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Research Article

Prediction of double cross hybrid performance in maize (*Zea mays* L.)

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Abstract:

A total of ten inbred lines of maize was used to predict the performance of double cross hybrids. The performance of predicted 630 double crosses was estimated on the basis of performance of their constituent single crosses. The predicted mean performance for grain yield per plant of 630 double crosses varied from 91.52 [(CML-83) x (CML-141)] x [(CML-3) x (CML-117)] to 142.88 g [(CML-601-S_4-2-3) x (CML-107)] x [(CML-83) x (Pop 34-C_5-HC-86-2-1# (x) 5-b)]. The expected yield performance of these crosses was 142.83, 142.15, 140.00 and 130.00 138.67 g/plant respectively, whereas the grain yield per plant of the best check variety, Suwan was only 120.26 g. The double cross [(CM 601-S_4-2-3) x (CML-107)] x [(CML-107)] x [(CML-83)] x (Pop 34-C_5-HC-86-2-1#(x) 5-b)] predicted better for most of the characters *viz*., earliness in 50 per cent silking and maturity, short plant and ear height, longer and thicker ears, average 500 kernel weight and number of kernel rows, short vegetative growth, medium grain filling and average grain moisture content. Similarly the second top ranking double cross [(M_9 x CM-601)-(x)-S_4-1) x (Pop 30-C_3-P_5-83)] x [(CML-3) x (CML-117)] was also expected to perform better for most of the desirable traits. Therefore, these two crosses may be used as double cross hybrids for breeding programme.

Key words : Maize, double cross hybrids.

Introduction

The evaluation of a large number of double crosses in maize for their performance in experimental plots needs enormous time, labour and financial resources. To save the precious resources and time Jenkins (1934) advocated prediction of double cross performance based on single cross performance. Anderson (1938) also realized the fact and found close correspondence between predicted and realized yield of double crosses in maize.

Material and Methods

A set of ten early generation inbred lines of maize (Table 1) were raised during rabi season in the breeding nursery for making all possible single crosses among them. The crosses were made with those of other lines in all possible combinations excluding reciprocals. By this way, a total of forty five crosses were made and these 45 F_1 crosses, 10 parent and 2 checks, total a set of 57 genotypes were sown in RBD with three replications in three environments (E_1, E_2 and E_3) i.e. three dates of planting (15th June, 30th June and 15th July) at three test locations i.e. Tirhut College of Agriculture, Dholi, Muzaffarpurp, Bihar, Kulbhashkar Ashram Post Graduate College Allahabad, U.P.; and C.S. Azad University of Agricultural and Technology, Kanpur, Besides the soil type there was tremendous variation in the rainfall amount and its distribution and temperature regime among three test locations. Each of the 57 genotypes was sown in a two row plot at each location. Each row was of 5 m length with inter and intra row spacing of 75 and 25 cm, respectively. All experimental areas on were fertilized with 120 kg N, 60 kg P_2O_2 and 40 kg K_2O/ha and other recommended agronomic practices and plant protection measures were adopted. All observations were recorded and the data were analysed staisticlly.

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Results and Discussion

The performance of predicted 630 double crosses was estimated on the basis of performance of their

constituent single crosses. The predicted performance, yield and its component traits of fourteen top ranking double crosses were presented in Table 2. The predicted mean performance for grain yield per plant of 630 double crosses varied from 91.52 [(CML-83) x (CML-141)] x [(CML-3) x (CML-117)] to 142.88 g [(CML-601-S_4-2-3) x (CML-107)] x [(CML-83) x (Pop 34-C_5-HC-86-2-1# (x) 5-b)]. Amongst predicted double crosses, the five top ranking double crosses for grain yield per plant were [(CM 601-S_4-2-3) x (CML-107)] x [(CML-83) x (Pop 34-C_5-HC-86-2-1# (x) 5-b)], [(M_9 x CM 601)-(x)-S_4-1) x (Pop 30-C_3-P_5-83)] x [(CML-3) x (CML-117)], [(CM 601-S_4-2-3) x (CML-14)] x [(Pop 34-C_5-HC-86-2-1#(x)-5-b) x (Pop 49 (C_4)-P_5-80)] and [(M_9 x CM 601)-(x)-S_4-1) x (Pop 30-C_3-P_5-83)] x [(CML-3) x (CML-107)].

The expected yield performance of these double crosses was 142.83, 142.15, 140.00 and 130.00 138.67 g/plant respectively, whereas the grain yield per plant of the best check variety, Suwan was only 120.26 g. Out of these top ranking double crosses, the double cross [(CM 601-S_4-2-3) x (CML-107)] x [(CML-107)] x [(CML-83)] x (Pop 34-C_5-HC-86-2-1#(x) 5-b)] predicted better for most of the characters *viz*., earliness in 50 per cent silking and maturity, short plant and ear height, longer and thicker ears, average 500 kernel weight and number of kernel rows, short vegetative growth, medium grain filling and average grain moisture content. Similarly the second top ranking double cross [(M_9 x CM-601)-(x)-S_4-1) x (Pop 30-C_3-P_5-83)] x [(CML-3) x (CML-117)] was also expected to perform better for most of the desirable traits. Therefore, these two crosses may be used as double cross hybrids for breeding programme.

References

Anderson, D.C. 1938. The relationship between single and double cross yields of corn. J. Amer. Soc. Agron. 30 : 209-211.

Jenkins, M.T. 1934. Methods of estimating the performance of double crosses in corn. Amer. Soc. Agron.26 : 199-204.

Table 1. Details of inbreds and checks of Maize used in the experiment

Sl. No.	Code	Pedigree	Source
1.	P_1	CM 601-S_4-2-3	TCA, Dholi
2.	P_2	(M_9 x CM 601)-(x)-S_4-1	TCA, Dholi
3.	P_3	CML-83	CIMMYT, Mexico
4.	P_4	Pop 30-C_3-P_5-83	CIMMYT, Mexico
5.	P_5	Pop 34-C_5-HC-86-2-1#(x)5-b	CIMMYT, Mexico
6.	P_6	Pop 49(C_4)-P_5-80	CIMMYT, Mexico
7.	P_7	CML-3	CIMMYT, Mexico
8.	P_8	CML-107	CIMMYT, Mexico
9.	P_9	CML-14	CIMMYT, Mexico
10.	P_{10}	CML-117	CIMMYT, Mexico
11.	C_1	Navjot (Check)	PAU, Ludhiana
12.	C_2	Suwan (Check)	TCA, Dholi

Table 2 : Prediction of double cross hybrid performance (top ranking) based on single cross performance

Crosses	Days to 50% silking	Days to maturity	Plant height (cm)	Ear height (cm)	Ear length (cm)	Ear girth (cm)	500-Kernel weight (g)	No. of kernel rows/ear	Grain yield/plant (g)	Vegetative growth period (days)	Grain filling period (days)	% Grain moisture at harvest
(P_1xP_8) x (P_3xP_5)	59.95	90.81	162.68	75.25	13.06	11.25	137.22	12.20	142.83	56.11	15.58	17.62
(P_2xP_4) x (P_7xP_{10})	59.11	89.75	171.35	72.79	13.46	11.75	157.91	12.45	142.15	55.25	15.50	17.94
(P_1xP_8) x (P_5xP_7)	60.33	91.19	176.57	81.87	12.88	11.38	143.36	11.89	140.49	56.08	15.81	16.93
(P_1xP_9) x (P_5xP_6)	60.31	90.42	172.34	79.74	13.20	11.48	156.47	12.31	138.00	56.17	16.19	17.00
(P_2xP_4) x (P_7xP_8)	59.42	90.41	161.12	73.24	13.25	11.92	150.00	12.42	138.67	55.40	16.36	18.37
(P_1xP_4) x (P_7xP_8)	59.89	91.11	177.45	78.83	13.03	11.79	151.00	12.47	137.67	55.95	16.36	17.62
(P_1xP_9) x (P_3xP_6)	60.11	91.25	167.15	76.42	13.35	11.30	162.42	11.95	137.40	55.83	15.86	18.14
(P_1xP_4) x (P_7xP_{10})	60.11	91.05	179.80	76.76	13.39	11.57	151.31	12.00	137.46	56.08	16.83	18.17
(P_1xP_2) x (P_7xP_{10})	59.45	90.41	175.78	76.02	13.35	11.44	146.94	12.34	137.03	55.44	16.28	18.37
(P_1xP_8) x (P_4xP_5)	60.11	91.11	171.45	78.65	13.04	11.52	140.86	12.20	137.13	55.92	16.08	17.11
(P_1xP_7) x (P_2xP_4)	59.50	90.53	167.10	72.65	13.35	11.47	147.15	12.20	137.80	55.58	16.17	18.47
(P_1xP_2) x (P_5xP_7)	59.64	90.41	165.22	78.35	13.12	11.27	139.37	12.17	137.10	55.67	16.53	18.36
(P_1xP_4) x (P_8xP_{10})	60.17	90.50	167.25	76.07	13.19	11.57	150.11	12.03	136.10	56.20	16.36	18.03
(P_1xP_8) x (P_3xP_4)	60.00	91.25	164.05	74.17	13.10	11.56	131.20	12.39	136.00	56.00	16.17	17.89
Navjot (Check)	62.36	92.66	177.11	85.11	12.09	10.29	119.11	11.56	93.43	58.78	15.56	18.17
Suwan (Check)	62.11	92.67	167.81	78.60	12.22	10.50	116.54	12.33	100.26	58.33	16.44	18.67