FORECAST OF SOME HYBRIDIZATION FORMULAE FOR INCREASING THE YIELDING POTENTIAL OF MAIZE BASED ON GENETIC VALUE OF PARENTAL FORMS

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ABSTRACT

The paper presents the estimation of genetic value of 8 inbred lines, according to the model proposed by Cãbulea (1983), aiming at increasing the productive potential of maize genotypes. The results reveal the genetic value of lines LC 4, LC 7 and LC 6, with positive effect in increasing the yielding potential under the conditions of the performed study. The importance of using genetically differentiated lines, in order to evidence at high levels the heterosis effect is outlined. The forecasted hybridization formulae reveal the significance which could be presented by the position of the three inbred lines in developing a performing hybrid.

Key words: inbred line, maize, yielding potential

INTRODUCTION

In order to achieve and provide to growers performing maize genotypes, a particular significance is afforded by the maize breeding teams, to knowledge of genetical value of inbred lines.

Cosmin (1983) showed that yield gains recorded in maize, in parallel with generalization of hybrid cropping are partly due to breeder efforts to know the action and interaction ways of hereditary factors, and also to developing the most suitable methods for recombining the favourable genes in an unique genotype. This topic is sufficiently approached in the special literature, therefore only a few reference works published in this country, will be mentioned, such as : Ceapoiu (1983), Cãbulea (1983), Cãbulea et al. (1994), Duþu (1998), Ha° et al. (1994), Murariu (1996), Radu et al. (1994). Most of these works have as main target the development of some strategies for identification of hybrid combinations with the highest possibilities to express heterosis.

In this work, the importance of knowledge on genetic value of parental forms is stressed, as well as the establishment of the optimal position in the three-way hybrid formula, in order to secure the expression at higher level of the productive potential in maize.

MATERIALS AND METHODS

The results provided by 56 single hybrids resulted from crossing in a diallel system of p (p-1) type of 8 inbred maize lines were used. The experiments were performed under prevailing conditions at A.R.S. Suceava, in randomized blocks with three replications. The estimation of genetic value of parental lines was performed according to the model proposed by Cãbulea (1983). Forecast of hybridization formulae to obtain three-way hybrids with superior productive performances was carried out after the formula proposed by Jenkins (1934), and namely : $\hat{u} + \hat{g}A + \hat{g}B + \hat{g}C + \hat{s}AC + \hat{s}BC + \hat{m}A + \hat{m}C + \hat{r}AC + \hat{r}BC$,

were:

$\hat{u}$ = mean of the system;

$\hat{g}A$, $\hat{g}B$, $\hat{g}C$ = values of additive genic actions of A, B, C parameters;

$\hat{s}AC$ and $\hat{s}BC$ = values of non-additive genic interactions of non-parental hybrids;

$\hat{m}A$ and $\hat{m}C$ = values of cytoplasmatic factors action of A and C parents;

$\hat{r}AC$ and $\hat{r}BC$ = values of genic nucleo-cytoplasmic interactions of non-parental hybrids.

RESULTS AND DISCUSSIONS

Table 1 presents the value of parental lines from the standpoint of an overall capacity for hereditary transmission of yielding potential in maize, by quantification of their additive genetic effects, as well as genic effects of cytoplasmic factors.

The results showed that they have good ability for hereditary transmission, in the sense of increasing the yielding potential in lines LC 4, LC 7 and LC 6. The genetic effects of cytoplasmic factors, which make possible to estab-

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lish the most favourable position of the line in the single hybridization formula, showed that the lines LC 6 and LC 7, used as mother form, positively influence the yielding potential.

Table 1. Genetic additive effects of cytoplasmic factors for the yielding potential (û = 73.9 q/ha)

Parental form	Additive genetic effects	Genetic effects of cytoplasmic factors
L.C. 1	- 6.88	- 0.75
L.C. 2	- 6.87	- 1.89
L.C. 3	- 9.33	0.81
L.C. 4	12.26	1.20
L.C. 5	- 2.53	- 0.64
L.C. 6	4. 01	0.62
L.C. 7	9.85	3.55
L.C. 8	-0.51	-2.90
LSD 5%	0.44	0.44

Table 2 presents the results referring to the effect of specific interaction of parental forms for yielding ability, as well as those regarding the effect of interactions between nucleus and cytoplasm.

Table 2. Genetic non-additive effects and those of interaction between nucleus and cytoplasm of parental forms for yielding potential

Combination	Non-additive genetic interactions	Genetic nucleo-cytoplasmic interactions
LC 2 x LC 1	-4.59	3.64
LC 3 x LC 1	2.72	1.69
LC 4 x LC 1	2.44	3.70
LC 5 x LC 1	6.97	3.59
LC 6 x LC 1	-4.72	-1.92
LC 7 x LC 1	3.40	-0.40
LC 8 x LC 1	-6.19	0.10
LC 3 x LC 2	-7.69	0.09
LC 4 x LC 2	-2.68	4.10
LC 5 x LC 2	0.16	0.99
LC 6 x LC 2	5.21	2.13
LC 7 x LC 2	2.33	1.15
LC 8 x LC 2	7.29	3.90
LC 4 x LC 3	-5.52	0.80
LC 5 x LC 3	-3.19	3.39
LC 6 x LC 3	3.87	-6.77
LC 7 x LC 3	2.09	0.25
LC 8 x LC 3	7.75	3.70
LC 5 x LC 4	-5.12	-2.50
LC 6 x LC 4	11.84	2.68
LC 7 x LC 4	1.61	4.45
LC 8 x LC 4	-2.54	-5.90
LC 6 x LC 5	-2.73	5.73
LC 7 x LC 5	3.39	-4.45
LC 8 x LC 5	0.55	-2.10
LC 7 x LC 6	-9.70	-4.60
LC 8 x LC 6	-3.74	4.55
LC 8 x LC 7	-3.08	-4.25
LSD 5%	2.20	1.76

The effects of specific nuclear interactions of parental forms allow to underline the existing genetic differentiation degree among the lines analysed, regarding the genetic control of maize yielding potential. From this standpoint, the combinations : LC 6 x LC 4, LC 8 x LC 3 and LC 8 x LC 2 are outstanding, they being able to provide yield gains of 11.48 q/ha, 7.75 q/ha and 7.29 q/ha, respectively. The combinations with negative values pointed out the combinations among lines genetically related, as to the heredity of yielding potential. The results pertaining to genic effect of interactions between nucleus and cytoplasm give an opportunity to establish the most favourable positions of lines, in order to get maximum heterosis effect for the yielding potential.

Having already the genetic value estimated in the eight parental lines and using the forecast formula of three-way hybrids, the combinations presented in table 3 could be evidenced in this particular case.

Table 3. Three-way hybrids forecasted on the basis of estimation of genetic values in parental forms (û = 73.9 q/ha)

Hy-brid	Forecasted formula	Esti-mated yield	Estimated yield gain	
			q/ha	%
HT 1	a) (LC4 x LC7) x LC5	110.01	36.11	48.86
	b) (LC7 x LC6) x LC4	106.78	32.88	44.49
	c) (LC7 x LC4) x LC6	97.80	23.90	32.34
HT 2	a) (LC7 x LC8) x LC4	95.20	21.30	28.82
	b) (LC4 x LC8) x LC7	91.88	17.98	24.33
	c) (LC4 x LC7) x LC8	83.83	9.93	13.44
HT 3	a) (LC4 x LC8) x LC6	105.57	31.67	42.85
	b) (LC6 x LC8) x LC4	95.16	21.26	28.77
	c) (LC4 x LC6) x LC8	93.19	19.29	26.10

Analysing the formulae presented from the view point of yield which could be achieved, theoretically, the fact should be underlined that in the hybridization formula for development of three-way hybrids, the position of parental lines could present particular significance in expressing the yielding potential of a new hybrid.

CONCLUSIONS

An outstanding role in developing three-way hybrids with high yielding potential is ascribed to genetic value of component lines. In the present study the lines LC 4, LC 7 and LC 6 were remarkable. The highest heterosis could be achieved by crossing genetic differentiated lines. Combinations LC 6 x LC 4, LC 8 x LC 3 and LC 8 x LC 2 could be an example for the above situation.

Genes with cytoplasmic location can influence the expression of the analysed trait. Lines LC 7 and LC 4, bearing genes favourable for increasing the yielding potential at nuclear level, have genes with cytoplasmic location, with positive effect on this trait.

The forecasted hybridization formulae revealed the importance of the position of parental lines in developing three-way hybrids.

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