 1 3/4 inches. Grains are scattered. None at all on the tip for one inch. Crossed grains are yellow with whitish caps. Uncrossed are pure yellow. Number of crossed grains, 29. Number of uncrossed grains, 117.

Results.

Table I.

Results of Crossing Corn. Female parent white; Male parent yellow.

Ear No.	Female	Cross - Male	Kind of Seed	No. of Seed.	Avg. wt. per seed.gm.	Increase %
1	Hickory King	X Imp. Leaming	pure hybrid	231 91	.492 .505	 2.64
2	Hickory King	X Imp. Leaming	pure hybrid	62 245	.473 .546	 15.43
3	Hickory King	X Gold Stand.	pure hybrid	300 3	.495 .513	 3.63
4	Boone Co. Spec.	X Imp. Leam.	pure hybrid	3 484	.293 .340	 16.04
5	Boone Co. Spec.	X Imp. Gold D.	pure hybrid	416 108	.342 .357	 4.38
6	Boone Co. Spec.	X Gold Stand.	pure hybrid	20 351	.450 .428	 5.14
7	Casey's Pure Bred	X Gold St.	pure hybrid	325 24	.431 .381	 -12.53
8	Boone Co. Spec.	X Gold Stand.	pure hybrid	258 196	.343 .367	 6.99
9	Casey's Pure Bred	X Gold St.	pure hybrid	171 1	.376 .425	 13.03
10	Collier's Excel.	X Gold Std.	pure hybrid	169 68	.400 .448	 12.00

Table I (Concluded)

Ear No.	Cross Female	- Male	Kind of Seed.	No. of Seed.	Avg. Wt per seed in gms.	Increase %
11	Collier's Excel.	X Gold Std.	pure	163	.460	
			hybrid	21	.437	-5.26
12	Columbian Beauty	X Imp. Leam.	pure	83	.471	
			hybrid	219	.502	6.58
13	Hickory King	X Imp. Leaming	pure	142	.582	
			hybrid	31	.513	-13.45
14	Boone Co. Spec.	X Gold Stand.	pure	219	.478	
			hybrid	123	.506	5.85
15	Casey's Pure Bred	X Gold St.	pure	164	.391	
			hybrid	115	.437	11.76
16	Hickory King	X Imp. Leaming	pure	37	.596	
			hybrid	250	.649	9.22
17	Collier's Exc.	X Gold Std.	pure	15	.291	
			hybrid	157	.329	13.05

The evidence of crossing was clearly visible, as would be expected, because of the dominance of yellow over white and of xenia in maize. It will be noted in the above table that in 13 of the 17 crosses there is an increase in yield, this increase varying from 2.64 per cent to 16.04 per cent. In the four cases where there is a decrease, the decrease ranged from 5.14 per cent to 13.45 per cent.

In all crosses producing an increase yield the increase is large enough to be of importance from a practical standpoint, and the same is true of the crosses showing a decrease.

It will be noted that in the above table the varieties which show decreased yields in one place also give increased yields in other instances. Due to this fact, these varieties should probably be left out of account and then all of the remaining varieties show an increase yield in every case.

In three of the four crosses where there is a decrease in yield, Gold Standard is the male parent. However, in other cases where Gold Standard is used as the male parent, large increases were obtained.

Table II.

Results of Crossing Corn, Female parent yellow, Male parent white.

Ear No.	Female	Cross - Male	Kind of Seed.	No. of Seed.	Avg. Wt. per seed.	Incre- gms. asc %
18	Gold Stand.	X Hickory King	pure	32	.478	
			hybrid	388	.427	-11.9
19	Gold Stand.	X Hickory King	pure	226	.257	
			hybrid	487	.277	7.78
20	Gold Stand.	X Coll. Excel.	pure	210	.351	
			hybrid	342	.344	- .02
21	Imp. Gold. Dent	X Coll. Excel.	pure	228	.346	
			hybrid	350	.331	- 4.53
22	Imp. Gold. Dent	X Coll. Excel.	pure	76	.413	
			hybrid	319	.414	.002
23	Imp. Leaming	X Boone Co. Spe.	pure	421	.364	
			hybrid	75	.371	1.92
24	Imp. Gold. Dent	X Coll. Excel.	pure	265	.406	
			hybrid	127	.399	-1.75
25	Imp. Gold. Dent	X Coll. Excel.	pure	342	.413	
			hybrid	23	.420	1.69
26	Gold Stand.	X Casey's P.B.	pure	321	.376	
			hybrid	54	.375	-.003
27	Imp. Leaming	X Boone Co. Spe.	pure	32	.444	
			hybrid	210	.446	.005
28	Imp. Leaming	X Boone Co."	pure	33	.445	
			hybrid	217	.427	-4.21
29	Imp. Leaming	X Col. Beauty	pure	50	.432	
			hybrid	172	.432	.002
30	Imp. Leaming	X Boone Co. Spe.	pure	89	.455	
			hybrid	160	.458	.007
31	Imp. Gold. Dent	X Coll. Excel.	pure	15	.444	
			hybrid	147	.451	1.57
32	Gold Stand.	X Casey's P.B.	pure	87	.424	
			hybrid	160	.435	2.59
33	Imp. Gold. Dent	X Coll. Excel.	pure	322	.401	
			hybrid	25	.404	.007
34	Imp. Leaming	X Boone Co. Spe.	pure	117	.327	
			hybrid	110	.339	3.66
35	Imp. Leaming	X Boone Co. Spe.	pure	128	.414	
			hybrid	244	.417	.007
36	Imp. Leaming	X Casey's P.B.	pure	197	.398	
			hybrid	19	.432	8.64
37	Gold Stand.	X Boone Co. Spe.	pure	117	.488	
			hybrid	29	.507	3.89

In the above table, as in Table I, those varieties which show a decreased yield in one place likewise given increased yields in other crosses.

In the six crosses where there is a decrease in yield, Gold Standard is the female parent in three and Collier's Excelsior is the male parent in three of them.

The evidence of crossing was shown by the yellow grains being capped with white or being a paler yellow than the pure seed. In many crosses the pure and hybrid seed were difficult to distinguish, but all doubtful seed were weighed with the hybrids. However, these results cannot be relied upon to as great an extent as those in Table I.

In six out of twenty crosses there is a decrease in yield varying from .003 of a per cent to 11.9 per cent. In eight instances, the difference is so small that we may say that crossing had no effect on the yield in these cases.

In eight crosses there are substantial increases in yield, while in four there are rather large decreases.

Selective Pollination and Crowding out of Seed.

It might be thought that the increase in size of hybrid seed on the same ear with pure seed could be attributed to the stimulus given by cross fertilization. By this stimulation the hybrid seed may be able to become fertilized more rapidly and then develop sooner and crowd out the pure seed. However, this was ^{not} the case. On ear No. 2, Hickory King X Improved Leaming, there was only one yellow grain in the last two inches at the tip, the others being uncrossed (pure white). The remainder of the ear showed all hybrid seed with the exception of twelve grains. The hybrid seed averaged .546 of a gram per seed, the pure seed at tip .473 of a gram, those intermixed with crossed grains averaged .476 of a gram. The grains at the extreme tip were excluded since they are usually smaller than the other grains on the ear.

Collins¹ found in a case of a similar nature that the hybrid seed weighed 292.5 grams per 1000 seed, pure seed 283 grams. We must conclude from this data that increased size of hybrid seed is not due to crowding out the pure seed

Production of First Generation Seed.

The results obtained in many experiments with corn show that the increase in yield in the F_1 generation is of more importance than that obtained due to the immediate effect of crossing the current year. Collins¹ found an increase of 21.1 per cent the current year; Carrier² 31.7 per cent; and an increase of 16 per cent was obtained in this experiment.

Collins⁷ obtained an increase in yield of 126 per cent over the average of the parents in the F_1 generation, with an average of 53 per cent increase for all the crosses.

Morrow and Gardner⁸ secured an average increase of 11 per cent in the F_1 generation.

In Maryland,⁹ there was an increase of 5 to 19 per cent in the F_1 generation of the hybrid seed over the better parent, however, there were many decreases in yield.

East⁷ obtained increases from 28.5 to 154 per cent in the F_1 generation.

The results of this experiment go to show that this method of cross pollination is profitable both to the farmer and seed grower. The following method of corn breeding will likely prove to be very efficient in producing pure and hybrid seed corn when properly carried out.

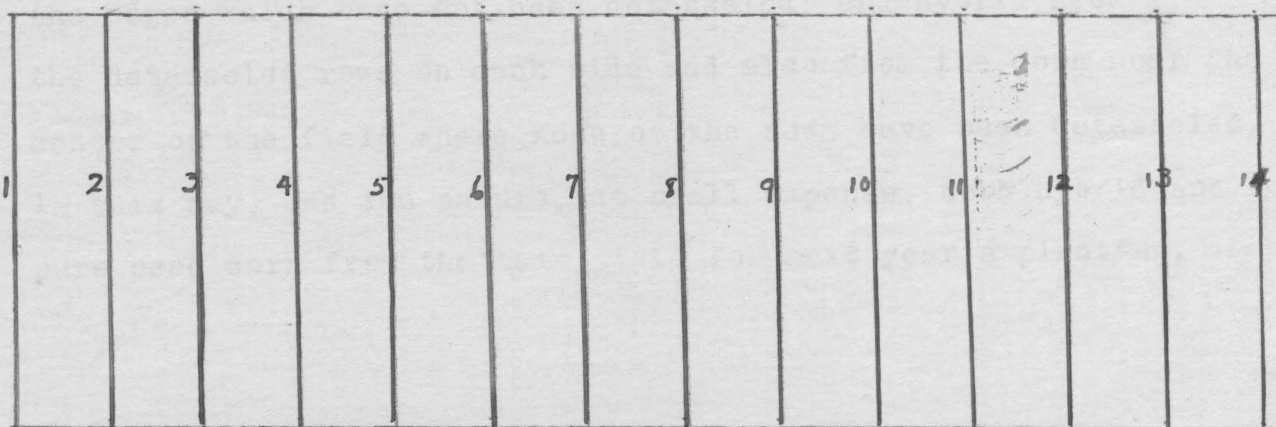


Diagram of field. Vertical lines represent rows of corn.

Row No. 1 may be planted with a pure bred white variety and row No. 2 with a pure bred yellow variety, the varieties alternating across the field. Different strains of the same variety may be used instead of distinct varieties.

On one side of the field a certain number of rows of the white variety may be detasseled. Thus the ears on the yellow or those stalks not detasseled will be pure, while those ears on the white or detasseled rows will be hybrid. On the other side of the field, a certain number of rows of the yellow variety may be detasseled. Thus in this case, the ears on the white or those stalks not detasseled will be pure, while those ears on the yellow or detasseled rows will be hybrid. If the field is large, it is not necessary to detassel alternate rows across the entire field. However, a sufficient number of rows should be detasseled on each

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side of the field to make sure that the rows nearest each edge are not close enough to the remainder of the corn in the field which has not been detasseled to be pollinated by it.

Pure seed corn can be obtained from the rows nearest the edges which have not been detasseled, and hybrid seed from the detasseled rows on each side and also from the corn near the center of the field where none of the rows have been detasseled. In this way, one can secure, at small expense, both hybrid and pure seed corn from the same field for next year's planting.

Conclusions.

1. In the crosses obtained, 56.8 per cent produced profitable increases in yield, and in 16.2 per cent the increase is slight. In 21.6 per cent of the crosses, the decrease is slight; in 5.4 per cent the decrease is slight. The largest increase is 16.04 per cent and the greatest decrease 13.45 per cent.

2. The farmer or seed grower can make profitable application of these results by mixing seed at planting time. He will not only get an increase the current year, but will obtain a larger one the following year.

3. The increases and decreases are not confined to any certain varieties. However, Gold Standard and Collier's Excelsior gave decreased yields in a larger number of crosses than any of the other varieties used.

4. All crosses were made between distinct varieties and not between strains of the same variety. In a previous experiment at this station², larger increases in yield were obtained in the latter case than were obtained in this experiment.

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