THE EFFECT ON VARIABILITY IN THE DOUBLE CROSS CORN HYBRID OF PARENTAL INBREDS DIFFERING IN MATURITY AND OTHER PLANT CHARACTERISTICS

By

James Warren Thayer, Jr.

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It is well recognized among corn breeders that "eye appeal" is of prime importance to farmers when selecting their "best hybrid". Uniformity of plant height, height, length and diameter of ear, and other plant characters of a similar nature all contribute to the desirability or "eye appeal" of a corn hybrid. Many a high yielding hybrid has failed to gain prominence because it lacked the necessary uniformity in one or more of these important plant characters.

Since uniformity or the lack of variability is of prime importance to the general acceptance of a corn hybrid, it is necessary for the corn breeder to know how the combining of parental inbreds affects the uniformity of the double crosses. The work reported here was undertaken for the purpose of determining the effect on variability, in the double cross hybrid, of the different combinations of parental inbreds with contrasting plant characters. The variability of ear moisture as affected by the combining of inbreds similar in maturity as contrasted to the combining of inbreds of varying maturity was of prime importance in the instigation of this study.

Although yield determinations were not a primary aim of this study, they were obtained for two reasons. First, because of the possibility of obtaining desirable hybrids as the result of the inbred combinations used in this study. Second, because of the excellent opportunity afforded by obtaining yield data to study the relationship between

the actual and predicted values obtained from the single crosses and their double cross combinations when grown in the same year.

REVIEW OF LITERATURE

Much work was done by the early breeders of hybrid corn to determine the relationship between the yielding ability of the inbred lines and their hybrid progeny. A good bibliography of these studies may be found in Jenkins' (6)[1] work reporting his correlation studies between many inbred plant characters and their F_1 hybrids. Two statements from Jenkins' studies are especially worthy of note. "The correlations between characters of the inbred parent and the mean values of the same character in the crossbred progenies were sufficiently high in many cases to be of value for prediction purposes." "Different inbred lines showed marked differences in prepotency for practically all of the characters studied."

In 1934 Jenkins (7) published the results of his studies determining the best method of predicting double cross performance. His "Method B" which uses the average performance of the four non-parental single crosses as the predicted value for the double cross has been generally accepted as the most satisfactory. Anderson (1) and Doxtator and Johnson (2) carried out experiments comparing the single cross predicted values with actual values obtained from growing the double crosses and substantiated the findings of Jenkins. They further showed that it was important to test the three combinations possible from the combining of any four inbreds because significantly different results might be obtained

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1 Figures in parenthesis refer to "Literature Cited", p. 37.

from the different combinations.

Eckhardt and Bryan (3) compared the effect on variability of the hybrid from the crossing of single crosses made up of closely related inbred lines and widely divergent inbred lines. They designated closely related singles as (A x B) and divergent singles (Y x Z). A comparison of the doubles (A x B)(Y x Z) to the doubles (A x Y)(B x Z) showed that the (A x B)(Y x Z) outyielded the (A x Y)(B x Z) in eleven out of twelve cases on the basis of a 3 year average. The one exception was consistent throughout the test. The authors conclude that, if inbreds are closely related, they should come into the double cross together rather than one in each single cross, if the best results are to be secured. Variability in the double cross was found to be significantly lower when this procedure was followed.

In a similar study Eckhardt and Bryan (4) compared the effect of the method of combining two early and two late inbred lines upon the yield and variability of the resulting double cross. The two general types of crosses produced were (E x E)(L x L) and (E x L)(E x L). In the first type differential plantings are necessary for making the double cross seed and in the second type this difficulty arises in the making of two single crosses. Variability studies indicated that significantly greater uniformity may be obtained by combining (E x E) (L x L). This was true for silking date, ear height, ear length, ear diameter and ear weight. The authors did not determine ear moisture variability but state that "It is reasonable to expect that this relationship would also hold for moisture content of ear corn at harvest time". They further state, "There seem to be definite advantages in

the production of superior hybrid seed corn from the practice of utilizing inbred lines of similar maturity in the same single cross parent".

Pinnell (9) studied variability in the double crosses for date of silking, date of first pollen, ear height, plant height, leaf area, % ear moisture, ear length and row number as effected by the method of combining two early and two late inbred lines. Significant differences in variability for certain characters were apparent between crosses, but it was impossible to predict relative variability in the double crosses on the basis of the character means of either the inbreds or their single crosses.

MATERIALS AND METHODS

In 1946 four late inbreds (CC 5, CC 25, 40 B, Oh 51) and four early inbreds (MS 24, MS 206, A 158, R 53) were selected on the basis of their past pollinating record to be used for this study.

All 28 possible single cross combinations were made in the summer of 1946 and all 210 possible double cross combinations were made in the summer of 1947.

In 1948 the 8 inbreds, their 28 single crosses and 1 of the 3 possible double crosses arising from the combining of any 4 inbreds (70 double crosses in all chosen at random) were planted on the College Farm at East Lansing, Michigan. Inbreds, single crosses, and double crosses were each planted as groups in randomized blocks. Plot size was 2 x 12 hills. Six replications were planted for all groups. Only 20 hills, totaling as near to 60 plants as possible, were selected from each plot

for harvest. At harvest, data for plant height, ear height, ear length, ear diameter, number of rows of kernels per ear, ear weight and ear moisture were obtained from one plant selected at random from each hill harvested in three replications.

Due to labor shortage and the time consuming nature of the work, harvesting was carried out in a systematic manner by replications. By this procedure a replication from which individual plant data were obtained and a straight yield replication were harvested in a 5-day week. Thus, the total harvesting operation was spread over a 3-week period.

Plant and ear height measurements were taken in the field at harvest time to the nearest inch. The ears from the measured plants were taken to the laboratory and the green ear weight determined to the nearest gram. The ears were then placed in an oven and dried to approximately 5% ear moisture. The dry weight was recorded to the nearest gram and the ear weight at 0% moisture was later determined by calculation. Ear length measurements were made on the dried ears to the nearest half centimeter and ear diameters to the nearest quarter centimeter. Ear row number was counted at the middle of the ear.

All statistical calculations were made directly from the individual character values wherever possible. Analysis of variance and correlation coefficients were obtained for all characters by machine methods of calculation as suggested by Snedecor (10). Inbred, single cross and double cross progeny variances were obtained by the formula;

$$\frac{SX_A^2 - CT_A + SX_B^2 - CT_B + SX_C^2 - CT_C}{3(k - 1)} = V_{progeny}$$

where k is the number of individual measurements (X) per plot and A, B and C are field replications. Prediction studies were carried out by using the method suggested by Millang and Sprague (8).

Due to poor stands in some of the inbred plots, all inbred calculations are based on 16 individuals per plot. All single and double cross calculations are based on 20 individuals per plot. Only data from 65 double crosses are reported.

Plot weights, to be used for yield determinations, were taken concurrently with field measurements of plant characters. The ear moisture values determined on the individual ear basis were averaged and used for correcting field weights to a uniform moisture of 15.5%.

EXPERIMENTAL RESULTS - VARIABILITY STUDIES

Inbred Data

A study of the mean values, Table 1, for the several characters shows that there are large differences between the inbred means. It is interesting to note that inbred G, which was chosen as an early inbred on the basis of its pollinating data, has a much higher ear moisture at harvest than the other three inbreds in the early group. All of the late inbreds have a relatively high ear moisture content.

The inbreds were divided into contrasting groups, Table 2, on the basis of the data in Table 1. For ear moisture, ear height, and plant height, it was possible to divide the inbreds into groups of either four and four or three and five and have the means of all of the inbreds in each group significantly different from the means in the contrasting group. Such a division of inbreds into contrasting groups was not possible for the characters ear weight, ear length, ear diameter and number

Table 1. Mean values and least significant differences for the seven characters of the inbreds studied and the code letters used to designate the inbreds in all other tables and the text.

Inbred	Code Letter	Ear Moisture	Ear [1] Weight	Ear [2] Length	Ear Diameter	Ear no. of Rows	Ear [3] Height	Plant Height
CC 5	A	48.5	98.7	13.5	3.85	16.7	28.9	77.2
CC 25	B	56.7	71.0	13.5	3.63	13.7	26.1	69.3
40 B	C	54.3	97.7	18.6	3.51	12.3	15.7	69.0
Oh 51	D	50.4	76.3	12.7	3.53	14.2	21.1	68.1
MS 24	E	44.9	85.0	12.3	4.13	14.4	10.6	48.4
MS 206	F	40.9	66.1	11.8	3.44	11.7	13.4	56.0
A 158	G	48.6	59.9	12.3	3.40	13.5	8.6	47.4
R 53	H	41.1	88.5	14.1	3.65	14.3	15.1	52.7
L. S.[4]		3.3	18.8	1.3	0.14	0.5	4.2	5.1

1 Weight in grams at 0% moisture.
2 Ear length and diameter in centimeters.
3 Ear and plant height in inches.
4 Least significant difference at the 5% point.

of rows per ear and so the inbreds were separated for these characters by placing the four inbreds with the high means into one group and those with the low means into the other group.

Table 2. Grouping of inbreds for the purpose of determining the effect of method of combining contrasting characters upon the variability of the resulting crosses.

Plant Character	Contrasting Characters	Code Letter	Inbred Code	X^2 (1)
Ear Moisture	(Late	H	A B C D G	0.99
	(Early	L	E F H	6.83
Ear Weight	(Heavy	H	A C E H	22.41*
	(Light	L	B D F G	2.11
Ear Length	(Long	H	A B C H	14.96*
	(Short	L	D E F G	27.93*
Ear Diameter	(Large	H	A B E H	19.26*
	(Small	L	C D F G	5.99
Ear no. of Rows	(Many	H	A D E H	7.17
	(Few	L	B C F G	6.55
Ear Height	(High	H	A B D	6.33
	(Low	L	C E F G H	11.63
Plant Height	(Tall	H	A B C D	5.28
	(Short	L	E F G H	14.06*

(1) Bartlett's chi-square test for homogeneity was calculated on the variances of the inbreds by groups.

* Chi-square values are too high to indicate homogeneity of variability within the inbred group.

With the exception of A which consistently falls into the high group and F which is always found in the low group, the inbreds shift from the high to the low group depending upon their expression of the

particular character in question. Inbreds A, B, C, D and H are found most frequently in the high groups and inbreds F, G and E in the low groups. These groupings indicate a tendency for the late inbreds to have high and the early inbreds low values for the several characters.

Table 3 presents in a condensed form the pertinent data from the inbred analyses: Tables 19-25. It shows for all characters whether or not there are significant differences between the means of the inbreds, the means of the high and low groups of inbreds and the means of the inbreds within the high and the low groups. For the 28 items indicated in the table, the F-values of 23 exceed the 1% point, 1 exceeds the 5% point and 4 show no significant differences.

Table 3. Significant mean differences indicated by analyses of variance for inbreds. Data summerized from Tables 19-25.

Character	Inbreds	High : Low	Within High	Within Low
Ear Moisture	**	**	**	*
Ear Weight	**	**	--	--
Ear Length	**	**	**	--
Ear Diameter	**	**	**	--
Ear no. of Rows	**	**	**	**
Ear Height	**	**	**	**
Plant Height	**	**	**	**

* Exceeds the 5% point.
** Exceeds the 1% point.
-- No significant difference.

The chi-square values, Table 2, indicate that the inbreds within some of the character groups differ significantly from each other in

variability. Inbred A, Table 27, shows a significantly greater variability for ear weight than either inbreds E or H. Similar differences in variability are apparent in both the high and the low groups of inbreds for ear length, Table 28. They, also, occur in the high group for ear diameter, Table 29, and in the low group for plant height, Table 32. These differences in variability may be due to either genetic heterozygosity or inbred reaction to environmental conditions. Since the inbreds used for this study have been selfed for many generations and have shown a high degree of uniformity, it is more likely that the differences in inbred variability are an expression of inbred sensitivity to environment rather than genetic segregation.

Inbred frequency distributions and variances for all characters are given in Tables 26-32.

Single Cross Data

The mean values for the several characters, as determined by averaging the single cross values for each inbred when crossed with every other inbred, are presented in Table 4. A comparison of the inbred values, Table 1, and their single cross combination values, Table 4, shows that for all inbreds the average moisture for inbreds in combinations is lower than for the inbreds themselves. For all characters, except ear moisture, the combination means are higher than the individual inbred values. When the inbred means and the single cross combination means are ranked from high to low, it becomes apparent that the inbreds do not maintain the same rank in combinations that they do as individuals. Also, there is less spread between the means of the inbreds in combinations than in the means of the inbreds themselves.

Table 4. Mean values and least significant differences for all characters of the single crosses involving each inbred with every other inbred.

Inbred Code	Ear Moisture	Ear [1] Weight	Ear [2] Length	Ear Diameter	Ear no. of Rows	Ear [3] Height	Plant Height
A	43.5	165	17.7	4.23	16.2	28.7	84.9
B	45.0	166	18.3	4.20	14.9	30.0	85.9
C	44.5	181	20.6	4.12	13.6	26.7	84.5
D	41.7	161	17.8	4.11	14.7	30.9	83.7
E	43.4	161	17.3	4.34	15.5	25.4	72.6
F	38.8	151	17.4	4.05	13.9	26.1	77.6
G	41.6	157	18.3	4.03	14.5	24.3	73.7
H	39.9	151	17.7	4.09	13.4	24.8	72.6
L. S.[4]	0.74	7.41	0.59	0.053	0.23	1.08	1.27

1 Weight in grams at 0% moisture.
2 Ear length and diameter in centimeters.
3 Ear and plant height in inches.
4 Least significant difference at the 5% point.

Since the inbreds were divided into high and low groups for each character, it becomes possible to separate the single crosses into three groups, high x high, low x low and high x low. Table 5 gives the group means and the high and low individual means within the groups of crosses for all characters. In every instance, the mean for the high x high group is highest, for the low x low group lowest and for the high x low group intermediate. In all but three cases, the highest individual mean value occurs in the high x high group and the lowest in the low x low group. However, for all characters, except plant height, there is a great deal of overlapping of individual means between all groups. Individual means equal to those in the high x high group may be found in the high x low and low x low groups and vice versa. For the character plant height, there is no overlapping of individual progeny means from one group of crosses to another.

The summary of Tables 19-25 of the single cross analyses of variance for the several characters, Table 6, shows that in these analyses significant differences at the 1% point are indicated for practically all of the comparisons between the means under consideration. The lack of a significant difference for plant height in the high x high and high x low groups is in sharp contrast to the significant differences indicated for all other comparisons within crossing groups.

The single cross variances by groups are given in Tables 26-32 for all characters and the means of these group variances are presented in Table 7. The data in this table show that, in all cases except ear moisture and ear weight, the highest mean variances are associated with the high x high crosses, the lowest with the low x low crosses,

Table 5. Group mean and high and low individual cross mean values for the single cross combinations of inbreds within and between contrasting groups for each character.

Character	Type of single cross								
	High x High			Low x Low			High x Low		
	Group	High	Low	Group	High	Low	Group	High	Low
Ear moisture	44.7	50.5	39.7	38.8	41.1	36.7	41.4	46.6	37.8
Ear weight	169.0	191.0	149.0	157.0	175.0	123.0	161.0	188.0	117.0
Ear Lenth	19.3	21.6	16.9	17.1	18.5	16.0	18.1	21.8	15.5
Ear diameter	4.3	4.5	4.1	4.0	4.1	3.8	4.1	4.3	3.9
Ear no. of rows	16.1	17.3	14.6	13.5	15.0	12.9	14.8	16.5	13.2
Ear height	33.8	34.7	32.1	23.1	27.1	18.1	28.3	33.1	25.1
Plant height	91.2	92.4	90.1	66.0	71.1	61.7	79.9	87.4	73.2

with the mean variances for the high x low crosses intermediate to those of the other two groups. The mean variance for ear moisture in the low x low group is exceptionally high because of the mean value of 28.78 for cross FH and the fact that there are only 3 crosses in this group. When the F-values are obtained for the various comparisons, Table 8, it is found that there are significant differences at the 2% point between the variances of many of the groups. Ear weight does not show any significant differences between groups.

Table 7. Single cross group mean variances for all characters. Summerized from Tables 26-32.

Character	Single crossing group		
	High x High	Low x Low	High x Low
Ear Moisture	9.52	12.74	9.49
Ear Weight	1412	1241	1448
Ear Length	7.00	3.60	5.03
Ear Diameter	0.066	0.044	0.063
Ear no. of Rows	2.72	1.65	2.30
Ear Height	19.90	16.47	15.06
Plant Height	31.6	20.9	24.8

In order to test whether or not there were any significant differences between the inbreds in their ability to cause high or low variances in their single crosses, the mean variances for each inbred when crossed with every other inbred were calculated for all characters. These data are presented in Table 9. When the F-values, Table 10, are obtained, it is found that there are significant differences between the mean variances of many of the inbreds in combinations. Inbred F is significantly higher than all of the other inbreds for ear moisture

Table 6. Significant differences between means indicated by analyses of variance for single crosses. Data summarized from Tables 19 - 25.

Item	Ear Moisture	Ear Weight	Ear Length	Ear Diameter	Ear no. of Rows	Ear Height	Plant Height
Crosses	**	**	**	**	**	**	**
1 H x H	**	**	**	**	**	*	--
2 L x L	**	**	**	**	**	**	**
3 1 : 2	**	**	**	**	**	**	**
4 H x L	**	**	**	**	**	**	--
5 1+2 : 4	**	--	*	--	--	**	**

* Exceeds the 5% point.
** Exceeds the 1% point.
-- No significant difference.

Table 8. F-values for all possible comparisons of variance means given in Table 7.

Comparison	Ear Moisture	Ear Weight	Ear Length	Ear Diameter	Ear no. of Rows	Ear Height	Plant Height
(HxH):(LxL)	1.34**	1.14	1.94**	1.50**	1.65**	1.21	1.51**
(HxH):(HxL)	1.00	1.00	1.39**	1.00	1.18	1.32**	1.27*
(HxL):(LxL)	1.34**	1.17*	1.40**	1.43**	1.39**	1.09	1.19**

* Exceeds the 10% point.
** Exceeds the 2% point.

Table 9. Mean variances for all characters of the single crosses involving each inbred with every other inbred.

Inbred Code	Ear Moisture	Ear Weight	Ear Length	Ear Diameter	Ear no. of Rows	Ear Height	Plant Height
A	9.75	1674	5.73	0.076	3.11	16.37	29.76
B	11.02	1661	7.14	0.071	2.01	17.10	26.73
C	8.35	1749	6.77	0.053	1.71	14.43	29.07
D	9.06	1221	3.86	0.053	1.85	18.01	25.43
E	7.92	1252	3.56	0.047	2.19	14.56	22.43
F	12.85	1152	5.34	0.063	2.26	20.64	26.33
G	10.01	1402	4.91	0.051	2.12	16.07	20.17
H	10.50	1055	3.86	0.064	2.77	15.79	23.66

Table 10. F-values for all possible comparisons of variance means given in Table 9.

Comparison	Ear Moisture	Ear Weight	Ear Length	Ear Diameter	Ear No. of Rows	Ear Height	Plant Height
A : B	1.13	1.01	1.25**	1.07	1.55**	1.04	1.11
C	1.17*	1.04	1.18*	1.43**	1.82**	1.13	1.02
D	1.08	1.37**	1.48**	1.43**	1.68**	1.10	1.17*
E	1.23*	1.34**	1.61**	1.62**	1.42**	1.12	1.33**
F	1.32**	1.45**	1.07	1.21*	1.38**	1.26**	1.13
G	1.03	1.19*	1.17*	1.49**	1.47**	1.02	1.47**
H	1.08	1.59**	1.48**	1.19*	1.12	1.04	1.27**
B : C	1.32**	1.05	1.05	1.34**	1.17*	1.19	1.09
D	1.22*	1.36**	1.85**	1.34**	1.09	1.05	1.05
E	1.39**	1.33**	2.01**	1.51**	1.09	1.17*	1.19*
F	1.17*	1.44	1.34**	1.13	1.12	1.21*	1.01
G	1.10	1.18*	1.45**	1.39**	1.05	1.06	1.33**
H	1.05	1.57**	1.85**	1.11	1.38**	1.08	1.13
C : D	1.09	1.43**	1.75**	1.00	1.08	1.25**	1.14
E	1.05	1.40**	1.90**	1.13	1.28**	1.01	1.30**
F	1.54**	1.52**	1.27**	1.19*	1.32**	1.43**	1.10
G	1.20*	1.25**	1.38**	1.04	1.24**	1.11	1.44**
H	1.26**	1.66**	1.75**	1.21*	1.62**	1.09	1.23**
D : E	1.14	1.03	1.08	1.13	1.18*	1.24**	1.13
F	1.42**	1.06	1.38**	1.19*	1.22*	1.15	1.03
G	1.10	1.15	1.27**	1.04	1.15	1.12	1.26**
H	1.16*	1.16*	1.00	1.21*	1.50**	1.14	1.07
E : F	1.62**	1.09	1.50**	1.34**	1.05	1.42**	1.17*
G	1.26**	1.12	1.38**	1.09	1.03	1.10	1.11
H	1.33**	1.19*	1.08	1.36**	1.26**	1.08	1.05
F : G	1.28**	1.22**	1.09	1.23*	1.07	1.28**	1.31**
H	1.22*	1.09	1.38**	1.01	1.23*	1.31**	1.11
G : H	1.05	1.33**	1.27**	1.25**	1.31**	1.02	1.17*

* Exceeds the 10% point.
** Exceeds the 2% point.

variability. Inbred E has the lowest variability but it is not significantly different from inbreds C and D in this respect.

A study of the progeny frequency distributions and variances presented in Tables 26-32 shows that for all characters there are significant differences in variability between many of the single crosses. Significant differences between individual crosses as tested by obtaining F-values from variances, occur for all characters, both between individuals within the same crossing group and between individuals in the different crossing groups.

Since date of harvest materially affects ear moisture in central Michigan, the frequency distributions for ear moisture are given for each replication. These data, Table 26, show that the different single crosses do not lose ear moisture uniformly. Compare, for example, the frequency distributions of the single crosses EH and FH in the early x early group.

During the three week harvest period, the ear moisture of cross EH did not change materially while that for cross FH changed more than 10%. Other examples of similar differences in rate of ear drying are apparent in the data.

Double Cross Data

From the three types of single crosses, it is possible to make six types or groups of double crosses; (HxH)(HxH), (LxL)(LxL), (HxH)(HxL), (HxL)(LxL), (HxH)(LxL) and (HxL)(HxL). Since only one third of the possible double cross combinations were chosen for this study, not more than one cross for each of the first two types can be obtained when the inbreds are separated four and four into contrasting

groups. When the inbreds are separated three and five, as in the case of the characters of ear moisture and ear height, no individuals of one or the other of the first two types are obtained. The number of progenies in the other groups varies according to the classification of the inbreds and the original selection of the crosses.

The group mean values and the individual high and low mean values within the groups for all characters are presented in Table 11. Plant height is the only character which shows the mean value for the cross (HxH)(HxH) to be higher than any individual appearing within one of the other crossing groups. Even this value, when tested by the least significant difference is found not to be significantly higher than the high value in the (HxH)(HxL) group. A study of the data show that the group means do not follow a similar pattern for all characters as they did in the case of the single crosses. The differences between many of the group means are small and even in several cases when these differences are indicated to be significant by the F-test, they are so minor as to be of doubtful significance from an agronomic standpoint.

A comparison of the individual means shows that there is much overlapping between groups for all characters. The characters ear moisture, ear diameter, ear number of rows, ear height and plant height have their lowest value in the (LxL)(LxL) or (HxL)(LxL) group. There is a tendency with all characters for the higher mean values to be associated with those crossing groups containing the greater number of high value inbreds and the lower mean values with those groups in which the low value inbreds predominate. For all characters except ear length, the individual mean low value for the (HxH)(LxL) crosses is higher than the comparable value in the (HxL)(HxL) crosses.

Table 11. Group means and high and low individual mean values for all characters of all double cross combination groups.

Character		Double cross combination groups					
		(HxH)(HxH)	(LxL)(LxL)	(HxH)(HxL)	(HxL)(LxL)	(HxH)(LxL)	(HxL)(HxL)
Ear Moisture	1[a]	43.9	----	42.4	39.6	40.5	39.7
	2	44.9	----	47.8	43.5	43.2	44.9
	3	42.3	----	38.0	35.8	37.6	35.8
Ear Weight	1	148.3	155.1	158.6	162.4	161.4	162.3
	2	-----	-----	173.8	177.0	167.5	180.2
	3	-----	-----	146.2	143.5	152.1	142.6
Ear Length	1	17.3	17.7	18.0	18.0	17.6	18.1
	2	----	----	19.9	19.5	18.6	19.7
	3	----	----	16.1	16.9	15.8	16.3
Ear Diameter	1	4.3	4.0	4.2	4.1	4.1	4.1
	2	---	---	4.3	4.2	4.3	4.2
	3	---	---	4.1	3.9	4.0	4.0
Ear no. of Rows	1	---	13.9	15.0	14.5	15.1	15.1
	2	---	----	16.7	15.4	16.3	16.5
	3	---	----	14.1	13.4	14.3	14.0
Ear Height	1	---	25.8	32.9	26.5	29.6	29.0
	2	---	26.5	35.3	31.6	33.5	31.7
	3	---	23.3	31.6	22.2	26.3	23.6
Plant Height	1	92.7	70.3	87.3	75.7	80.0	81.6
	2	----	----	91.4	80.0	83.8	87.8
	3	----	----	84.1	71.6	77.7	76.7

a 1 Group mean value; 2 High individual mean value; 3 Low individual mean value.

The summary of Tables 19-25 of the double cross analyses of variance for the several characters, Table 12, shows that for all characters, except ear weight, significance exceeding the 1% point is indicated for many of the items under consideration. No significant differences for any items are indicated for the character ear weight. Ear diameter also shows a lack of significance for most items. It should be remembered (see Tables 19 to 25) that for items A1 and A2 only one degree of freedom was possible in the case of most characters and so there are no values available for testing in these crossing groups.

The group mean variance was determined for each type of double crossing group and these data are presented for all characters in Table 13. The highest mean variance does not occur in the same crossing group for all characters. It is found three times in the (HxH)(HxH) group, twice in the (HxH)(HxL) group and twice in the (HxL)(HxL) group. The lowest group mean variance is found five times in the (LxL)(LxL) group, and once each in the (HxL)(LxL) and (HxL)(HxL) groups. F-values, Table 14, obtained for all possible mean variance comparisons of Table 13 show a very irregular pattern of significant differences. The extremely high variance of 10.98 for the (HxH)(HxH) cross in ear length is significantly higher than all other variances for this character. Significant differences are more numerous for this character than for the others.

The double cross progeny frequency distributions and variances, Tables 26-32, show, in general, slightly greater frequency ranges and higher variances than were shown by the single crosses. When the variability of the progenies is tested by obtaining F-values from their

Table 12. Significant mean differences indicated by analyses of variance for double crosses. Data summarized from Tables 19 - 25.

Item	Ear Moisture	Ear Weight	Ear Length	Ear Diameter	Ear no. of Rows	Ear Height	Plant Height
Crosses	**	--	**	**	*	**	**
A1 (HxH)(HxH)	--	--	--	--	--	--	--
A2 (LxL)(LxL)	--	--	--	--	--	**	--
3 A1 : A2	--	--	--	**	--	--	**
B4 (HxH)(HxL)	**	--	**	--	**	--	**
B5 (HxL)(LxL)	**	--	**	--	**	**	**
6 B4 : B5	**	--	--	**	**	**	**
7 A : B	**	--	--	--	**	**	--
C8 (HxH)(LxL)	**	--	**	**	**	**	--
C9 (HxL)(HxL)	**	--	**	--	**	*	**
10 C8 : C9	*	--	**	--	--	**	**
11 A+B : C	**	--	--	--	--	**	--

* Exceeds the 5% point.
** Exceeds the 1% point.
-- No significant difference.

Table 13. Group mean variance and high and low individual variance for all characters of all double cross combination groups.

Character		Double cross combination groups					
		(HxH)(HxH)	(LxL)(LxL)	(HxH)(HxL)	(HxL)(LxL)	(HxH)(LxL)	(HxL)(HxL)
Ear Moisture	1[a]	15.70	---	14.58	15.50	14.33	12.68
	2	16.35	---	26.50	21.62	21.11	18.76
	3	12.69	---	7.66	9.75	9.00	9.67
Ear Weight	1	1750	1060	1630	1211	1324	1433
	2	----	----	2477	1879	1629	2032
	3	----	----	862	882	911	953
Ear Length	1	10.98	3.94	6.22	3.93	5.05	5.84
	2	-----	----	8.62	6.89	8.75	9.07
	3	-----	----	4.16	3.34	3.04	3.96
Ear Diameter	1	0.084	0.056	0.098	0.086	0.080	0.086
	2	-----	-----	0.120	0.120	0.120	0.124
	3	-----	-----	0.064	0.062	0.050	0.056
Ear no. of Rows	1	-----	2.49	3.83	2.68	3.33	3.29
	2	-----	----	5.12	3.26	4.61	5.70
	3	-----	----	2.75	1.61	2.12	2.05
Ear Height	1	-----	15.98	20.55	21.07	18.46	23.14
	2	-----	18.3	25.7	32.3	24.4	30.0
	3	-----	13.1	13.2	9.6	12.9	15.1
Plant Height	1	36.30	32.50	49.63	49.05	45.30	51.21
	2	-----	-----	81.8	77.3	49.9	76.3
	3	-----	-----	38.3	30.4	32.7	30.9

a 1 Group mean variance; 2 High individual variance; 3 Low individual variance.

Table 14. F-values obtained for all comparisons of group mean variance values in Table 13.

Comparison	Ear Moisture	Ear Weight	Ear Length	Ear Diameter	Ear no. of Rows	Ear Height	Plant Height
1[a] : 2	----	1.65*	2.79**	1.50	----	----	1.12
3	1.08	1.07	1.77*	1.17	----	----	1.37
4	1.00	1.45*	2.79**	1.00	----	----	1.35
5	1.10	1.32	2.17**	1.05	----	----	1.25
6	1.24*	1.22	1.88**	1.00	----	----	1.41
2 : 3	----	1.54*	1.58*	1.75**	1.54*	1.29*	1.53*
4	----	1.14	1.00	1.53*	1.08	1.32**	1.51*
5	----	1.25	1.28	1.43*	1.34	1.15	1.39
6	----	1.36	1.48*	1.53*	1.32	1.45**	1.57*
3 : 4	1.06*	1.35**	1.58**	1.14*	1.43**	1.03	1.00
5	1.00	1.23**	1.23**	1.22**	1.15*	1.11	1.09
6	1.15*	1.14*	1.07	1.14*	1.16**	1.13	1.03
4 : 5	1.08	1.09	1.28**	1.07	1.24**	1.14*	1.08
6	1.22*	1.18**	1.49**	1.00	1.23**	1.10*	1.04
5 : 6	1.13*	1.08*	1.16**	1.07	1.01	1.25**	1.13*

a 1 (HxH)(HxH); 2 (LxL)(LxL); 3 (HxH)(HxL); 4 (HxL)(LxL); 5 (HxH)(LxL); 6 (HxL)(HxL).
* Exceeds the 10% point.
** Exceeds the 2% point.

variances, it is found that there are significant differences between many of the progenies both within and between crossing groups. The individual high and low variance values for all crossing groups and characters, Table 13, show how generally, rather uniformly, high and low variance values are found in all groups. An F- test shows no significant differences between the individual high values in each group above the 10% point. The same holds true when the low values of all groups are tested.

EXPERIMENTAL RESULTS - PREDICTION STUDIES

In determining predicted double cross values, Jenkins' (7) method of averaging the four non-parental single cross means was used. The actual double cross means and their corresponding predicted values are given for the seven plant characters under study and for yield in Tables 33 - 40. The pertinent data from these tables are presented in summary form in Table 15.

The correlation coefficient was obtained between the actual and predicted values in all instances as a measure of testing the accuracy of this method of determining double cross values from single cross results. Although, all of the r-values obtained from the data under consideration show significance exceeding the 1% point, there are wide differences between them.

Ear moisture, ear diameter, ear number of rows, and plant height all gave r-values exceeding 0.78 which indicates that these values for the double crosses in the present study may be predicted with a high degree of accuracy from the single cross values. Ear weight gave an

r-value of 0.23 and indicates that little credence can be placed on the predicted values of this character. Yield which showed an r-value of 0.75 in Jenkins' (7) studies and which has been supported by other workers (5),(2), only gave an r-value of 0.31 in the present instance.

Table 15. Average of actual means of double crosses, average of double cross means predicted from single crosses, and their r-values for all characters. Summarized from Tables 33-40.

Character	Actual Mean	Predicted Mean	r value
Ear Moisture	41.15	42.25	0.82**
Ear Weight	161.10	162.31	0.23**
Ear Length	17.97	18.21	0.54**
Ear Diameter	4.15	4.15	0.78**
Ear no. of Rows	15.01	14.81	0.85**
Ear Height	28.09	26.93	0.59**
Plant Height	80.97	79.17	0.89**
Yield	61.56	61.98	0.31**

**Exceeds the 1% point.

Since yield and certain other plant character double cross values may be predicted from single cross data with a satisfactory degree of accuracy, an attempt was made to predict variability values for plant characters in the double cross on the basis of variability values obtained in the single crosses. Jenkins' method as used with

single cross mean values was followed except that single cross progeny variance values were averaged to obtain the double cross predicted values.

The actual variances for the double crosses and their corresponding variances, as predicted from the single cross variance values are given for all characters in Tables 41-47. A summary of the pertinent data from these tables is presented in Table 16. For all the characters, the actual average variance of all crosses is higher than the predicted average variance. When r-values are calculated between the actual and predicted values, values of r exceeding the 1% point are obtained for the characters ear moisture, ear weight and ear length and ear number of rows. However, these values, except in the case of ear number of rows, are small, 0.26, 0.38 and 0.34, respectively, and would indicate that the method is of doubtful value for useful prediction purposes. The r-value of 0.52 for ear number of rows is substantially higher than the other values and indicates that predictions as to variability of this character might be of use. The two r-values, 0.08 and 0.01, obtained for ear height and plant height, respectively, indicate that, in the present study at least, there is no relationship between the actual double cross variances and variances predicted from the non parental single cross variance values.

Table 16. Average of actual variances for double crosses, average of variances predicted from single crosses and their r-values for all characters. Summarized from Tables 41-47.

Character	Actual Mean Variance	Predicted Mean Variance	r value
Ear Moisture	14.16	9.67	0.26**
Ear Weight	1410.4	1388.9	0.38**
Ear Length	5.37	5.11	0.34**
Ear Diameter	0.0867	0.0603	0.22*
Ear no. of Rows	3.26	2.31	0.52**
Ear Height	20.83	16.27	0.08
Plant Height	48.67	25.24	0.01

* Exceeds the 5% point.
** Exceeds the 1% point.

Since the attempt to predict variability in the double crosses from single cross data proved unsatisfactory, an analysis of the inbreds involved in the double crosses showing the 10 highest and 10 lowest variances for all characters was made. The average variance, Table 17, of the high variance group was two or more times that of the low group, in the case of each character, which makes the difference between the groups highly significant.

The analysis, Table 17, shows that all of the inbreds do not occur with the same frequency in both the high and the low variance groups of double crosses. There is shown a definite tendency for certain inbreds to be associated with either the high or low variance

Table 17. Frequency of occurence of inbreds in the double crosses with the 10 highest and 10 lowest variances for all characters.

Inbred Code	Ear Moisture	Ear Weight	Ear Length	Ear Diameter	Ear no. of Rows	Ear Height	Plant Height
			High Variance Crosses				
A	5	7	6	8	8	4	3
B	6	6	4	6	3	6	6
C	5	7	9	5	2	4	5
D	4	2	1	1	4	5	4
E	4	5	3	5	6	8	4
F	6	4	3	5	3	3	6
G	6	5	8	5	7	7	4
H	4	4	5	5	7	3	8
Aver. variance	21.00	1998	8.33	0.115	4.74	28.94	70.24
			Low Variance Crosses				
A	2	4	2	3	1	7	8
B	6	4	4	5	7	4	3
C	6	2	3	7	8	6	3
D	7	5	8	5	6	1	3
E	6	7	7	6	3	5	7
F	6	9	6	8	6	4	7
G	4	4	5	3	5	6	3
H	3	5	3	3	4	7	6
Aver. variance	9.35	930	3.22	0.058	2.10	13.28	33.96

group for one or more characters. Inbred D does not occur as often in the high group for several characters as would be expected by chance alone. The same is true of inbred A in the low variance group. However, these two inbreds also show that an inbred may be associated with low variance for one character and high variance for another.

In order to show what types of crosses were involved in the high and low variance groups of double crosses, the data in Table 18 were assembled. Except that no (LxL)(LxL) crosses appear in the high variance group, all possible types of double crosses occur in both groups. In the high variance group, the (HxH)(HxL) and (HxL)(HxL) types occur most frequently while in the low group the (HxL)(LxL) type predominates.

DISCUSSION

Corn inbreds which have been selfed sufficiently to make them appear uniform for plant characters and show no hybrid vigor when sib mated are considered more or less genetically homozygous for practical purposes. When several inbreds are grown in replicated plots side by side and show significant differences in variability for a character, it may be considered that they are expressing differences in sensitivity to their environmental surroundings. This is assumed to be the reason for the significant differences in variability for the several characters of the inbreds under study.

Single cross corn hybrids are expected, because of their genetic constitution, to express the maximum of uniformity for plant characters. As in the case of inbreds, variability of plant character expression must be attributed to plant reaction to environmental conditions. Since

Table 18. Frequence of occurence of the different possible double cross types in the double crosses having the 10 highest and 10 lowest variances for all characters.

Cross type	Ear Moisture	Ear Weight	Ear Length	Eaf Diameter	Ear no. of Rows	Ear Height	Plant Height
			High Variance Crosses				
(HxH)(HxH)	1	0	1	0	0	0	0
(LxL)(LxL)	0	0	0	0	0	0	0
(HxH)(HxL)	5	4	3	5	5	0	1
(HxL)(LxL)	1	1	1	1	0	5	3
(HxH)(LxL)	2	0	2	1	1	0	1
(HxL)(HxL)	1	5	3	3	4	5	5
			Low Variance Crosses				
(HxH)(HxH)	0	0	0	0	0	0	1
(LxL)(LxL)	0	0	0	1	0	2	1
(HxH)(HxL)	7	2	0	1	0	1	0
(HxL)(LxL)	1	4	7	2	7	5	3
(HxH)(LxL)	1	3	3	3	1	1	2
(HxL)(HxL)	1	1	0	3	2	1	3

the inbreds showed significant differences in variability, it is only logical to expect that the single crosses would also show significant differences in this respect.

One might expect that the crossing of inbreds with high variability would produce single crosses with higher variability than the crossing of inbreds with low variability. The present study does not indicate that such is necessarily the case. For ear moisture, inbreds A and C in the late group had variances of 31.06 and 28.63, respectively. The single cross AC had a variance of only 11.33. In contrast, inbreds F and H in the early group had variances of 17.32 and 18.78, respectively, and the single cross FH had a variance of 28.78. It would appear that interaction of factors enters into the expression of variance and the variability of the single cross cannot be accurately predicted on the basis of the variability of the inbred parents.

Variability is expected to be greater in double cross corn hybrids than in single crosses because there is opportunity for a certain amount of genetic segregation in the double cross hybrid. A double cross of the type (HxH)(LxL) would theoretically be more uniform than a cross of the type (HxL)(HxL). Crosses of the types (HxH)(HxH) and (LxL)(LxL) would be expected to show the least variability.

In the double crosses, it appears that the combination of factors plays just as an important role as it does in the single crosses. In the case of ear moisture, the cross of the four late inbreds which all have high variance gave a double cross with high variance which

is what we might anticipate. However, crosses of the (HxH)(HxL) type gave 7 of the 10 lowest variances for this character which is not according to expectation.

The data indicate that on the basis of the averages of all the individuals within the different crossing groups for ear moisture that the (HxL)(HxL) group gave significantly lower average variances than any of the other groups tested. However, it should be remembered that there are individual crosses in all of the other groups that have just as low variances as those in the (HxL)(HxL) group. Unfortunately, there were no crosses in the (LxL)(LxL) group since only three inbreds fell into the low group.

In so far as the present study is concerned, it may well be concluded that the variability in ear moisture cannot be predicted from the parent inbreds. It would seem that it is entirely practicable to cross early and late maturing inbreds to produce hybrids with low variability of ear moisture. One has no assurance from the work reported herein that the practice of combining all early and all late inbreds will produce lower variability of ear moisture than the combining of early and late inbreds in the same cross.

This discussion concerning variability in the double crosses has been confined to ear moisture since it was the primary object of this study. However, what has been said about ear moisture and its variability in the double-crosses might well be repeated for all of the other characters studied.

SUMMARY

1. Experiments were conducted to study the effect upon variability in the plant characters ear moisture, ear dry weight, ear length, ear diameter, ear number of rows, ear height and plant height, of different methods of combining inbreds with similar plant characters and inbreds with contrasting plant characters.

2. Eight inbreds which showed marked differences for the plant characters under study were combined into all possible single and double cross combinations. All of the inbreds, single crosses and one-third of the possible double cross combinations were planted in the season of 1948 and a study of plant to plant variability was made at harvest time.

3. Significant mean differences for all characters were found to exist between the inbreds giving the highest and lowest mean values for any particular character.

4. Significant differences in variability were found between inbreds for all characters and were attributed to inbred sensitivity to environmental conditions.

5. For plant height, the crossing of tall x tall inbreds always produced the tallest hybrids; short x short the shortest; and tall x short inbreds always produced hybrids with mean heights intermediate to the other two types of crosses. For all other characters, there was a slight tendency for the crossing of inbreds with high values to produce high value hybrids; the crossing of low value inbreds to produce low values; and the crossing of a high value inbred with a

low value inbred to produce intermediate value hybrids, but some hybrids of similar value resulted from each of these three types of crosses.

6. Significant differences were obtained for all characters, except ear weight, between many of the group mean variances for the three types of single crosses.

7. The differences between the group means for all characters in the double crosses, although statistically significant in many cases, are so small in some instances, as to be of doubtful value from an agronomic standpoint. There is a tendency for the crosses with the greater number of high value inbreds to produce hybrids of high value and crosses with a greater number of low value inbreds to produce low value hybrids.

8. There were significant differences between many of the group mean variances for all characters in the double crosses. However, the results were so variable for the different characters that it is impossible to say that the variability of one type of cross is consistently greater than that of another.

9. Predicted mean values and variance values for all characters and yield in the double crosses were calculated by averaging the four non parental single cross values. Significant correlation coefficients between the predicted mean values and the actual mean values were obtained in all cases. The correlation coefficients obtained between the predicted variance values and the actual variance values, although significant for certain characters, were so small in all cases that it

is doubtful whether this method of predicting variability in the double crosses is of any practical value.

10. An analysis of the double crosses with the 10 highest and the 10 lowest variances for all characters showed that most of the inbreds occurred with equal frequency in both groups. Certain inbreds showed a definite tendency to be associated with crosses of either high or low variances but this association was not the same for all characters.

The one conclusion to be drawn from this study is that the inherent characters within the inbreds determine variability in the hybrid and this variability could not be accurately predicted from the inbreds themselves, their single crosses or the method of combining the inbreds.

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Table 19. Analysis of variance for ear moisture of inbreds, single crosses and double crosses.

Source	DF	SS	V	F
Inbreds				
Total	383	23,204		
Replications	2	1,951	975.5	17.02**
Inbreds	7	11,653	1,664.7	29.05**
1 H : L[a]	1	8,270	8,270.0	144.33**
2 H	4	2,837	709.3	12.38**
3 L	2	547	273.5	4.77*
R x I	14	803	57.3	2.35**
Within plots	360	8,797	24.4	
Single Crosses				
Total	1,679	45,491		
Replications	2	8,807	4,403.5	152.90**
Crosses	27	19,775	732.4	25.43**
1 H x H	9	6,156	684.0	23.75**
2 L x L	2	568	284.0	9.86**
3 1 : 2	1	4,903	4,903.0	170.24**
4 H x L	14	6,760	482.9	16.77**
5 1+2 : 4	1	1,387	1,387.0	48.16**
R x C	54	1,557	28.8	3.00**
Within plots	1,596	15,352	9.6	
Double Crosses				
Total	3,899	83,191		
Replications	2	16,176	8,088.0	170.27**
Crosses	64	27,243	425.7	8.96**
A1 (HxH)(HxH)	3	251	83.7	1.84
A2 (LxL)(LxL)	0	0	0.0	0.00
3 A1 : A2	0	0	0.0	0.00
B4 (HxH)(HxL)	26	8,899	342.3	7.21**
B5 (HxL)(LxL)	5	2,147	429.4	9.04**
6 B4 : B5	1	2,252	2,252.0	47.41**
7 A : B	1	932	932.0	19.43**
C8 (HxH)(LxL)	10	1,842	184.2	3.88**
C9 (HxL)(HxL)	16	6,124	382.7	8.06**
10 C8 : C9	1	290	290.0	6.11*
11 A+B : C	1	4,515	4,515.0	95.05**
R x C	128	6,083	47.5	5.22**
Within plots	3,705	33,689	9.1	

a H equals late inbred; L equals early inbred.
* Exceeds the 5% point.
** Exceeds the 1% point.

Table 20. Analysis of variance for ear weight of inbreds, single crosses and double crosses.

Source	DF		SS	V	F
Inbreds					
Total	383		334,559		
Replications	2		14,591	7,295.5	3.96
Inbreds	7		73,740	10,534.0	5.72**
1 H : L[a]		1	61,327	61,327.0	33.32**
2 H		3	6,513	2,171.0	1.18
3 L		3	5,900	1,966.7	1.07
R x I	14		25,769	1,840.6	3.00**
Within plots	360		220,459	612.4	
Single Crosses					
Total	1,679		3,115,980		
Replications	2		160,645	80,322.5	28.12**
Crosses	27		585,237	21,675.0	7.59**
1 H x H		5	86,124	17,224.0	6.03**
2 L x L		5	124,495	24,899.0	8.72**
3 1 : 2		1	28,703	28,703.0	10.05**
4 H x L		15	343,499	22,899.9	8.02**
5 1+2 : 4		1	2,415	2,415.0	1.18
R x C	54		154,224	2,856.0	2.06**
Within plots	1,596		2,215,874	1,388.3	
Double Crosses					
Total	3,899		5,680,269		
Replications	2		130,327	65,163.5	17.15**
Crosses	64		346,834	5,419.2	1.43
A1 (HxH)(HxH)		0	0	0.0	0.00
A2 (LxL)(LxL)		0	0	0.0	0.00
3 A1 : A2		1	1,069	1,069.0	3.55
B4 (HxH)(HxL)		13	68,690	5,283.8	1.39
B5 (HxL)(LxL)		13	69,172	5,320.9	1.40
6 B4 : B5		1	5,096	5,096.0	1.34
7 A : B		1	7,994	7,994.0	2.10
C8 (HxH)(LxL)		9	15,128	1,680.9	2.26
C9 (HxL)(HxL)		24	173,940	7,247.5	1.91
10 C8 : C9		1	505	505.0	7.53
11 A+B : C		1	5,239	5,239.0	1.38
R X C	128		468,458	3,800.4	2.97**
Within plots	3,705		4,734,650	1,277.9	

a H equals heavy ear weight; L equals light ear weight.
** Exceeds the 1% point.

Table 21. Analysis of variance for ear length of inbreds, single crosses and double crosses.

Source	DF	SS	V	F
Inbreds				
Total	383	3,936		
Replications	2	33	16.5	1.90
Inbreds	7	1,539	219.9	25.27**
1 H : L[a]	1	694	694.0	79.77**
2 H	3	835	278.3	31.99**
3 L	3	10	3.3	2.64
R x C	14	122	8.7	1.40
Within plots	360	2,242	6.2	
Single Crosses				
Total	1,679	14,112		
Replications	2	86	43.0	4.73*
Crosses	27	4,990	184.8	20.31**
1 H x H	5	908	181.6	19.96**
2 L x L	5	323	64.6	7.10**
3 1 : 2	1	767	767.0	84.29**
4 H x L	15	2,991	199.4	21.91**
5 1+2 : 4	1	2	2.0	4.55*
R x C	54	491	9.1	1.72**
Within plots	1,596	8,545	5.3	
Double Crosses				
Total	3,899	24,800		
Replications	2	131	65.5	5.65**
Crosses	64	2,952	46.1	3.97**
A1 (HxH)(HxH)	0	0	0.0	0.00
A2 (LxL)(LxL)	0	0	0.0	0.00
3 A1 : A2	1	5	5.0	2.32
B4 (HxH)(HxL)	15	781	52.1	4.49**
B5 (HxL)(LxL)	14	621	44.3	3.82**
6 B4 : B5	1	1	1.0	11.60
7 A : B	1	35	35.0	3.02
C8 (HxH)(LxL)	7	319	45.6	3.93**
C9 (HxL)(HxL)	23	1,103	47.9	4.13**
10 C8 : C9	1	86	86.0	7.41**
11 A+B : C	1	0	0.0	0.00
R x C	128	1,488	11.6	2.11**
Within plots	3,705	20,229	5.5	

a H equals long ear length; L equals short ear length.
* Exceeds the 5% point.
** Exceeds the 1% point.

Table 22. Analysis of variance for ear diameter of inbreds, single crosses and double crosses.

Source	DF		SS	V	F
Inbreds					
Total	383		91.35		
Replications	2		1.38	0.690	6.90**
Inbreds	7		18.79	2.684	27.03**
1 H : L[a]		1	11.34	11.340	114.20**
2 H		3	6.90	2.300	23.16**
3 L		3	0.55	0.183	1.85
R x I	14		1.39	0.099	1.95
Within plots	360		69.79	0.194	
Single Crosses					
Total	1,679		129.53		
Replications	2		1.82	0.910	4.92*
Crosses	27		42.63	1.579	8.54**
1 H x H		5	6.75	1.350	7.31**
2 L x L		5	3.52	0.704	3.81**
3 1 : 2		1	16.43	16.430	88.91**
4 H x L		15	15.93	1.062	5.75**
5 1+2 : 4		1	0.00	0.000	0.00
R x C	54		9.98	0.185	3.92**
Within plots	1,596		75.10	0.047	
Double Crosses					
Total	3,899		394.77		
Replications	2		1.03	0.515	2.73
Crosses	64		29.49	0.461	2.44**
A1 (HxH)(HxH)		0	0.00	0.000	0.00
A2 (LxL)(LxL)		0	0.00	0.000	0.00
3 A1 : A2		1	3.94	3.940	20.87**
B4 (HxH)(HxL)		14	3.50	0.250	1.32
B5 (HxL)(LxL)		13	4.52	0.348	1.84
6 B4 : B5		1	5.80	5.800	30.72**
7 A : B		1	0.00	0.000	0.00
C8 (HxH)(LxL)		14	6.65	0.475	2.51**
C9 (HxL)(HxL)		18	4.53	0.252	1.33
10 C8 : C9		1	0.20	0.200	1.06
11 A+B : C		1	0.34	0.340	1.80
R x C	128		24.17	0.189	2.05**
Within plots	3,705		340.08	0.092	

a H equals large ear diameter; L equals small ear diameter.
* Exceeds the 5% point.
** Exceeds the 1% point.

Table 23. Analysis of variance for number of rows of inbreds, single crosses and double crosses.

Source	DF		SS	V	F
Inbreds					
Total	383		1,799		
Replications	2		10	5.0	3.57
Inbreds	7		734	104.9	74.92**
1 H : L[a]		1	441	441.0	315.00**
2 H		3	172	57.3	40.93**
3 L		3	120	40.0	28.57**
R x I	14		20	1.4	2.07
Within plots	360		1,035	2.9	
Single Crosses					
Total	1,679		6,629		
Replications	2		5	2.5	1.08
Crosses	27		2,630	97.4	36.07**
1 H x H		5	294	58.8	21.77**
2 L x L		5	266	53.2	19.70**
3 1 : 2		1	1,253	1,253;0	464.07**
4 H : L		15	816	54.4	20.15**
5 1+2 : 4		1	1	1.0	2.70
R x C	54		148	2.7	1.13
Within plots	1,596		3,846	2.4	
Double Crosses					
Total	3,899		15,036		
Replications	2		49	24.5	5.10*
Crosses	64		2,210	34.5	7.19*
A1 (HxH)(HxH)		0	0	0.0	0.00
A2 (LxL)(LxL)		0	0	0.0	0.00
3 A1 : A2		1	0	0.0	0.00
B4 (HxH)(HxL)		14	450	32.1	6.69**
B5 (HxL)(LxL)		15	255	17.0	3.53**
6 B4 : B5		1	495	495.0	103.13**
7 A : B		1	64	64.0	13.33**
C8 (HxH)(LxL)		8	156	19.5	4.06**
C9 (HxL)(HxL)		23	774	33.7	7.02**
10 C8 : C9		1	1	1.0	4.80
11 A+B : C		1	15	15.0	3.13
R x C	128		616	4.8	1.45**
Within plots	3,705		12,161	3.3	

a H equals many rows per ear; L equals few rows per ear.
* Exceeds the 5% point.
** Exceeds the 1% point.

Table 24. Analysis of variance for height of ear of inbreds, single crosses and double crosses.

Source	DF	SS	V	F
Inbreds				
Total	383	24,344		
Replications	2	185	92.5	1.01
Inbreds	7	17,175	2,453.5	26.27**
1 H : L[a]	1	13,631	13,631.0	145.94**
2 H	4	1,988	497.0	5.32**
3 L	2	1,556	778.0	8.33**
R x I	14	1,308	93.4	5.91**
Within plots	360	5,676	15.8	
Single Crosses				
Total	1,679	65,437		
Replications	2	5,595	2,797.5	45.79**
Crosses	27	29,569	1,095.1	17.92**
1 H x H	2	388	194.0	3.17*
2 L x L	9	6,214	690.4	11.30**
3 1 : 2	1	15,155	15,155.0	248.04**
4 H x L	14	4,562	325.9	5.33**
5 1+2 : 4	1	3,250	3,250.0	53.19**
R x C	54	3,297	61.1	3.61**
Within plots	1,596	26,976	16.9	
Double Crosses				
Total	3,899	122,516		
Replications	2	6,961	3,480.5	49.93**
Crosses	64	32,228	503.5	7.23**
A1 (HxH)(HxH)	0	0	0.0	0.00
A2 (LxL)(LxL)	4	1,153	288.3	4.14**
3 A1 : A2	0	0	0.0	0.00
B4 (HxH)(HxL)	3	465	155.0	2.22
B5 (HxL)(LxL)	29	9,771	336.9	4.83**
6 B4 : B5	1	8,785	8,785.0	126.04**
7 A : B	1	605	605.0	8.68**
C8 (HxH)(LxL)	8	3,406	425.7	6.11**
C9 (HxL)(HxL)	16	2,320	145.0	2.08*
10 C8 : C9	1	2	2.0	34.85
11 A+B : C	1	5,723	5,723.0	82.11**
R x C	128	8,918	69.7	3.49**
Within plots	3,705	74,409	20.0	

a H equals high height of ear; L equals low height of ear.
* Exceeds the 5% point.
** Exceeds the 1% point.

Table 25. Analysis of variance for plant height of inbreds, single crosses and double crosses.

Source	DF		SS	V	F
Inbreds					
Total	383		52,629		
Replications	2		248	124.0	1.08
Inbreds	7		40,029	5,718.4	42.71**
1 H : L[a]		1	34,353	34,353.0	256.56**
2 H		3	2,912	971.0	7.25**
3 L		3	2,763	921.0	6.88**
R x I	14		1,875	133.9	4.60**
Within plots	360		10,477	29.1	
Single Crosses					
Total	1,679		171,306		
Replications	2		894	446.9	5.33**
Crosses	27		130,131	4,819.6	57.44**
1 H x H		5	324	64.8	1.29
2 L x L		5	3,013	602.7	7.18**
3 1 : 2		1	113,151	113,151.0	1,348.64**
4 H x L		15	12,947	86.3	1.03
5 1+2 : 4		1	696	696.0	8.28**
R x C	54		4,529	83.9	3.74**
Within plots	1,596		35,753	22.4	
Double Crosses					
Total	3,899		225,239		
Replications	2		1,374	687.0	4.51*
Crosses	64		98,040	1,531.8	10.06**
A1 (HxH)(HxH)		0	0	0.0	0.00
A2 (LxL)(LxL)		0	0	0.0	0.00
3 A1 : A2		1	14,941	14,941.0	98.17**
B4 (HxH)(HxL)		12	5,351	445.9	2.93**
B5 (HxL)(LxL)		15	6,785	452.3	2.97**
6 B4 : B5		1	58,988	58,988.0	387.57**
7 A : B		1	40	40.0	3.81
C8 (HxH)(LxL)		12	2,796	233.0	1.53
C9 (HxL((HxL)		20	7,974	398.7	2.62**
10 C8 : C9		1	1,162	1,162.0	7.63**
11 A+B : C		1	3	3.0	50.73
R x C	128		19,477	152.2	5.30**
Within plots	3,705		106,348	28.7	

a H equals tall inbred type; L equals short inbred type.
* Exceeds the 5% point.
** Exceeds the 1% point.

Table 26. Frequency distribution, mean and variance of ear moisture for inbreds, single crosses and double crosses.

Code	% Moisture 25 28 31 34 37 40 43 46 49 52 55 58 61 / 27 30 33 36 39 42 45 48 51 54 57 60 64	Mean	V
Inbreds - Late			
A[a]	4 4 1 4 1 2		
"[b]	1 1 2 6 2 4		
"[c]	1 2 6 4 1 0 1 0 1	48.5	31.1
B	1 0 3 4 8		
"	1 2 4 3 6		
"	2 5 3 3 2 1	56.7	17.1
C	1 2 3 3 7		
"	1 5 2 6 2		
"	1 0 0 1 7 2 3 2	54.3	28.6
D	2 0 0 4 4 4 2		
"	2 8 3 1 2		
"	6 5 1 1 0 0 3	50.4	36.8
G	2 5 5 1 3		
"	1 0 5 6 4		
"	2 0 4 4 2 4	48.6	25.9
Group mean		51.7	27.8
Inbreds - Early			
E	2 5 6 1 1 1		
"	1 1 1 2 6 5		
"	2 2 4 3 3 2	44.9	18.5
F	1 5 5 1 2 1 1		
"	1 5 6 3 0 1		
"	3 4 5 3 1	40.9	17.3
H	1 0 2 6 5 1 1		
"	2 3 3 5 2 1		
"	1 0 0 2 5 6 2	41.1	18.8
Group mean		42.3	18.2
Single Crosses - Late x Late			
AB	1 3 6 5 3 1 1		
"	1 9 5 2 2 1		
"	1 1 4 11 2 1	49.2	13.7
AC	3 3 4 6 3 0 1		
"	1 7 8 4		
"	7 8 2 3	47.3	11.3

a Harvested during the week of September 19th.
b Harvested during the week of September 26th.
c Harvested during the week of October 3rd.

Table 26. Continued

Code	% Moisture													Mean	V
	25	28	31	34	37	40	43	46	49	52	55	58	61		
	27	30	33	36	39	42	45	48	51	54	57	60	64		
Single Crosses - Late x Late (Cont.)															
AD						3	5	7	5						
"						4	9	4	2	1					
"			1	1	1	13	3	1						44.0	9.5
AG					1	9	4	5	1						
"					5	7	8								
"			1	2	6	8	1	2						41.6	9.4
BC								2	6	7	1	3	1		
"							1	4	9	5	0	0	1		
"						1	4	6	6	2	0	1		50.5	14.6
BD							3	10	4	2	1				
"				1	0	3	8	5	3						
"				1	2	6	10	0	1					44.9	11.2
BG						2	11	5	2						
"						7	8	3	1	1					
"				1	5	8	5	1						43.3	7.9
CD							6	11	3						
"						2	15	2	1						
"				1	10	7	2							43.6	4.9
CG				1	1	0	10	5	3						
"						9	7	3	0	1					
"					11	6	2	1						42.8	7.7
DG					1	12	7								
"			1	1	7	9	2								
"			1	4	10	5								39.7	4.9
Group mean														44.7	9.5
Single Crosses - Early x Early															
EF					7	8	4	0	1						
"			2	2	14	2									
"			1	7	9	3								38.5	5.7
EH					2	9	9								
"					3	14	2	1							
"					9	8	3							41.1	3.7
FH					8	3	6	1	2						
"		2	6	6	5	1									
"	4	2	5	3	1	3	2							36.7	28.8
Group mean														38.8	12.7
Single Crosses - Late x Early															
AE						4	6	7	3						
"						4	10	4	2						
"					2	10	5	1	1	1				44.4	8.5
AF				2	4	6	6	1	0	1					
"					11	6	2	1							
"			5	12	2	1								38.7	8.7

Table 26. Continued

Code	% Moisture													Mean	V
	25	28	31	34	37	40	43	46	49	52	55	58	61		
	27	30	33	36	39	42	45	48	51	54	57	60	64		
						Single Crosses - Late x Early (Cont.)									
AH					5	9	5	0	0	1					
"					10	9	1								
"				6	11	2	1							39.7	7.1
BE						1	1	5	10	1	2				
"						1	7	7	3	0	2				
"					2	7	8	2	1					46.6	12.4
BF						12	5	2	0	0	1				
"				2	8	6	3	1							
"		1	4	4	9	2								39.6	10.3
BH						8	7	2	2	1					
"				5	12	3									
"					3	14	2	1						40.9	7.1
CE							3	7	6	3	1				
"						2	5	7	2	3	1				
"					2	7	10	1						46.3	9.6
CF					1	11	6	1	0	1					
"					5	7	6	2							
"			1	10	8	1								40.1	7.1
CH						8	10	2							
"					2	13	3	2							
"				4	13	3								40.7	3.4
DE						3	6	6	4	1					
"						9	10	1							
"					2	14	4							43.4	5.2
DF					4	8	5	1	2						
"			1	3	8	6	1	0	1						
"	1	1	6	7	4	1								38.8	12.6
DH					8	8	2	2							
"			4	1	12	3									
"	1	0	5	5	5	4								37.8	10.2
GE						1	7	9	3						
"					1	5	7	6	1						
"					5	7	6	1	1					44.1	10.3
GF						3	11	3	1	1	0	1			
"			2	1	9	6	2								
"	2	2	7	3	5	1								39.1	16.7
GH						4	8	6	0	2					
"					6	6	4	3	0	1					
"			2	2	4	8	4							42.5	13.2
Group mean														41.4	9.5

Table 26. Continued

Code	% Moisture													Mean	V
	25	28	31	34	37	40	43	46	49	52	55	58	61		
	27	30	33	36	39	42	45	48	51	54	57	60	64		
Double Crosses - (Late x Late)(Late x Late)															
ACBD					1	3	3	5	5	2	0	1			
"				1	4	8	2	4	1						
"				1	3	6	9	1						43.9	15.4
ACBG						1	10	4	3	1	1				
"				1	2	2	5	6	3	1					
"					1	5	10	3	1					44.9	12.7
AGCD				1	0	4	9	4	2						
"				1	5	4	5	2	3						
"			2	2	4	6	5	0	1					42.3	16.3
BGCD				1	1	3	3	5	3	1	2	1			
"					1	4	12	2	1						
"			1	0	1	4	7	6	1					44.6	18.4
Group mean														43.9	15.7
Double Crosses - (Late x Late)(Late x Early)															
AEBC						1	2	7	5	2	2	1			
"					1	3	4	6	5	1					
"			2	1	2	5	7	1	2					45.9	21.1
AEDE					1	1	3	3	6	4	0	1	1		
"					2	5	8	3	2						
"			1	1	3	7	8							44.6	17.2
BECD						1	3	4	5	7					
"					3	2	9	4	2						
"					2	8	8	1	1					45.1	9.8
ABCF					1	2	5	3	7	1	0	1			
"				2	1	9	3	3	2						
"			2	2	4	8	4							43.1	16.5
AFED					3	7	4	4	1	1					
"				3	10	4	3								
"			1	2	9	4	3	1						40.6	11.9
EDCF					1	7	7	3	2						
"		1	1	0	4	9	5								
"				2	4	13	1							41.4	9.8
AGEE				1	0	4	5	6	1	2	1				
"				2	2	8	4	2	2						
"					3	5	6	6						43.8	17.6
AFEG					2	5	7	3	1	1	1				
"	1	2	0		9	6	2								
"		2	4		3	3	6	1	1					40.9	26.5
AECG							1	2	8	4	3	2			
"					1	4	5	8	1	0	1				
"					1	0	7	6	6					47.8	12.1
AGCF			2	0	1	10	4	3							
"			4	2	7	3	3	1							
"			1	5	5	7	2							39.4	15.1

Table 26. Continued

Code	% Moisture													Mean	V
	25	28	31	34	37	40	43	46	49	52	55	58	61		
	27	30	33	36	39	42	45	48	51	54	57	60	64		
Double Crosses-- (Late x Late)(Late x Early) (Cont.)															
ADEG				1	5	5	6	3							
"					4	8	4	4							
"				3	5	9	3							41.4	10.2
BECG						3	4	6	5	1	1				
"					2	2	6	8	0	2					
"					1	8	5	2	4					45.2	15.3
BCFG						2	6	6	3	2	1				
"			2	0	1	13	1	1	2						
"			1	0	3	6	9	1						43.4	16.2
BEDG						2	8	7	2	1					
"				1	4	5	8	1	1						
"			1	0	4	9	5	1						43.1	9.5
BFDG		1	0	3	0	6	7	1	1	1					
"		2	3	1	6	5	3								
"			3	3	6	6	1	1						39.4	22.0
CDEG						4	9	5	2						
"			1	3	2	5	5	3	1						
"	1	0	0	3	4	5	6	0	1					42.2	16.6
CGDF					4	6	9	1							
"				1	5	10	3	1							
"		1	3	4	8	3	1							39.9	7.7
AHBC							7	2	3	3	3	2			
"						3	7	3	7						
"				1	1	7	5	3	1	1	1			46.7	21.8
AHBD					7	5	0	4	3	0	1				
"		1	3	5	6	2	2	1							
"				5	9	6								39.5	16.6
ABGH						1	9	6	3	1					
"			2	2	5	4	6	0	1						
"	1	0	1	1	4	11	2							41.7	12.4
AHCD				2	2	2	5	4	4	1					
"		1	1	1	5	4	5	2	1						
"				2	8	7	3							41.7	18.7
ACGH					3	5	7	5							
"				1	3	7	4	3	2						
"					5	5	9	1						42.6	11.0
AGDH			1	1	5	8	2	3							
"	1	1	3	8	5	2									
"		2	1	2	7	6	1	1						38.0	15.7
BHCD				1	3	0	9	6	1						
"				1	5	10	4								
"				3	6	9	2							42.3	9.8
BGCH						5	8	5	1	1					
"				2	4	7	5	2							
"					2	7	9	1	1					42.8	9.6

Table 26. Continued

Code	% Moisture													Mean	V
	25	28	31	34	37	40	43	46	49	52	55	58	61		
	27	30	33	36	39	42	45	48	51	54	57	60	64		
Double Crosses - (Late x Late)(Late x Early) (Cont.)															
BGDH				2	3	4	9	1	1						
"			2	2	9	7									
"				1	6	6	6	1						40.4	10.1
CDGH					1	4	10	3	2						
"		1	0	2	4	8	4	1							
"			2	2	2	9	4	1						41.5	12.9
Group mean														42.4	14.6
Double Crosses - (Late x Early)(Early x Early)															
BFCE						3	3	5	6	3					
"					3	7	8	0	1	1					
"			2	1	3	7	5	2						43.5	15.4
AEFH			2	0	4	6	8								
"			1	1	11	6	1								
"				1	7	7	2	3						40.2	9.7
BEFH						7	3	9	0	2					
"			1	3	2	7	5	2							
"		1	3	3	7	3	2	1						41.2	17.2
CEFH					3	3	9	3	2						
"			1	4	8	5	2								
"	2	1	4	3	7	3								39.1	14.5
DEFH				1	8	8	3								
"	1	3	5	4	7										
"	3	2	4	8	2	1								35.8	12.4
EFGH				1	5	10	2	2							
"	1	2	3	6	2	4	1	0	1						
"	1	1	2	3	7	5	1							37.9	21.6
Group mean														39.6	15.5
Double Crosses - (Late x Late)(Early x Early)															
ABEF						4	6	6	3	0	1				
"				1	6	5	5	2	1						
"		1	2	3	6	7	1							41.6	15.8
BDEF				3	10	5	2								
"		1	2	1	9	6	1								
"		1	0	2	8	9								38.5	9.0
AGEF				2	6	6	6								
"			2	2	9	5	1	1							
"	1	1	2	2	3	5	4	1	1					39.5	20.1
CGEF				2	1	4	10	3							
"					6	6	7	1							
"			1	3	6	7	2	1						41.2	9.1

Table 26. Continued

Code	% Moisture													Mean	V
	25	28	31	34	37	40	43	46	49	52	55	58	61		
	27	30	33	36	39	42	45	48	51	54	57	60	64		
Double Crosses - (Late x Late)(Early x Early) (Cont.)															
ABEH						5	9	5	1						
"				1	5	7	6	0	1						
"		1	1	2	7	5	3	0	1					41.7	13.5
ABFH			1	0	2	9	4	3	0	0	1				
"			2	4	6	8									
"	1	1	5	3	7	2	1							38.7	15.5
BCEH						2	5	7	5	0	1				
"			2	1	2	3	8	3	1						
"			1	2	2	7	6	2						43.2	15.5
BCFH					1	1	5	5	1	3	3	1			
"				1	5	9	3	2							
"	1	2	2	4	7	2	2							42.1	21.1
BDEH				2	5	5	7	1							
"		1	1	0	9	6	2	1							
"			1	3	4	7	4	1						40.1	12.3
CGEH					3	12	4	1							
"				3	5	7	4	0	1						
"			1	1	6	7	2	1	1	1				40.7	13.6
DGFH				1	8	4	5	1	1						
"			5	11	3	1									
"		1	5	6	3	3	2							37.6	12.1
Group mean														40.5	14.3
Double Crosses - (Late x Early)(Late x Early)															
AFCE						4	7	3	3	3					
"			1	0	8	7	4								
"	1	0	0	2	7	8	2							41.6	13.3
AEDF					5	4	10	0	1						
"				2	9	7	2								
"			2	2	7	5	3	1						40.2	9.7
CFDE						1	13	4	1	1					
"		1	3	4	6	3	2	0	1						
"			1	5	10	4								40.0	10.7
BEFG					1	2	10	3	4						
"		1	0	3	5	7	2	1							
"		1	1	3	5	7	2	1						41.4	16.6
DFEG			1	2	7	6	2	2							
"	1	2	4	4	3	5	0	1							
"		1	5	6	4	2	1	0	1					37.4	18.8
AECH						2	5	8	2	2	1				
"						7	6	4	2	1					
"					1	9	6	3	0	1				44.9	11.4
AHCF					7	9	3	1							
"	1	1	2	6	7	1	1	1							
"		3	6	5	5	1								37.1	11.2

Table 26. Continued

Code	% Moisture													Mean	V
	25	28	31	34	37	40	43	46	49	52	55	58	61		
	27	30	33	36	39	42	45	48	51	54	57	60	64		
Double Crosses - (Late x Early)(Late x Early) (Cont.)															
AHDF		1	1	2	9	4	2	1							
"		2	2	9	7										
"			6	5	6	3								36.8	10.1
AEGH				1	0	3	8	4	3	0	0	1			
"				2	1	12	4	1							
"					4	10	5	1						42.8	12.7
AHFG		1	1	2	6	8	1	1							
"	1	3	5	7	4										
"	1	2	1	10	4	2								35.8	14.4
BHDF				3	7	5	3	1	1						
"		2	4	4	7	2	1								
"		1	1	3	6	8	1							38.1	14.8
BEGH						4	8	5	2	1					
"				1	4	7	5	3							
"			2	3	6	6	3							41.9	9.9
BHFG				2	6	6	5	0	1						
"	1	0	3	6	8	1	1								
"	1	2	4	4	8	1								39.4	12.4
CEDH						1	7	8	3	0	1				
"			1	1	5	5	7	1							
"		1	0	2	9	5	2	1						42.1	11.1
CHDF				2	9	7	2								
"			1	6	7	3	1	2							
"		2	1	8	2	6	1							38.0	14.2
CFGH				2	6	6	4	1	1						
"		1	0	5	10	2	1	1							
"			2	3	8	6	1							39.0	12.9
DEGH					2	2	11	5							
"			2	6	8	4									
"	2	1	1	7	4	5								38.8	11.5
Group mean														39.7	12.7

Table 27. Frequency distribution, mean and variance of ear weight for inbreds, single crosses and double crosses.

Code	Weight in grams: 25–49	50–74	75–99	100–124	125–149	150–174	175–199	200–224	225–249	250–274	275–299	Mean	V
Inbreds - Heavy													
A	6	5	12	15	4	5	1					98.7	1,302
C	2	12	13	9	10	2						97.7	722
E		18	20	9	1							85.0	366
H	2	11	21	11	4							88.5	452
Group mean												92.5	710
Inbreds - Light													
B	14	20	8	5	1							71.0	393
D	13	11	15	9								76.3	548
F	12	21	8	7								66.1	600
G	21	17	8	1	1							59.9	517
Group mean												68.3	514
Single Crosses - Heavy x Heavy													
AC		2	0	6	10	11	9	13	3	4	2	179.2	2,394
AE		1	1	10	24	7	9	7	1			151.2	1,378
AH		1	1	7	8	20	11	10	2			166.4	1,308
CE		1	2	2	8	15	12	9	8	3		180.5	1,642
CH				3	5	8	18	19	7			191.1	1,029
Group mean												169.5	1,412
Single Crosses - Light x Light													
ED		1	5	3	7	9	17	14	3	1		171.3	1,460
EF		2	2	5	8	12	16	12	3			168.3	1,607
EG			1	7	7	10	18	12	5			175.2	1,499
DF		2	7	6	11	24	10					142.1	1,064
DG		1	1	4	14	15	23	2				162.4	919
FG	2	2	5	21	18	9	3					122.9	897
Group mean												157.0	1,241
Single Crosses - Heavy x Light													
AB	1	1	5	9	6	18	8	8	2	1	1	156.4	2,099
AD		1	3	9	8	11	12	15	1			163.1	1,467
AF			3	6	8	10	13	12	3			172.5	1,323
AG			3	7	12	10	14	10	3	1		167.2	1,753
CB	1	2	3	4	14	7	19	7	2	1		160.4	2,213
CD				5	9	8	10	17	8	3		188.4	1,214
CF				4	10	10	17	10	8	1		179.8	1,316
CG		2	2	4	7	7	11	13	7	6	1	186.1	2,437
EB			2	8	9	13	11	8	7	2		174.9	1,796
ED			8	5	13	12	18	3	1			152.8	1,286
EF		1	2	9	9	26	11	2				153.5	903
EG		1	0	4	15	12	15	12				167.2	1,037
HB		2	5	0	10	20	16	7				161.5	956
HD		1	3	15	7	21	13					147.1	1,142
HF		5	13	16	18	7	1					117.1	958
HG	2	4	9	13	16	13	1	2				125.0	1,272
Group mean												160.8	1,448

Table 27. Continued

Code	Weight in grams: 25–49	50–74	75–99	100–124	125–149	150–174	175–199	200–224	225–249	250–274	275–299	Mean	V
Double Crosses - (Heavy x Heavy)(Heavy x Heavy)													
AECH		2	6	10	13	10	12	5	2			148.3	1,750
Double Crosses - (Light x Light)(Light x Light)													
BFDG			3	8	15	15	16	2	1			155.1	1,060
Double Crosses - (Heavy x Heavy)(Heavy x Light)													
AEBC		2	4	9	11	13	6	7	4	4		161.0	1,757
AFCE			1	5	16	14	17	6	0	1		163.4	936
AECG		1	4	13	14	12	5	7	3	1		150.7	1,807
AHBC	2	2	8	8	8	18	6	4	3	1		146.4	2,477
ABEH		2	6	7	16	15	11	3				146.2	1,230
AHCD		1	5	7	9	15	13	7	2	1		160.7	1,779
AHCF			1	3	11	15	13	12	2			173.8	2,179
ACGH	1	0	2	4	14	15	10	9	3	2		168.8	1,736
AEFH	1	0	4	7	21	14	11	2				146.3	862
AEGH	1	1	1	12	10	16	15	4				152.5	1,347
BCEH		1	6	7	9	17	12	6	2			155.7	1,593
CEDH		2	2	9	10	11	15	8	2	0	1	162.0	1,732
CEFH		1	2	7	10	13	24	2	1			160.8	1,235
CGEH			1	7	10	13	13	7	7	1	1	173.3	2,152
Group mean												158.6	1,630
Double Crosses - (Heavy x Light)(Light x Light)													
AFBD			4	4	8	13	17	13	1			169.9	1,191
BDCF	1	0	0	3	12	14	20	7	3			172.2	1,028
BDEF			2	5	7	18	16	11	0	1		170.5	1,180
AFBG	1	0	5	5	9	19	14	6	1			158.0	1,465
BGCD		1	3	7	8	11	14	11	5			169.9	1,453
BCFG		2	8	9	10	14	10	7				148.0	1,879
BEDG				4	11	16	15	7	6	1		177.0	1,297
BEFG			2	4	12	21	16	5				161.4	945
CGDF			1	6	10	16	16	10	1			168.7	1,715
DFEG			1	5	17	16	15	5	1			160.4	888
HDF		1	2	9	12	11	18	7				157.9	905
BGDH			2	13	7	18	13	6	1			158.0	1,111
BHFG		1	1	3	18	20	13	3	1			158.4	882
DGFH		1	8	6	20	15	7	3				143.5	1,019
Group mean												162.4	1,211

Table 27. Continued

Code	Weight in grams 25–49	50–74	75–99	100–124	125–149	150–174	175–199	200–224	225–249	250–274	275–299	Mean	V
Double Crosses - (Heavy x Heavy)(Light x Light)													
ACHD	1	0	0	9	10	13	14	9	2	2		167.5	1,442
AEDF			4	4	14	19	11	5	1	2		158.8	1,023
BFCE			1	11	18	14	12	4				152.1	993
ACBG		2	1	3	11	18	11	11	3			166.2	1,572
AHBD		2	2	6	10	16	11	8	5			163.5	1,607
AHDF			2	3	13	13	24	4	1			165.8	911
AHFG			4	7	11	20	11	6	1			157.3	1,430
BGCH		1	3	6	9	19	10	9	2	1		163.9	1,629
BDEH		1	3	6	17	14	13	6				154.4	1,103
CHDF		1	2	5	11	14	17	9	1			164.1	1,533
Group mean												161.4	1,324
Double Crosses - (Heavy x Light)(Heavy x Light)													
ABDE		3	4	11	13	17	6	5	0	1		147.1	1,797
BECD		1	2	3	5	14	19	12	4			176.6	1,305
ABCF		3	5	6	15	11	9	9	2			153.9	1,723
ABEF	1	1	2	8	7	13	17	5	4	2		164.5	2,032
CFDE			1	7	7	10	16	14	5			177.2	1,364
AGBE		1	2	5	9	9	19	11	4			170.0	1,811
AGCD		2	4	7	8	12	19	5	2	0	1	163.6	2,021
AGCF		1	2	3	6	13	16	12	6	1		180.2	1,481
ADEG	1	0	1	4	11	19	19	4	1			162.8	1,028
AGEF			3	7	13	13	18	4	2			161.8	1,127
BECG		1	2	2	6	11	20	7	9	2		175.5	1,396
CDEG			1	1	7	14	21	11	5			179.8	1,137
CGEF			3	6	8	13	21	7	2			167.8	1,139
AEFH	1	2	3	7	18	10	15	3	1			150.3	1,567
ABGH		1	5	4	13	17	12	6	1	1		159.6	1,440
AGDH				14	6	18	15	5	2			158.4	1,189
BHCD	1	0	4	6	11	9	12	10	7			167.3	1,229
BCFH		2	8	10	8	16	8	6	2			146.7	1,829
BEFH		1	7	11	8	16	15	4				150.4	1,383
BEGH			6	9	9	15	9	8	4			161.2	1,637
CDGH			2	8	11	19	10	8	2			161.6	1,179
CFGH		2	2	2	10	20	17	6	1			164.2	1,193
DEFH		2	4	7	13	16	13	5				151.0	1,392
DEGH			2	6	15	11	18	8				164.5	953
EFGH		4	4	10	13	15	12	2				142.6	1,488
Group mean												162.3	1,433

Table 28. Frequency distribution, mean and variance of ear length for inbreds, single crosses and double crosses.

Code	Length in centimeters: 5 6	7 8	9 10	11 12	13 14	15 16	17 18	19 20	21 22	23 24	25 26	27 28	Mean	V
Inbreds - Long														
A		2	7	13	16	7	3						13.5	4.87
B				15	24	9							13.5	1.69
C				1	1	9	14	16	7				18.6	4.66
H			3	5	22	13	4	1					14.1	2.91
Group mean													14.9	3.53
Inbreds - Short														
D		1	4	21	19	3							12.7	2.31
E			3	32	13								12.3	1.45
F		4	15	10	12	6	1						11.8	5.85
G		4	12	14	13	3	2						12.3	5.29
Group mean													12.3	3.73
Single Crosses - Long x Long														
AB			1	3	10	13	17	14	2				16.9	11.00
AC				1	1	6	12	16	14	9	1		20.0	7.32
AH				2	6	29	21	2					18.4	2.43
BC			1	1	4	4	7	16	18	7	3		20.0	15.01
BH				1	5	0	15	35	4				18.8	3.52
CH						1	3	11	29	15	1		21.6	2.80
Group mean													19.3	6.25
Single Crosses - Short x Short														
DE				2	10	22	25	0	1				16.1	2.60
DF			1	2	5	10	31	9	2				17.1	5.19
DG				1	1	3	25	29	1				18.5	2.16
EF				1	6	11	33	8	1				17.1	3.29
EG				1	0	7	28	23	1				18.2	2.05
FG	1	0	1	4	10	18	17	9					16.0	6.17
Group mean													17.1	3.60
Single Crosses - Long x Short														
AD				3	6	14	21	15	1				17.1	4.59
AE			1	0	11	27	19	2					16.1	3.55
AF				4	5	7	29	13	2				17.4	5.40
AG					5	13	6	17	11				18.3	5.95
BD			1	1	6	7	17	28					17.8	4.65
BE				1	7	8	18	19	7				18.1	4.91
BF				3	5	8	18	22	4				17.8	5.87
BG				1	1	10	10	15	17				18.9	4.99
CD					2	4	9	10	31	4			20.3	4.13
CE			1	1	1	3	13	18	22	1			19.6	5.91
CF					2	3	4	16	20	14	1		21.0	5.33
CG					1	2	6	7	20	21	2	1	21.8	6.99
HD				1	5	12	29	13					17.4	3.64
HE				2	8	23	23	4					16.4	2.57
HF			2	8	13	18	14	5					15.5	6.07
HG		1	1	3	11	15	22	7					16.2	5.98
Group mean													18.1	5.03

Table 28. Continued

Code	Length in centimeters												Mean	V
	5 6	7 8	9 10	11 12	13 14	15 16	17 18	19 20	21 22	23 24	25 26	27 28		
	Double Crosses - (Long x Long)(Long x Long)													
AHBC			2	3	10	13	8	16	7	1			17.3	10.98
	Double Crosses - (Short x Short)(Short x Short)													
DFEG				1	4	13	27	13	2				17.7	3.94
	Double Crosses - (Long x Long)(Long x Short)													
ACHD					2	9	24	13	10	2			18.6	4.98
AEBC			1	3	6	9	23	12	4	2			17.5	6.05
ABCF				3	3	18	13	15	7	1			17.6	6.37
ACBG				2	3	10	15	14	14	2			18.5	8.28
AHBD				3	3	11	23	15	5				17.7	5.45
AHEH			2	2	13	15	21	7					16.1	5.13
AHFH		1	0	3	4	13	22	14	3				17.0	6.43
AHGH				2	5	11	22	20					17.7	4.16
AHCD				1	6	14	15	14	10				18.0	6.71
AHCH				4	8	14	18	11	3	2			17.0	7.24
AHCF						3	15	24	14	3	1		19.9	4.17
ACGH		1	0	0	3	8	19	13	10	6			18.9	8.62
BHCD			1	1	3	4	15	22	10	4			18.9	5.02
BCEH		1	0	2	7	14	17	17	1	1			17.9	6.63
BCFH				3	5	12	18	14	7	1			17.7	6.93
BGCH				1	2	11	14	15	12	4	1		19.0	7.27
Group mean													18.0	6.22
	Double Crosses - (Long x Short)(Short x Short)													
AEDF				1	8	22	16	9	4				16.9	4.32
BDEF					2	8	27	17	6				18.2	3.25
CFDE					2	3	18	23	11	3			19.3	3.36
ADEG					4	13	20	21	2				17.8	3.57
AGEF				1	4	18	17	17	3				17.6	3.97
BEDG					2	15	24	17	2				17.9	2.94
BFDG				2	6	8	23	17	4				17.5	5.15
BEFG				1	4	15	25	13	2				17.4	3.90
CDEG					1	4	13	26	15	1			19.5	3.41
CGDF					1	5	15	31	6	1	1		19.2	3.58
CGEF					1	5	19	23	12				19.0	3.49
DEFH				3	2	16	27	12					17.2	3.70
DEGH					3	15	25	15	2				17.7	3.34
DGFH				3	3	14	25	14	1				17.4	4.11
EFGH			1	4	8	9	23	12	3				17.0	6.89
Group mean													18.0	3.93

Table 28. Continued

Code	Length in centimeters												Mean	V
	5	7	9	11	13	15	17	19	21	23	25	27		
	6	8	10	12	14	16	18	20	22	24	26	28		
Double Crosses - (Long x Long)(Short x Short)														
ABDE	1	1	6	7	24	15	5	1					15.8	6.61
ABEF		2	1	9	10	24	12	2					17.0	6.22
BCFG		1	2	6	11	16	13	8	3				17.9	8.75
ABDF				3	12	34	9	2					17.6	2.38
ABFG			3	3	8	29	14	3					17.8	4.59
BBDF				5	9	26	19	1					17.8	3.04
BBFG			1	0	7	25	22	4	1				18.4	3.38
CBDF			2	2	11	11	24	10					18.6	5.45
Group mean													17.6	5.05
Double Crosses - (Long x Short)(Long x Short)														
BECD		1	0	3	9	12	20	13	2				18.9	6.47
AFBD			2	2	14	19	21	2					17.9	4.14
AFCE			1	5	11	25	13	4					17.7	4.00
BDCF			1	0	7	14	27	9	2				19.3	4.11
BFCE				5	15	20	17	2	1				17.6	4.49
AGBE			4	9	7	23	14	3					17.2	6.30
AFBG		1	1	4	9	26	14	5					17.8	6.42
AGCD			3	3	5	16	23	5	5				18.7	9.07
AECG			2	6	14	17	13	4	3	1			17.7	8.76
AGCF			1	2	4	9	22	19	3				19.7	4.98
BGCD			1	3	9	17	13	14	3				18.8	6.17
BECG		1	0	4	7	21	15	12					18.8	6.06
AGDH			3	2	9	25	18	3					17.8	4.24
AEFH		1	2	6	25	16	8	2					16.3	4.40
AEGH	1	0	1	7	11	23	14	4					17.4	6.81
BDEH			2	4	10	24	17	3					17.7	3.96
BGDH			1	4	12	21	18	3	1				17.9	4.39
BEFH		1	7	4	18	20	10						16.5	5.99
BEGH			1	9	15	13	19	3					17.4	5.68
CEDH			2	5	12	15	19	5	2				18.0	6.58
CDGH			1	1	13	12	27	6					18.5	4.46
CEFH	1	0	0	3	8	16	24	8					18.5	5.18
CGEH				3	2	18	18	15	4				19.4	5.33
CFGH		1	0	3	6	11	18	18	3				19.3	7.53
Group mean													18.1	5.84

Table 29. Frequency distribution, mean and variance of ear diameter for inbreds, single crosses and double crosses.

Code	Diameter in centimeters										Mean	V
	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00		
Inbreds - Large												
A		2	4	10	7	15	6	4			3.85	0.143
B		1	4	22	12	9					3.63	0.048
E				2	6	22	7	11			4.13	0.076
H			2	22	13	11					3.65	0.048
Group mean											3.81	0.079
Inbreds - Small												
C	1	6	4	21	14	2					3.51	0.074
D		2	13	13	19	1					3.53	0.079
F		4	15	21	6	1	1				3.44	0.075
G		5	15	23	5						3.40	0.041
Group mean											3.47	0.067
Single Crosses - Large x Large												
AB			1	2	2	11	17	21	5	1	4.29	0.096
AE						13	16	23	8		4.36	0.061
AH				2	5	22	15	16			4.16	0.073
BE						1	11	37	9	2	4.50	0.034
BH				2	6	25	14	13			4.12	0.100
EH						8	13	34	4	1	4.40	0.035
Group mean											4.30	0.066
Single Crosses - Small x Small												
CD					3	28	18	11			4.15	0.042
CF				4	6	31	19				4.02	0.040
CG			2	4	5	39	8	1	1		3.97	0.057
DF				3	12	36	6	3			3.97	0.044
DG				4	7	38	5	6			4.02	0.048
FG			1	9	24	25	1				3.82	0.036
Group mean											3.99	0.044
Single Crosses - Large x Small												
AC			1	1	3	21	18	14	2		4.18	0.079
AD				2	6	14	14	22	2		4.23	0.085
AF				2	3	16	15	23	1		4.24	0.076
AG				1	5	22	18	14			4.16	0.063
BC			2	2	10	31	13	2			3.99	0.057
BD				1	3	15	21	20			4.23	0.050
BF				1	4	24	15	16			4.17	0.116
BG				1	3	31	16	9			4.12	0.044
EC				1	2	9	8	31	8	1	4.39	0.057
ED					4	15	24	16	1		4.23	0.061
EF					6	15	28	11			4.18	0.050
EG					1	8	35	14	2		4.29	0.031
HC					3	33	15	9			4.13	0.037
HD			1	3	12	37	6	1			3.95	0.044
HF			1	10	12	26	5	6			3.93	0.082
HG		1	0	6	11	32	6	3	1		3.95	0.077
Group mean											4.15	0.063

Table 29. Continued

Code	Diameter in centimeters 3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00	5.25	Mean	V
Double Crosses - (Large x Large)(Large x Large)												
ABEH			1	1	14	13	22	9			4.34	0.084
Double Crosses - (Small x Small)(Small x Small)												
CGDF			2	19	26	10	2	1			3.97	0.056
Double Crosses - (Large x Large)(Large x Small)												
AEBC			1	2	13	13	24	2	5		4.34	0.098
ABDE			2	2	25	11	16	2	2		4.22	0.092
ABEF			1	5	10	17	20	4	2	1	4.31	0.111
AGBE			2	3	11	21	18	3	2		4.27	0.096
AHBC			5	7	19	10	14	4	1		4.15	0.120
AHBD			4	3	21	15	13	4			4.17	0.095
ABFH	1	0	2	6	24	13	13	1			4.12	0.064
ABGH		1	2	7	17	17	12	3	1		4.17	0.110
AECH		1	4	6	14	14	19	2			4.17	0.120
AEFH		1	2	3	20	19	13	2			4.17	0.084
AEGH			3	6	19	7	21	3	1		4.21	0.110
BCEH			2	7	13	14	21	3			4.23	0.099
BDEH			5	5	18	17	12	2	1		4.15	0.081
BEFH			2	4	14	14	22	2	2		4.27	0.100
BEGH				7	9	19	19	4	2		4.30	0.095
Group mean											4.22	0.098
Double Crosses - (Large x Small)(Small x Small)												
BDCF			2	12	26	13	5	2			4.05	0.067
CFDE				6	21	15	17	1			4.19	0.067
AGCD	1	0	4	5	20	15	14	1			4.12	0.110
AGCF			4	9	21	11	10	4	1		4.13	0.120
BGCD			4	11	25	8	12				4.06	0.075
BCFG		1	4	12	21	10	10	2			4.05	0.096
BFDG			6	7	18	15	14				4.10	0.089
CDEG			1	8	21	11	16	1	2		4.18	0.100
CGEF			3	6	15	15	18	3			4.20	0.097
DFEG		1	1	6	24	16	12				4.12	0.075
CHDF			1	8	23	18	10				4.12	0.062
CDGH	1	0	2	5	23	15	14				4.13	0.092
CFGH		1	3	21	23	7	5				3.95	0.068
DGFH			8	16	20	8	8				3.97	0.081
Group mean											4.10	0.086

Table 29. Continued

Code	Diameter in centimeters										Mean	V
	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00	5.25		
Double Crosses - (Large x Large)(Small x Small)												
BECD			1	0	16	20	20	3			4.28	0.054
ABCF			6	7	25	17	4	1			4.04	0.076
AEDF				6	22	17	15				4.16	0.050
AECG			2	7	22	13	16				4.14	0.073
BECG			1	2	15	10	30	2			4.26	0.051
BEDG				3	17	13	22	3	2		4.30	0.085
BEFG			1	6	15	17	17	4			4.23	0.120
AHCD			6	8	17	19	7	3			4.10	0.100
AHCF			2	7	24	14	11	1	0	1	4.14	0.084
AHDF				11	20	16	12	1			4.13	0.071
AHFG			5	10	24	11	9	1			4.05	0.091
BHCD		1	2	11	18	17	9	2			4.10	0.081
BHDF			3	11	23	11	12				4.07	0.076
BHFG			1	9	32	10	8				4.06	0.084
CGBH			4	6	19	15	12	2	1		4.14	0.100
Group mean											4.15	0.080
Double Crosses - (Large x Small)(Large x Small)												
ACBD	1	0	4	4	17	12	19	3			4.18	0.116
AFBD			3	6	24	10	15	1	1		4.15	0.099
AFCE				5	21	19	14	1			4.19	0.057
BFCE				4	27	15	11	3			4.17	0.056
BDEF			1	4	25	14	15	0	1		4.17	0.067
ACBG			1	3	21	18	15	2			4.21	0.067
AFBG			6	6	21	14	10	3			4.10	0.110
ADEG				7	18	15	17	2	1		4.22	0.085
AGEF		1	3	2	21	14	15	4			4.19	0.100
ACGH			5	10	14	17	13	1			4.11	0.100
AGDH			3	12	25	10	8	2			4.06	0.083
BCFH			11	10	15	11	11	2			4.03	0.124
BGCH			2	9	24	14	11				4.10	0.067
BGDH			5	9	20	11	15				4.09	0.094
CEDH		1	0	9	15	19	16				4.16	0.074
CEFH			5	10	19	16	9	0	1		4.07	0.096
DEFH			8	10	22	13	6	1			4.00	0.093
DEGH			3	4	17	17	16	3			4.20	0.075
EFGH			4	9	24	17	6				4.05	0.066
Group mean											4.13	0.086

Table 30. Frequency distribution, mean and variance of number of rows for inbreds, single crosses and double crosses.

Code	Number of rows per ear: 8	10	12	14	16	18	20	22	24	Mean	V
Inbreds - Many Rows											
A				9	22	13	5			16.7	2.91
D			7	28	13					14.2	1.69
E			5	30	13					14.4	1.38
H			7	27	12	2				14.3	2.22
Group mean										14.9	2.05
Inbreds - Few Rows											
B			12	34	2					13.7	1.07
C		5	32	11						12.3	1.22
F		14	29	4	1					11.7	1.80
G		1	19	22	6					13.5	2.07
Group mean										12.8	1.54
Single Crosses - Many x Many											
AD				13	25	21	1			16.3	2.45
AE				3	31	18	8			17.0	2.59
AH			1	8	13	27	8	1		17.3	4.05
DE			2	20	29	9				15.5	2.24
DH			10	25	22	3				14.6	2.60
EH				11	34	12	3			16.2	2.40
Group mean										16.1	2.72
Single Crosses - Few x Few											
BC				32	28					12.9	1.02
BF				12	30	15	3			14.3	2.63
BG				3	27	25	5			15.0	2.17
CF			2	37	19	2				12.7	1.44
CG				28	30	2				13.1	1.33
FG				32	26	2				13.0	1.33
Group mean										13.5	1.65
Single Crosses - Many x Few											
AB				9	29	21	1			16.5	2.02
AC			11	27	14	8				14.6	3.30
AF			4	13	25	14	4			16.0	4.14
AG			3	14	28	13	2			15.9	3.23
DB			4	39	15	2				14.5	1.49
DC			15	35	9	1				13.9	1.19
DF		1	22	36	1					13.2	1.17
DG			6	31	22	1				14.6	1.79
EB			12	16	33	9	1			15.8	2.54
EC			13	38	8	1				13.9	1.61
EF			9	33	16	2				14.4	1.98
EG			1	10	40	7	2			15.9	1.96
HB			3	19	34	3	1			15.3	2.17
HC			16	30	14					13.9	2.05
HF			24	21	13	2				13.8	3.11
HG		1	11	19	26	3				14.6	3.03
Group mean										14.8	2.30

Table 30. Continued

Code	Number of rows per ear. 8	10	12	14	16	18	20	22	24	Mean	V
				Double Crosses - (Few x Few)(Few x Few)							
BCFG			18	28	12	2				13.9	2.49
				Double Crosses - (Many x Many)(Many x Few)							
ABDE				10	25	21	4			16.7	2.75
AEDF			9	19	24	6	0	2		15.0	3.82
ADEG			7	14	19	17	2	1		15.9	5.05
AHBD			1	13	30	12	4			16.2	3.05
ABEH			3	5	32	10	9	1		16.7	4.32
AHCD		1	6	17	24	11	1			15.4	4.03
AECH			10	18	21	11				15.1	3.23
AHDF			8	27	14	10	1			15.0	3.65
AGDH			3	17	26	10	3	1		15.9	4.11
AEFH			12	17	21	8	2			15.0	3.40
AEGH			5	16	19	15	4	1		16.0	5.12
BDEH			3	13	30	10	4			16.0	3.49
CEDH			14	25	14	6	1			14.5	3.96
DEFH		1	18	19	20	2				14.1	3.39
DEGH			10	12	27	9	2			15.4	4.07
Group mean										15.0	3.83
				Double Crosses - (Many x Few)(Few x Few)							
ABCF			9	27	17	7				14.7	3.23
BDCF			11	36	11	2				14.1	2.00
BFCE			11	35	13	1				14.1	1.74
ACBG			1	27	23	8	1			15.4	2.58
AFBG			7	19	21	12	1			15.4	3.44
AGCF			8	24	20	7	1			15.0	3.58
BGCD			14	27	17	2				14.2	2.63
BECG			10	20	23	7				14.7	3.00
BFDG		1	10	28	16	5				14.5	3.26
BEFG			10	22	23	5				14.8	3.03
CGDF			17	34	9					13.7	1.61
CGEF			11	31	16	2				14.3	2.37
BCFH		1	14	25	15	5				14.3	3.42
BGCH			9	33	15	3				14.4	2.30
BHFG			9	27	21	3				14.6	2.54
CFGH		1	23	30	5	1				13.4	2.14
Group mean										14.5	2.68

Table 30. Continued

Code	Number of rows per ear: 8	10	12	14	16	18	20	22	24	Mean	V
				Double Crosses - (Many x Many)(Few x Few)							
AEBC				17	24	14	4	1		16.3	3.70
CFDE			15	25	16	4				14.3	3.21
AECG			10	27	17	5	1			14.6	2.98
AHBC			4	24	19	11	2			15.4	3.70
AHCF			10	17	24	9				15.1	3.54
AHFG			11	22	17	9	0	1		14.9	4.61
BCEH			4	21	23	12				15.4	3.09
BGDH			6	30	21	3				14.7	2.12
CGEH			6	21	28	3	2			15.1	3.07
Group mean										15.1	3.33
				Double Crosses - (Many x Few)(Many x Few)							
ACBD			4	17	32	7				15.4	2.39
BECD			8	26	25	1				14.6	2.11
AFBD			3	11	29	13	3	1		16.2	3.95
ABEF			1	12	31	13	2	0	1	16.2	3.49
AFCE			10	24	23	3				14.6	2.47
BDEF			6	21	30	3				15.0	2.26
AGBE				10	24	24	2			16.6	2.51
AGCD			8	22	23	6	1			15.0	3.35
AGEF			9	17	21	9	4			15.4	5.02
BEDG			7	21	22	8	2			15.2	3.84
CDEG			11	22	23	3	1			14.7	5.12
DFEG			6	23	26	5				15.0	2.59
ABFH			5	18	26	8	3			15.5	3.79
ABGH			5	11	15	23	4	2		16.5	5.70
ACGH			5	16	27	10	2			15.6	3.28
BHCD			7	23	28	2				14.8	2.05
BHDF			10	28	20	1	1			14.5	2.51
BEFH			14	20	20	4	2			14.7	4.31
BEGH			3	22	26	9				15.3	2.56
CHDF		2	14	28	14	2				14.0	2.95
CDGH	2	1	11	27	18	1				14.0	3.82
CEFH		1	15	28	11	5				14.1	3.19
DGFH			12	29	17	2				14.3	2.40
EFGH		1	11	27	15	6				14.5	3.42
Group mean										15.1	3.29

Table 31. Frequency distribution, mean and variance of height of ear for inbreds, single crosses and double crosses.

Code	Height of ear in inches												Mean	V
	0 4	5 8	9 12	13 16	17 20	21 24	25 28	29 32	33 36	37 40	41 44	45 48		
Inbreds - High														
A					3	9	12	12	9	3			28.9	16.5
B					2	13	25	8					26.1	7.7
D				5	15	24	3	1					21.1	11.5
Group mean													25.4	11.9
Inbreds - Low														
C			8	22	15	3							15.7	9.9
E		11	25	11	1								10.6	7.1
F		8	16	10	10	3	1						13.4	18.6
G	5	21	15	5	2								8.6	10.5
H	1	0	12	14	15	6							15.1	10.2
Group mean													12.7	11.3
Single Crosses - High x High														
AB						3	13	15	18	11			32.1	17.0
AD						1	7	13	20	10	7	2	34.5	17.6
BD						2	4	17	18	11	6	2	34.6	25.1
Group mean													33.8	19.9
Single Crosses - Low x Low														
CE				3	10	22	12	11	2				24.4	25.6
CF					3	16	19	14	6	2			27.1	13.7
CG					6	18	18	16	2				25.9	8.0
CH					5	24	17	11	2	1			25.3	13.6
EF					2	14	21	22	1				26.2	10.1
EG				1	15	24	13	7					23.2	12.6
EH			2	6	23	12	8	9					21.7	10.4
FG	1	1	6	14	14	18	6						18.2	22.6
FH			4	8	21	18	7	2					20.1	20.8
GH		3	5	15	20	11	5	1					18.1	27.3
Group mean													23.1	16.5
Single Crosses - High x Low														
AC				1	11	18	16	10	4				25.1	14.8
AE					3	14	22	18	2	1			26.8	9.5
AF				1	1	3	12	24	12	5	2		30.9	27.3
AG					9	14	23	11	2	0	1		25.8	16.8
AH					4	19	24	11	1	1			26.0	11.6
BC					1	17	27	13	2				26.4	12.2
BE					1	12	15	21	7	3	1		28.9	17.4
BF					1	5	14	21	13	6			30.6	20.1
BG					3	9	21	14	8	5			28.5	13.4
BH					2	8	24	15	9	2			28.6	14.5
DC							6	24	20	7	3		33.1	13.1
DE					6	22	19	7	5	1			25.5	16.3
DF					1	7	24	15	9	4			28.9	29.9
DG					1	7	14	19	14	4	1		30.0	11.8
DH						7	20	17	13	3			29.6	12.3
Group mean													28.3	15.1

Table 31. Continued

Code	Height of ear in inches												Mean	V
	0 4	5 8	9 12	13 16	17 20	21 24	25 28	29 32	33 36	37 40	41 44	45 48		
Double Crosses - (Low x Low)(Low x Low)														
CGEF					1	6	19	22	10	2			29.1	15.9
CEFH					6	20	24	8	2				25.3	13.1
CGEH				1	6	14	22	9	7	1			26.5	17.9
CFGH				5	12	19	17	7					23.3	14.7
EFGH				1	7	25	14	10	3				24.7	18.3
Group mean													25.8	16.0
Double Crosses - (High x High)(High x Low)														
ACHD						3	8	22	14	12	1		32.4	13.2
AEDE						3	13	20	13	11			31.6	20.3
AFHD							4	11	23	15	6	1	35.3	23.0
AHBD					1	4	4	22	15	10	4		32.5	25.7
Group mean													32.9	20.5
Double Crosses - (High x Low)(Low x Low)														
AFCE				1	4	13	21	14	5	2			26.8	21.8
BFCE				2	3	19	19	10	4	3			26.4	25.1
CFDE					4	8	18	16	9	5			28.9	23.9
AECG				11	13	15	12	5	2	1	1		22.7	27.7
AGCF					4	12	24	13	3	1	3		27.9	28.1
AGEF					2	7	29	13	7	2			28.1	14.5
BECG				1	4	10	12	22	8	2	1		28.0	18.8
BCFG				1	8	18	20	9	3	1			25.3	20.4
BEFG				1	1	16	10	19	7	6			28.6	29.6
CDEG					3	15	16	16	8	2			27.9	18.3
CGDF				1	3	18	15	13	5	4	1		27.7	25.1
DFEG						5	10	21	16	7	1		31.6	21.3
AECH			1	8	11	24	10	5	1				22.2	16.7
AHCF					1	7	22	18	10	2			29.0	16.9
ACGH				4	14	15	13	11	2	1			24.4	15.3
AEFH			2	5	14	15	18	3	3				22.7	12.3
AEGH				1	16	26	14	3					22.4	9.6
AHFG					6	5	18	23	4	4			28.2	25.3
BCEH					3	21	25	9	1	1			25.7	12.1
BCFH					10	13	24	9	4				25.5	21.4
BGCH				1	6	8	18	15	9	3			28.1	24.2
BEFH				2	9	18	22	7	2				24.8	19.0
BEGH				4	12	20	13	5	3	3			24.3	27.4
BHFG					4	8	22	14	9	3			28.2	21.9
CEDH			1	4	9	15	19	8	3	1			24.4	19.7
CHDF					2	8	21	18	9	2			28.5	18.2
CDGH				2	6	20	18	11	2	1			25.4	19.9
DEFH				1	4	8	11	17	13	6			29.5	32.3
DEGH					9	8	20	15	3	5			27.3	29.1
DGFH					5	16	22	12	5				26.0	16.2
Group mean													26.5	21.1

Table 31. Continued

Code	Height of ear in inches												Mean	V
	0-4	5-8	9-12	13-16	17-20	21-24	25-28	29-32	33-36	37-40	41-44	45-48		
Double Crosses - (High x High)(Low x Low)														
ABCF					2	10	23	16	7	2			28.3	19.2
ABEF				1	2	5	12	22	10	7	1		30.2	24.4
BDCF						1	13	19	16	9	1	1	32.6	19.0
BDEF						2	8	15	20	10	5		33.5	17.8
ADEG					4	12	14	14	14	1	1		28.7	15.8
ABEH					3	14	20	15	4	4			27.8	17.0
ABFH					6	18	17	14	4	1			26.3	19.2
ABGH					6	11	25	13	5				26.8	12.9
BDEH						3	12	17	15	10	2	1	32.3	20.9
Group mean													29.6	18.5
Double Crosses - (High x Low)(High x Low)														
AEBC					1	8	13	15	13	8	2		30.8	29.1
BECD						6	12	18	13	8	2	1	31.7	27.9
AEDF				1	2	5	12	22	10	7	1		26.7	24.1
ACBG					3	18	14	12	11	2			27.8	15.1
AGBE				1	0	13	12	11	16	7			29.6	30.0
AFBG						4	20	20	12	4			30.2	15.6
AGCD					1	8	15	22	10	3	1		29.6	19.7
BGCD				1	0	4	8	23	15	6	3		31.6	18.8
BEDG				1	1	10	18	17	6	5	2		29.1	27.7
BFDG					3	11	20	14	11	1			27.9	15.7
AHBC						12	26	8	11	3			28.4	17.3
AHCD					2	10	16	17	9	4	2		29.2	26.6
AHDF						2	14	17	15	7	5		23.6	23.0
AGDH					2	9	12	25	6	5	1		29.7	25.0
BHCD					1	10	14	22	8	2	2	1	29.6	24.4
BHDF					5	5	14	16	16	3	1		29.7	25.5
BGDH				1	1	15	18	9	14	1	1		28.2	27.9
Group mean													29.0	23.1

Table 32. Frequency distribution, mean and variance of plant height for inbreds, single crosses and double crosses.

Code	Plant height in inches (40–44, 45–49, 50–54, 55–59, 60–64, 65–69, 70–74, 75–79, 80–84, 85–89, 90–94, 95–99, 100–104)	Mean	V
Inbreds - Tall			
A	2 6 7 15 13 2 3	77.2	43.3
B	1 10 16 15 5 1	69.3	24.3
C	6 12 15 9 3 3	67.0	31.5
D	2 13 16 13 4	68.1	24.3
Group mean		70.4	30.9
Inbreds - Short			
E	11 19 15 3	48.4	13.4
F	8 9 17 7 6 1	56.0	40.4
G	15 20 10 3	47.4	23.8
H	2 9 18 12 6 0 1	52.7	31.9
Group mean		51.1	27.4
Single Crosses - Tall x Tall			
AB	2 1 9 11 20 13 4	90.6	42.7
AC	13 14 16 13 4	90.1	32.7
AD	6 13 21 16 4	91.9	24.9
BC	2 4 19 25 9 1	90.2	24.9
BD	2 4 6 26 19 3	92.4	34.8
CD	1 7 8 24 16 4	92.0	29.7
Group mean		91.2	31.6
Single Crosses - Short x Short			
EF	6 16 23 13 2	71.1	22.5
EG	2 2 10 22 24	66.7	19.8
EH	1 3 17 20 16 3	61.7	17.5
FG	3 6 19 21 11	64.8	20.9
FH	1 4 12 21 20 1 1	67.1	26.8
GH	3 2 25 17 12 1	64.9	17.8
Group mean		66.0	20.9
Single Crosses - Tall x Short			
AE	1 1 2 15 23 14 4	76.8	32.3
AF	1 1 0 3 9 25 18 3	87.4	36.6
AG	1 6 26 19 7 0 1	79.2	17.8
AH	2 14 20 16 7 1	78.3	21.3
BE	10 13 28 6 2 0 1	80.3	30.9
BF	3 18 21 15 3	86.5	16.6
BG	2 12 30 16	81.8	15.6
BH	1 1 9 16 25 6 2	79.6	21.6
CE	5 9 34 11 1	76.4	13.2
CF	2 1 1 2 21 19 10 4	85.1	45.6
CG	1 0 2 7 20 25 6	78.9	28.8
CH	2 10 17 21 10	79.1	28.6
DE	1 0 11 27 15 6	73.2	20.8
DF	7 12 28 12 1	81.2	15.3
DG	5 10 22 21 2	77.8	20.5
DH	1 6 11 21 13 7 1	77.5	32.0
Group mean		79.9	24.8

Table 32. Continued

Code	Plant height in inches: 45–49	50–54	55–59	60–64	65–69	70–74	75–79	80–84	85–89	90–94	95–99	100–104	Mean	V
Double Crosses - (Tall x Tall)(Tall x Tall)														
ACBD						2	4	10	17	18	9		92.7	36.3
Double Crosses - (Short x Short)(Short x Short)														
EFGH			1	11	12	17	16	3					70.3	32.5
Double Crosses - (Tall x Tall)(Tall x Short)														
AEBC						4	8	13	16	11	8		85.9	41.1
AEDE				1	1	3	9	15	13	14	4		84.1	42.8
BECD							8	10	14	13	11	4	88.5	55.0
ABCF				1	0	0	5	9	17	13	12	3	88.9	41.7
AFBD							4	3	13	22	13	5	91.4	40.6
BDCF						1	0	9	8	19	16	7	92.1	38.3
ACBG						2	7	11	11	22	6	1	87.6	46.3
AGCD					1	6	6	20	15	6	4	2	83.9	59.2
BGCD						2	3	8	11	18	12	6	90.4	47.9
AHBC						3	14	14	13	9	6	1	84.8	48.1
AHBD				2	0	5	8	17	11	6	8	3	84.9	81.8
AHCD					1	1	6	13	14	6	2		87.1	48.5
BHCD					1	5	6	14	14	10	7	3	85.7	54.0
Group mean													87.3	49.6
Double Crosses - (Tall x Short)(Short x Short)														
AGEF				1	4	10	19	17	8	1			78.3	30.4
BEFG				2	7	11	12	15	8	3	2		78.5	59.8
CGEF					2	14	13	16	11	3	1		80.0	41.8
DFEG			1	0	3	12	21	14	6	2	1		78.2	48.9
AEFH				10	13	16	13	6	2				71.6	36.4
AEGH			2	6	12	20	14	5	1				71.9	37.8
AHFG					2	14	14	18	10	2			79.0	33.9
BEFH			1	6	7	16	12	14	3	1			74.4	51.9
BEGH			1	8	14	13	10	7	6	1			73.3	73.1
BHFG				1	5	15	16	14	4	4	1		77,8	38.9
CEFH			1	5	4	12	16	12	6	4			76.6	63.2
CGEH			2	4	7	17	18	11	0	0	1		74.0	52.7
CFGH			3	4	7	17	18	9	2				73.4	44.9
DEFH			2	6	5	8	13	17	8	0	1		76.4	77.3
DEGH				8	13	13	14	9	3				72.7	50.5
DGFH			1	2	9	21	11	13	3				74.5	43.3
Group mean													75.7	49.1

Table 32. Continued

Code	Plant height in inches												Mean	V
	45	50	55	60	65	70	75	80	85	90	95	100		
	49	54	59	64	69	74	79	84	89	94	99	104		
Double Crosses - (Tall x Tall)(Short x Short)														
ADEF						7	14	16	11	10	2		82.3	32.7
BDEF						6	12	14	11	13	4		83.8	46.3
ADEG				2	4	12	17	10	7	9	2		78.4	48.3
BCFG				1	1	6	18	16	7	9	2		81.6	49.4
CDEG					3	12	11	14	13	7			80.6	47.2
ABEH				1	4	14	15	10	11	4	1		79.1	49.9
ABFH					3	14	6	22	10	5			80.2	40.0
ABGH					6	14	17	13	8	1	1		77.7	42.2
ACGH				2	0	14	16	20	8				78.4	39.3
BCEH				2	4	12	15	17	9	1			78.0	37.3
BCFH				1	2	10	12	18	5	9	3		80.8	63.3
BDEH					3	5	12	22	12	2	4		81.7	45.0
CDGH				1	5	12	15	16	7	4			77.9	48.1
Group mean													80.0	45.3
Double Crosses - (Tall x Short)(Tall x Short)														
AFCE					2	7	7	23	10	9	0	2	82.9	55.0
AEDF				1	6	10	9	19	12	3			78.9	37.4
BFCE					3	2	17	18	10	9	1		81.9	44.4
CFDE				1	0	5	15	16	13	7	3		82.4	46.6
AGBE					1	6	11	20	10	6	6		82.6	57.8
AFBG					1	2	12	16	19	4	5	1	84.5	42.9
AECG				2	10	13	10	13	8	4			77.1	46.3
AGCF				2	2	10	11	17	13	2	1	2	80.6	63.8
BECG						8	15	15	12	8	2		81.8	52.8
BEDG			1	1	1	7	8	21	10	7	4		82.1	88.3
BFDG				1	3	5	13	15	14	8	1		81.8	37.9
CGDF					3	10	12	11	13	6	3	1	81.2	51.2
AECH			1	0	5	16	18	15	3	2			76.7	31.8
AHCF					5	4	12	14	7	12	2	4	83.5	76.3
AHDF						1	2	16	14	20	5	2	87.8	30.9
AGDH				m	2	9	11	23	9	2	2	2	81.5	49.3
BGCH					4	7	8	15	11	9	4	2	83.2	75.4
BHDF					3	4	8	17	12	10	5	1	84.2	61.9
BGDH					3	13	12	19	7	5	1		79.2	48.6
CEDH			1	4	4	9	12	15	7	5	3		78.8	59.4
CHDF					2	11	10	21	13	1	2		80.5	39.6
Group mean													81.6	51.2

Table 33. Actual means of double crosses and predicted means from single cross values for the character ear moisture.

Double Cross	Actual Mean	Predicted Mean	Double Cross	Actual Mean	Predicted Mean
ACBD	43.9	46.8	ABEH	41.7	42.9
AEBC	45.8	47.3	ABFH	38.6	39.7
ABDE	44.6	45.0	ABGH	41.7	41.4
BECD	45.1	46.3	AHCD	41.6	42.5
ABCF	43.0	44.0	AECH	44.8	43.6
AFBD	40.5	42.9	AHCF	37.1	40.9
ABEF	41.6	42.3	ACGH	42.6	41.2
AFCE	41.6	42.6	AHDF	36.8	39.3
AEDF	40.1	41.1	AGDH	37.9	41.5
BDCF	41.4	43.1	AEFH	40.2	39.5
BFCE	43.4	43.9	AEGH	42.8	41.6
BDEF	38.5	42.1	AHFG	35.8	39.9
CFDE	40.0	41.8	BHCD	42.3	43.5
ACBG	44.9	46.0	BCEH	43.2	43.6
AGBE	43.8	45.2	BCFH	42.2	40.3
AFBG	40.9	42.4	BGCH	42.8	44.2
AGCD	42.3	43.5	BDEH	40.0	42.2
AECG	47.7	44.8	BHDF	38.1	39.7
AGCF	39.5	42.0	BGDH	40.4	42.0
ADEF	41.4	42.3	BEFH	41.4	40.0
AGEF	39.4	41.5	BEGH	41.9	42.3
BGCD	44.7	44.5	BHFG	37.1	40.5
BECG	45.0	46.0	CEDH	42.0	42.2
BCFG	43.4	41.5	CHDF	38.0	39.5
BEDG	43.1	43.9	CDGH	41.5	40.3
BFDG	39.4	41.5	CEFH	39.1	40.1
BEFG	41.4	41.3	CGEH	40.7	43.4
CDEG	42.2	43.1	CFGH	39.0	39.8
CGDF	40.0	40.6	DEFH	35.7	39.1
CGEF	41.1	42.4	DEGH	38.8	40.7
DFEG	37.4	40.2	DGFH	37.6	39.5
AHBC	46.7	44.5	EFGH	37.9	40.2
AHBD	39.6	43.0			

Average of actual values	41.15
Average of predicted values	42.25
Correlation coefficient	0.82

Table 34. Actual means of double crosses and predicted means from single cross values for the character ear weight.

Double Cross	Actual Mean	Predicted Mean	Double Cross	Actual Mean	Predicted Mean
ACBD	167.5	163.2	ABEH	146.2	163.2
AEBC	161.0	172.5	ABFH	150.3	167.0
ABDE	147.1	165.0	ABGH	159.6	167.2
BECD	176.6	166.2	AHCD	160.7	170.0
ABCF	153.9	170.0	AECH	148.3	168.7
AFBD	169.9	157.0	AHCF	173.8	165.0
ABEF	164.5	166.7	ACGH	168.8	177.5
AFCE	163.4	165.7	AHDF	165.8	150.0
AEDF	158.8	160.5	AGDH	158.4	154.0
BDCF	172.2	164.5	AEFH	146.3	160.2
BFCE	152.1	167.0	AEGH	152.5	162.2
BDEF	170.5	159.5	AHFG	157.3	145.5
CFDE	177.2	166.0	BHCD	167.3	167.2
ACBG	166.2	167.0	BCEH	155.7	177.0
AGBE	170.0	162.0	BCFH	146.7	175.0
AFBG	158.0	153.2	BGCH	163.9	158.0
AGCD	163.6	172.5	BDEH	154.4	159.0
AECG	150.7	173.5	BHDF	157.9	150.7
AGCF	180.2	165.2	BGDH	158.0	154.7
ADEG	162.8	158.2	BEFH	150.4	157.7
AGEF	161.8	153.5	BEGH	161.2	163.0
BGCD	169.9	169.7	BHFG	158.4	147.2
BECG	175.5	170.7	CEDH	162.0	170.2
BCFG	148.0	177.2	CHDF	164.1	158.0
BEDG	177.0	166.5	CDFH	161.6	171.5
BFDG	155.1	152.7	CEFH	160.8	168.2
BEFG	161.4	165.7	CGEH	173.3	166.0
CDEG	179.8	170.5	CFGH	164.2	154.2
CGDF	168.7	163.2	DEFH	151.0	148.7
CGEF	167.8	162.7	DEGH	164.5	156.2
DFEG	160.4	147.7	DGFH	143.5	134.2
AHBC	146.4	171.5	EFGH	142.6	139.0
AHBD	163.5	156.5			

Average of actual values	161.1
Average of predicted values	162.3
Correlation coefficient	0.23

Table 35. Actual means of double crosses and predicted means from single cross values for the character ear length.

Double Cross	Actual Mean	Predicted Mean	Double Cross	Actual Mean	Predicted Mean
ACBD	18.59	18.57	ABEH	16.13	17.82
AEBC	17.49	18.65	ABFH	17.03	18.07
ABDE	15.81	17.27	ABGH	17.67	18.57
BECD	18.87	18.37	AHCD	18.01	19.02
ABCF	17.63	18.80	AECH	17.03	18.60
AFBD	17.88	17.20	AHCF	19.94	18.62
ABEF	17.02	17.35	ACGH	18.94	20.02
AFCE	17.67	18.52	AHDF	17.61	16.85
AEDF	16.89	16.90	AGDH	17.77	17.55
BDCF	19.34	18.77	AEFH	16.33	17.30
BFCE	17.63	19.02	AEGH	17.39	17.82
BDEF	18.23	17.25	AHFG	17.77	16.85
CFDE	19.32	18.47	BHCD	18.89	19.20
ACBG	18.54	19.25	BCEH	17.95	19.50
AGBE	17.21	17.52	BCFH	17.75	19.87
AFBG	17.78	17.25	BGCH	19.04	19.17
AGCD	18.74	19.35	BDEH	17.73	17.57
AECG	17.71	19.02	BHDF	17.83	17.12
AGCF	19.74	18.80	BGDH	17.95	17.80
ADEG	17.83	17.25	BEFH	16.45	17.47
AGEF	17.64	16.92	BEGH	17.37	18.15
BGCD	18.83	19.52	BHFG	18.44	17.10
BECG	18.79	19.17	CEDH	17.96	18.60
BCFG	17.91	19.87	CHDF	18.60	18.55
BEDG	17.90	17.75	CDGH	18.52	19.82
BFDG	17.47	17.42	CEFH	18.45	19.00
BEFG	17.42	17.97	CGEH	19.37	18.90
CDEG	19.49	19.00	CFGH	19.25	18.72
CGDF	19.17	18.95	DEFH	17.16	16.95
CGEF	18.99	18.70	DEGH	17.73	17.62
DFEG	17.66	16.90	DGFH	17.40	16.65
AHBC	17.25	19.30	EFGH	17.03	16.52

Average of actual values	17.97
Average of predicted values	18.21
Correlation coefficient	0.54

Table 36. Actual means of double crosses and predicted means from single cross values for the character ear diameter.

Double Cross	Actual Mean	Predicted Mean	Double Cross	Actual Mean	Predicted Mean
ACBD	4.18	4.17	ABEH	4.34	4.29
AEBC	4.34	4.34	ABFH	4.12	4.17
ABDE	4.22	4.33	ABGH	4.17	4.14
BECD	4.28	4.21	AHCD	4.10	4.12
ABCF	4.04	4.15	AECH	4.17	4.28
AFBD	4.15	4.17	AHCF	4.14	4.12
ABEF	4.31	4.32	ACGH	4.11	4.11
AFCE	4.19	4.19	AHDF	4.13	4.09
AEDF	4.16	4.22	AGDH	4.06	4.09
BDCF	4.05	4.07	AEFH	4.17	4.25
BFCE	4.17	4.17	AEGH	4.21	4.25
BDEF	4.17	4.22	AHFG	4.05	4.07
CFDE	4.19	4.17	BHCD	4.10	4.07
ACBG	4.21	4.10	BCEH	4.23	4.29
AGBE	4.27	4.27	BCFH	4.03	4.11
AFBG	4.10	4.11	BGCH	4.10	4.01
AGCD	4.12	4.10	BDEH	4.15	4.20
AECG	4.14	4.25	BHDF	4.07	4.07
AGCF	4.13	4.05	BGDH	4.09	4.08
ADEG	4.22	4.19	BEFH	4.27	4.22
AGEF	4.19	4.18	BEGH	4.30	4.23
BGCD	4.06	4.05	BHFG	4.06	4.04
BECG	4.26	4.20	CEDH	4.16	4.23
BCFG	4.05	4.07	CHDF	4.12	4.01
BEDG	4.30	4.22	CDGH	4.13	4.02
BFDG	4.10	4.03	CEFH	4.07	4.18
BEFG	4.23	4.19	CGEH	4.14	4.19
CDEG	4.18	4.15	CFGH	3.95	3.96
CGDF	3.99	4.00	DEFH	4.00	4.13
CGEF	4.20	4.13	DEGH	4.20	4.17
DFEG	4.12	4.06	DGFH	3.97	3.92
AHBC	4.15	4.18	EFGH	4.05	4.11
AHBD	4.17	4.15			

Average of actual values	4.147
Average of predicted values	4.148
Correlation coefficient	0.78

Table 37. Actual means of double crosses and predicted means from single cross values for the character ear number of rows.

Double Cross	Actual Mean	Predicted Mean	Double Cross	Actual Mean	Predicted Mean
ACBD	15.40	14.90	ABEH	16.67	16.35
AEBC	16.27	15.20	ABFH	15.53	15.82
ABDE	16.68	15.90	ABGH	16.53	15.87
BECD	14.63	14.20	AHCD	15.42	14.85
ABCF	14.73	14.45	AECH	15.10	15.50
AFBD	16.17	15.17	AHCF	15.07	14.57
ABEF	16.23	15.77	ACGH	15.60	15.05
AFCE	14.63	14.67	AHDF	14.97	15.17
AEDF	15.03	15.55	AGDH	15.87	15.70
BDCF	14.13	13.67	AEFH	15.02	15.97
BFCE	14.13	13.95	AEGH	15.97	16.32
BDEF	15.00	14.70	AHFG	14.93	15.17
CFDE	14.27	13.85	BHCD	14.83	13.97
ACBG	15.36	14.60	BCEH	15.43	14.72
AGBE	16.56	16.20	BCFH	14.27	14.05
AFBG	15.37	14.92	BGCH	14.40	13.97
AGCD	15.00	14.65	BDEH	15.97	15.30
AECG	14.64	15.07	BHDF	14.50	14.40
AGCF	14.97	14.17	BGDH	14.70	14.85
ADEG	15.93	15.75	BEFH	14.67	15.05
AGEF	15.40	15.47	BEGH	15.32	15.60
BGCD	14.24	13.77	BHFG	14.60	14.42
BECG	14.72	14.42	CEDH	14.50	14.87
BCFG	13.93	13.77	CHDF	14.00	13.75
BEDG	15.23	15.22	CDGH	14.03	14.05
BFDG	14.47	13.92	CEFH	14.13	14.30
BEFG	14.77	14.90	CGEH	15.13	14.57
CDEG	14.70	14.27	CFGH	13.40	13.45
CGDF	13.73	13.55	DEFH	14.10	14.60
CGEF	14.30	13.87	DEGH	15.37	15.32
DFEG	15.00	14.37	DGFH	14.30	13.95
AHBC	15.43	15.07	EFGH	14.47	14.72
AHBD	16.20	15.67			

Average of actual values	15.01
Average of predicted values	14.81
Correlation coefficient	0.85

Table 38. Actual means of double crosses and predicted means from single cross values for the character ear height.

Double Cross	Actual Mean	Predicted Mean	Double Cross	Actual Mean	Predicted Mean
ACBD	42.4	31.5	ABEH	27.8	27.6
AEBC	30.8	27.6	ABFH	26.3	29.0
ABDE	31.6	31.2	ABGH	26.8	27.2
BECD	31.7	27.9	AHCD	29.2	28.6
ABCF	28.3	28.3	AECH	22.2	24.3
AFBD	35.3	31.5	AHCF	29.0	25.3
ABEF	30.2	29.3	ACGH	24.4	25.7
AFCE	26.8	26.5	AHDF	32.6	28.8
AEDF	26.7	29.4	AGDH	29.7	27.1
BDCF	32.6	27.3	AEFH	22.7	26.3
BFCE	26.4	27.3	AEGH	22.4	24.2
BDEF	33.5	28.5	AHFG	28.2	23.7
CFDE	28.9	28.3	BHCD	29.6	29.0
ACBG	27.8	27.5	BCEH	25.7	26.8
AGBE	29.6	27.7	BCFH	25.5	27.9
AFBG	30.2	26.7	BGCH	28.1	24.7
AGCD	29.6	28.9	BDEH	32.3	28.1
AECG	22.7	24.6	BHDF	29.7	28.7
AGCF	27.9	25.0	BGDH	28.2	27.9
ADEG	28.7	27.0	BEFH	24.8	26.9
AGEF	28.1	24.8	BEGH	24.3	25.5
BGCD	31.6	29.3	BHFG	28.2	24.3
BECG	28.0	25.6	CEDH	24.4	26.4
BCFG	25.3	28.0	CHDF	28.5	27.5
BEDG	29.1	28.0	CDGH	25.4	27.7
BFDG	27.9	27.6	CEFH	25.3	25.2
BEFG	28.6	27.3	CGEH	26.5	22.7
CDEG	27.9	26.5	CFGH	23.3	22.4
CGDF	27.7	27.1	DEFH	29.5	26.7
CGEF	29.1	23.2	DEGH	27.3	26.1
DFEG	31.6	25.1	DGFH	26.0	23.7
AHBC	28.4	27.8	EFGH	24.7	20.8
AHBD	32.5	31.2			

Average of actual values	28.09
Average of predicted values	26.93
Correlation coefficient	0.59

Table 39. Actual means of double crosses and predicted means from single cross values for the character plant height.

Double Cross	Actual Mean	Predicted Mean	Double Cross	Actual Mean	Predicted Mean
ACBD	92.7	91.2	AEEH	79.1	78.7
AEBC	85.9	84.3	AEFH	80.2	82.9
AEDE	84.2	85.3	AEGH	77.7	79.7
BECD	88.5	83.1	AHCD	87.1	84.6
ABCF	88.9	88.5	AECH	76.8	76.6
AFBD	91.4	87.5	AHCF	83.5	80.9
AEEF	82.3	82.7	ACGH	78.4	78.9
AFCE	82.9	80.7	AHDF	87.8	81.0
AEDF	78.9	80.9	AGDH	81.5	78.2
BDCF	92.1	87.5	AEFH	71.6	74.6
BFCE	81.9	81.7	AEGH	71.9	71.5
BDEF	83.8	80.3	AHFG	79.0	74.7
CFDE	82.4	80.2	BHCD	85.7	84.8
ACBG	87.6	84.7	BCEH	78.0	78.9
AGBE	82.6	79.0	BCFH	80.8	82.6
AFBG	84.5	80.3	BGCH	83.2	78.4
AGCD	83.9	84.7	BDEH	81.7	77.7
AECG	77.1	78.1	BHDF	84.2	80.9
AGCF	80.6	80.3	BGDH	79.2	78.7
ADEG	78.4	76.7	BEFH	74.4	74.7
AGEF	78.3	73.9	BEGH	73.3	72.5
BGCD	90.4	84.8	BHFG	77.8	75.1
BECG	81.8	78.8	CEDH	78.8	76.5
BCFG	81.6	83.1	CHDF	80.5	80.4
BEDG	82.1	78.5	CDGH	77.9	78.3
BFDG	81.8	80.1	CEFH	76.6	74.3
BEFG	78.5	76.5	CGEH	74.0	71.8
CDEG	80.6	76.6	CFGH	73.4	72.5
CGDF	81.2	79.9	DEFH	76.4	72.9
CGEF	80.0	73.3	DEGH	72.7	70.9
DFEG	78.2	71.7	DGFH	74.5	72.1
AHBC	84.8	84.8	EFGH	70.3	65.1
AHBD	84.9	84.9			

Average of actual values	80.97
Average of predicted values	79.17
Correlation coefficient	0.89

Table 40. Actual means of double crosses and predicted means from single cross values for yield in bushels per acre at 15.5% moisture.

Double Cross	Actual Mean	Predicted Mean	Double Cross	Actual Mean	Predicted Mean
ACBD	65.6	63.1	ABEH	60.5	63.0
AEBC	59.5	63.5	ABFH	61.9	65.4
ABDE	59.6	61.8	ABGH	61.8	65.4
BECD	64.0	62.4	AHCD	61.9	66.2
ABCF	63.0	65.1	AECH	56.6	62.5
AFBD	62.2	59.0	AHCF	64.5	63.8
ABEF	59.6	63.8	ACGH	65.5	68.2
AFCE	64.2	64.5	AHDF	57.4	59.0
AEDF	53.8	61.2	AGDH	61.9	58.8
BDCF	66.5	64.0	AEFH	52.9	60.1
BFCE	61.7	63.4	AEGH	56.1	58.1
BDEF	64.1	60.7	AHFG	55.8	57.0
CFDE	67.9	63.8	BHCD	63.0	65.1
ACBG	63.8	63.3	BCEH	60.7	67.7
AGBE	64.5	58.9	BCFH	57.7	69.7
AFBG	60.4	57.9	BGCH	63.9	62.5
AGCD	66.4	66.0	BDEH	60.9	63.3
AECG	56.4	62.9	BHDF	58.4	60.2
AGCF	70.1	62.7	BGDH	60.3	61.2
ADEG	63.7	61.7	BEFH	57.2	61.7
AGEF	61.2	55.1	BEGH	60.7	60.2
BGCD	66.1	64.9	BHFG	57.0	57.9
BECG	63.9	61.4	CEDH	62.2	65.8
BCFG	57.2	69.5	CHDF	62.9	64.4
BEDG	63.3	60.9	CDGH	62.4	68.1
BFDG	58.7	57.3	CEFH	64.2	64.4
BEFG	62.9	61.4	CGEH	63.0	60.5
CDEG	71.0	65.3	CFGH	61.3	59.5
CGDF	65.5	63.7	DEFH	61.2	57.3
CGEF	65.5	58.4	DEGH	61.3	57.9
DFEG	63.5	56.5	DGFH	55.0	52.6
AHBC	56.3	66.4	EFGH	58.0	49.3
AHBD	61.5	61.6			

Average of actual values	61.56
Average of predicted values	61.98
Correlation coefficient	0.31

Table 41 Actual variance of double crosses and predicted variance from single cross variances for the character ear moisture.

Double Cross	Actual Variance	Predicted Variance	Double Cross	Actual Variance	Predicted Variance
ACBD	15.39	10.67	ABEH	13.52	8.77
AEBC	21.13	11.75	ABFH	15.53	8.30
ABDE	17.20	10.40	ABGH	12.37	7.87
BECD	9.77	10.15	AHCD	18.72	8.60
ABCF	16.15	11.23	AECH	11.38	7.93
AFBD	11.87	11.53	AHCF	11.16	13.05
ABEF	15.82	9.97	ACGH	11.02	6.90
AFCE	13.25	8.15	AHDF	10.12	14.30
AEDF	9.67	7.27	AGDH	15.71	8.67
BDCF	9.81	10.60	AEFH	9.75	6.30
BFCE	15.37	9.95	AEGH	12.75	7.63
BDEF	9.00	10.13	AHFG	14.36	15.03
CFDE	10.68	8.20	BHCD	9.65	9.85
ACBG	12.69	11.35	BCEH	15.16	8.13
AGBE	17.63	10.10	BCFH	21.11	9.97
AFBG	26.50	12.53	BGCH	9.60	10.65
AGCD	16.35	8.35	BDEH	12.31	8.73
AECG	12.13	10.15	BHDF	14.83	15.13
AGCF	15.14	11.10	BGDH	10.07	9.10
ADEG	10.19	7.00	BEFH	17.23	6.70
AGEF	20.12	11.05	BEGH	9.93	7.25
BGCD	18.36	9.60	BHFG	12.39	15.05
BECG	15.35	10.60	CEDH	11.09	4.30
BCFG	16.17	8.25	CHDF	14.18	12.75
BEDG	9.54	8.65	CDGH	12.92	6.55
BFDG	21.97	12.20	CEFH	14.52	4.97
BEFG	16.62	8.55	CGEH	13.64	9.13
CDEG	16.62	6.85	CFGH	12.93	14.15
CGDF	7.66	8.40	DEFH	12.39	8.05
CGEF	9.05	10.93	DEGH	11.54	7.27
DFEG	18.76	8.13	DGFH	12.05	13.17
AHBC	21.76	8.87	EFGH	21.62	14.87
AHBD	16.60	10.13			

Average of actual variances	14.16
Average of predicted variances	9.67
Correlation coefficient	0.26

Table 42 Actual variance of double crosses and predicted variance from single cross variances for the character ear weight.

Double Cross	Actual Variance	Predicted Variance	Double Cross	Actual Variance	Predicted Variance
ACBD	1442	1728	ABEH	1230	1359
AEBC	1757	1982	ABFH	1567	1298
ABDE	1797	1525	ABGH	1440	1379
BECD	1305	1650	AHCD	1779	1508
ABCF	1723	1884	AECH	1750	1516
AFBD	1191	1559	AHCF	2179	1426
ABEF	2032	1526	ACGH	1736	1631
AFCE	936	1497	AHDF	911	1222
AEDF	1023	1245	AGDH	1189	1241
BDCF	1028	1524	AEFH	862	1064
BFCE	993	1557	AECH	1347	1205
BDEF	1182	1438	AHFG	1430	1326
CFDE	1364	1205	BHCD	1229	1461
ACBG	1572	2145	BCEH	1593	1355
AGBE	1811	1503	BCFH	1829	1227
AFBG	1465	1589	BGCH	1629	1719
AGCD	2021	1804	BDEH	1103	1295
AECG	1807	1706	BHDF	905	1291
AGCF	1481	1762	BGDH	1111	1151
ADEG	1028	1334	BEFH	1383	1047
AGEF	1127	1158	BEGH	1637	1053
BGCD	1453	1757	BHFG	882	1334
BECG	1396	1597	CEDH	1732	1062
BCFG	1879	1714	CHDF	1533	1157
BEDG	1297	1320	CDGH	1179	1381
BFDG	1060	1230	CEFH	1235	993
BEFG	945	1261	CGEH	2152	1245
CDEG	1137	1571	CFGH	1193	1330
CGDF	1715	1086	DEFH	1392	958
CGEF	1139	1223	DEGH	953	955
DFEG	888	1001	DGFH	1019	1093
AHBC	2477	1619	EFGH	1488	904
AHBD	1607	1416			

Average of actual variances	1410.4
Average of predicted variances	1388.9
Correlation coefficient	0.38

Table 43 Actual variance of double crosses and predicted variance from single cross variances for the character ear length.

Double Cross	Actual Variance	Predicted Variance	Double Cross	Actual Variance	Predicted Variance
ACED	4.98	8.67	ABEH	5.13	3.57
AEBC	6.05	7.27	ABFH	6.43	4.30
ABDE	6.61	4.43	ABGH	4.16	4.20
BECD	6.47	7.05	AHCD	6.71	4.57
ABCF	6.37	8.40	AECH	7.24	4.55
AFBD	4.14	6.67	AHCF	4.17	5.40
ABEF	6.22	4.93	ACGH	8.62	4.53
AFCE	4.00	4.85	AHDF	2.38	4.93
AEDF	4.32	3.97	AGDH	4.24	3.80
BDCF	4.11	7.55	AEFH	4.40	4.43
BFCE	4.49	7.13	AEGH	6.81	3.25
BDEF	3.25	4.65	AHFG	4.59	5.85
CFDE	3.36	4.63	BHCD	5.02	6.53
ACBG	8.28	9.73	BCEH	6.63	4.27
AGBE	6.30	6.50	BCFH	6.93	4.37
AFBG	6.42	7.25	BGCH	7.27	7.87
AGCD	9.07	5.27	BDEH	3.96	3.65
AECG	8.76	5.30	BHDF	3.04	5.07
AGCF	4.98	6.47	BGDH	4.39	4.10
ADEG	3.57	3.55	BEFH	5.99	3.83
AGEF	3.97	4.30	BEGH	5.68	3.30
BGCD	6.17	7.23	BHFG	3.38	5.75
BECG	6.06	7.00	CEDH	6.58	3.03
BCFG	8.75	5.80	CHDF	5.45	4.77
BEDG	2.94	3.60	CDGH	4.46	3.90
BFDG	5.15	5.27	CEFH	5.18	3.50
BEFG	3.90	4.07	CGEH	5.33	4.20
CDEG	3.41	4.43	CFGH	7.53	5.53
CGDF	3.58	4.45	DEFH	3.70	3.67
CGEF	3.49	4.87	DEGH	3.34	2.63
DFEG	3.94	3.57	DGFH	4.11	5.25
AHBC	10.98	6.15	EFGH	6.89	4.25
AHBD	5.45	5.67			
	Average of actual variances			5.37	
	Average of predicted variances			5.11	
	Correlation coefficient			0.34	

Table 44 Actual variance of double crosses and predicted variance from single cross variances for the character ear diameter.

Double Cross	Actual Variance	Predicted Variance	Double Cross	Actual Variance	Predicted Variance
ACBD	0.116	0.070	ABEH	0.084	0.067
AEBC	0.098	0.067	ABFH	0.064	0.091
ABDE	0.092	0.057	ABGH	0.110	0.070
BECD	0.054	0.056	AHCD	0.100	0.061
ABCF	0.076	0.082	AECH	0.120	0.061
AFBD	0.099	0.085	AHCF	0.084	0.068
ABEF	0.111	0.071	ACGH	0.100	0.057
AFCE	0.057	0.057	AHDF	0.071	0.071
AEDF	0.050	0.068	AGDH	0.083	0.071
BDCF	0.067	0.065	AEFH	0.084	0.058
BFCE	0.056	0.045	AEGH	0.110	0.051
BDEF	0.067	0.064	AHFG	0.091	0.074
CFDE	0.067	0.048	BHCD	0.081	0.047
ACBG	0.067	0.068	BCEH	0.099	0.057
AGBE	0.096	0.058	BCFH	0.124	0.073
AFBG	0.110	0.078	BCGH	0.067	0.073
AGCD	0.110	0.067	BDEH	0.081	0.060
AECG	0.073	0.057	BHDF	0.076	0.073
AGCF	0.120	0.062	BGDH	0.094	0.069
ADEG	0.085	0.058	BEFH	0.100	0.075
AGEF	0.100	0.051	BEGH	0.095	0.053
BGCD	0.075	0.053	BHFG	0.084	0.080
BECG	0.051	0.047	CEDH	0.074	0.004
BCFG	0.096	0.064	CHDF	0.062	0.052
BEDG	0.085	0.047	CDGH	0.092	0.047
BFDG	0.089	0.043	CEFH	0.096	0.041
BEFG	0.120	0.060	CGEH	0.100	0.051
CDEG	0.100	0.055	CFGH	0.068	0.053
CGDF	0.056	0.041	DEFH	0.093	0.043
CGEF	0.097	0.041	DEGH	0.075	0.040
DFEG	0.075	0.049	DGFH	0.081	0.050
AHBC	0.120	0.078	EFGH	0.066	0.046
AHBD	0.095	0.081			
	Average of actual variances			0.087	
	Average of predicted variances			0.060	
	Correlation coefficient			0.22	

Table 45 Actual variance of double crosses and predicted variance from single cross variances for the character number of rows.

Double Cross	Actual Variance	Predicted Variance	Double Cross	Actual Variance	Predicted Variance
ACBD	2.39	1.67	ABEH	4.32	2.84
AEBC	3.70	2.37	ABFH	3.79	3.25
ABDE	2.75	2.27	ABGH	5.70	2.91
ABCF	3.23	2.77	AHCD	4.03	2.60
AFBD	3.95	2.07	AECH	3.23	2.84
ABEF	3.49	2.97	AHCF	3.54	3.15
AFCE	2.47	2.33	ACGH	3.28	2.67
AEDF	3.82	2.70	AGDH	4.11	2.83
BDCF	2.00	1.50	AEFH	3.40	3.14
BCCE	1.74	1.75	AEGH	5.12	2.91
BDEF	2.26	2.15	AHFG	4.61	3.38
CFDE	3.21	1.49	BHCD	2.05	1.79
ACBG	2.58	1.90	BCEH	3.09	2.09
AGBE	2.51	2.19	BCFH	3.42	2.07
AFBG	3.44	2.30	BGCH	2.30	1.89
AGCD	3.35	2.22	BDEH	3.49	2.39
AECG	2.98	2.53	BHDF	2.51	2.46
AGCF	3.58	2.53	BGDH	2.12	2.12
ADEG	5.05	2.46	BEFH	4.31	2.29
AGEF	5.02	2.51	BEGH	2.56	2.17
BGCD	2.63	1.41	BHFG	2.54	2.73
BECG	3.00	1.69	CEDH	3.96	1.97
BCFG	2.49	1.90	CHDF	2.95	2.09
BEDG	3.84	1.97	CDGH	3.82	1.94
BFDG	3.26	1.54	CEFH	3.19	1.97
BEFG	3.03	2.19	CGEH	3.07	2.16
CDEG	5.12	1.74	CFGH	2.14	1.95
CGDF	1.61	1.44	DEFH	3.39	2.04
CGEF	2.37	1.59	DEGH	4.07	5.97
DFEG	2.59	1.83	DGFH	2.40	2.03
AHBC	3.70	2.39	EFGH	3.42	2.20
AHBD	3.05	2.31			
	Average of actual variances			3.26	
	Average of predicted variances			2.31	
	Correlation coefficient			0.52	

Table 46 Actual variance of double crosses and predicted variance from single cross variances for the character ear height.

Double Cross	Actual Variance	Predicted Variance	Double Cross	Actual Variance	Predicted Variance
ACBD	13.2	15.0	ABEH	17.0	13.3
AEBC	29.1	18.7	ABFH	19.2	18.4
ABDE	20.3	17.4	ABGH	12.9	14.1
BECD	27.9	19.8	AHCD	26.6	14.6
ABCF	19.2	18.6	AECH	16.7	15.6
AFBD	23.0	21.1	AHCF	16.9	19.1
ABEF	24.4	18.6	ACGH	15.3	12.5
AFCE	21.8	11.5	AHDF	23.0	19.5
AEDF	24.1	17.8	AGDH	25.0	17.1
BDCF	19.0	13.8	AEFH	12.3	14.9
BFCE	25.1	13.3	AEGH	9.6	12.9
BDEF	17.8	20.9	AHFG	25.3	23.1
CFDE	23.9	19.7	BHCD	24.4	15.8
ACBG	15.1	13.5	BCEH	12.1	17.8
AGBE	30.0	13.1	BCFH	21.4	15.5
AFBG	15.6	19.1	BGCH	24.2	15.5
AGCD	19.7	13.0	BDEH	20.9	15.1
AECG	27.7	17.5	BHDF	25.5	19.6
AGCF	28.1	18.2	BGDH	27.9	19.7
ADEG	15.8	13.6	BEFH	19.0	13.8
AGEF	14.5	18.5	BEGH	27.4	12.7
BGCD	18.8	14.2	BHFG	21.9	20.4
BECG	18.8	15.9	CEDH	19.7	13.3
BCFG	20.4	13.8	CHDF	18.2	15.0
BEDG	27.7	16.8	CDGH	19.9	11.4
BFDG	15.7	22.7	CEFH	13.1	11.9
BEFG	29.6	14.1	CGEH	17.9	17.3
CDEG	18.3	15.4	CFGH	14.7	16.3
CGDF	25.1	15.3	DEFH	32.3	15.7
CGEF	15.9	18.6	DEGH	29.1	11.8
DFEG	21.3	15.2	DGFH	16.2	23.0
AHBC	17.3	14.9	EFGH	18.3	16.6
AHBD	25.7	15.3			
	Average of actual variances			20.83	
	Average of predicted variances			16.27	
	Correlation coefficient			0.08	

Table 47. Actual variance of double crosses and predicted variance from single cross variances for the character plant height.

Double Cross	Actual Variance	Predicted Variance	Double Cross	Actual Variance	Predicted Variance
ACHD	36.3	30.7	ABEH	49.9	26.5
AEBC	41.1	29.9	ABFH	40.0	24.0
ABDE	42.8	30.7	ABGH	42.2	19.1
BECD	55.0	23.4	AHCD	48.5	29.5
ABCF	41.7	27.7	AECH	31.8	21.2
AFBD	40.6	24.9	AHCF	76.3	31.2
ABEF	32.7	29.1	ACGH	39.3	24.1
AFCE	55.0	33.3	AHDF	30.9	30.1
AEDF	37.4	26.3	AGDH	49.3	21.1
BDCF	38.3	21.6	AEFH	36.4	24.5
BFCE	44.4	31.0	AEGH	37.8	19.1
BDEF	46.3	20.9	AHFG	33.9	24.7
CFDE	46.6	20.2	BHCD	54.0	30.1
ACBG	46.3	28.5	BCEH	37.3	23.6
AGBE	57.8	27.6	BCFH	63.3	28.1
AFBG	42.9	24.5	BGCH	75.4	23.3
AGCD	59.28	26.7	BDEH	45.0	26.3
AECG	46.3	26.9	BHDF	61.9	27.5
AGCF	63.8	29.7	BGDH	48.6	23.7
ADEG	48.3	22.9	BEFH	51.9	19.5
AGEF	30.4	27.4	BEGH	73.1	18.6
BGCD	47.9	27.3	BHFG	38.9	19.2
BECG	52.8	18.4	CEDH	59.4	24.1
BCFG	49.4	26.7	CHDF	39.6	33.5
BEDG	66.3	22.7	CDGH	48.1	27.5
BFDG	37.9	21.7	CEFH	63.2	28.5
BEFG	59.8	18.6	CGEH	52.7	23.7
CDEG	47.2	20.8	CFGH	44.9	26.3
CGDF	51.2	29.2	DEFH	77.3	21.9
CGEF	41.8	24.9	DEGH	50.5	22.5
DFEG	48.9	21.2	DGFH	43.4	25.1
AHBC	48.1	31.5	EFGH	32.5	21.3
AHBD	81.8	30.3			

Average of actual variances	48.67
Average of predicted variances	25.24
Correlation coefficient	0.004