UDC 575:633.15
DOI: 10.2298/GENSR1003565Z
Original scientific paper

COMBINING ABILITIES OF MAIZE INBRED LINES FOR GRAIN YIELD AND YIELD COMPONENTS

Tomislav ŽIVANOVIĆ[1], Gordana BRANKOVIĆ[1], Slavko RADANOVIĆ[2]

[1] Faculty of Agriculture, Belgrade, Serbia
[2] Agricultural Institute of Republika Srpska, Banja Luka, Bosnia and Herzegovina

Živanović T., G. Branković, and S.Radanović (2010): *Combining abilities of maize inbred lines for grain yield and yield components*.- Genetika, Vol 42, No. 3,565-574.

Diallel mating design experiment with reciprocal crosses was used to determine combining abilities of five maize inbred lines and their hybrid combinations for grain yield, ear length, ear diameter, number of kernel rows *per* ear, number of kernels *per* row in 2005. and 2006. year. GCA and SCA significant values were observed for all traits under study in both years. GCA/SCA relation showed that dominant gene effect had prevalent influence in the inheritance of grain yield, ear length and ear diameter. Additive gene effect had larger importance in the inheritance of number of kernel rows *per* ear. NS-1445 inbred line showed best GCA effect for grain

---

Corresponding author: Gordana Branković, Faculty of Agriculture, University of Belgrade, Nemanjina 6, 11080 Beograd, gbrankovic@agrif.bg.ac.rs, phone: 0112615315/lok.239, fax: (0)113161987

yield, ear length and number of kernels *per* row, but worst GCA effect for number of kernel rows *per* ear. Best GCA effect for ear diameter achieved inbred line F-7R. Line BL-47 showed best GCA effect for number of kernel rows *per* ear in both years, but also the worst GCA effect for grain yield and number of kernels *per* row. Hybrid combination NS-1445 x BL-47 showed largest SCA effect for grain yield in both years and also showed, like hybrid combination F-7R x NS-1445, significant SCA effects for all other traits, except ear diameter. This cross also proved that hybrid combinations that include one parent with good GCA effect and the other parent with bad GCA effect can have very successful performance. It will be useful during selection material testing, to keep also genotypes which show bad GCA effect, but have phenotypic favorable trait values. Reciprocity effect was significant for SCA effects of all traits but ear diameter. It is the conformation of involvement of plasmagenes in maize quantitative traits inheritance. The largest reciprocity effect for grain yield achieved F-7R x BL-47 in both years. Significantly higher grain yield in this hybrid combination was achieved when line F-7R was used as a female parent and significantly higher number of kernel rows *per* ear was achieved when line BL-47 was used as a female parent.

Key words: combining abilities, GCA, gene effects, maize, SCA

INTRODUCTION

Grain yield of maize is a complex trait. Grain yield includes a number of components, that are inherited in a quantitative manner (ŽIVANOVIĆ *et al*., 2006). The main task of maize selection is obtaining new hybrids, which with their genetic potential for yield and positive features exceed the existing commercial hybrids (SEČANSKI *et al*., 2010, ČVARKOVIC *et al*., 2009). Diallel crosses have been widely used in plant breeding to investigate combining abilities of the parental lines in order to identify superior parents for use in hybrid development programmes. Diallel mating design has been devised, also, in genetic research to investigate the inheritance of important traits among a set of genotypes and gene effects (MALIK *et al*., 2005).

The concepts of general and specific combining ability were introduced by SPRAGUE and TATUM (1942). General combining ability (GCA) is the average performance of a line in hybrid combination and specific combining ability (SCA) is the deviation of crosses on the basis of average performance of the lines involved. The four experimental methods and two models were proposed (GRIFFING, 1956) for the analysis of GCA and SCA in a diallel mating design. Variance for GCA is associated to additive genetic effects while that of SCA includes non-additive genetic effects, arising largely from dominance and epistatic deviations (FALCONER and MACKAY, 1996). Combining ability has been investigated by several authors in maize (BECK *et al*., 1990; CROSSA *et al*., 1990; VASAL *et al*., 1992; KANG *et al*., 1995;

KIM and AYALA, 1996; XINGMING *et al*., 2001; BETRÁN *et al*., 2002; REVILLA *et al*., 2002; BHATNAGAR *et al*., 2004; GLOVER *et al*., 2005).

Reciprocal effects in a diallel mating design are important in order to determine if plasmagenes from mitochondria and plastids contribute to trait inheritance (GLOVER *et al*., 2005).

The objectives of this study were to evaluate GCA and SCA effects of five maize inbred lines for grain yield, ear length, ear diameter, number of kernel rows *per* ear, number of kernels *per* row in the diallel design experiment with reciprocal crosses.

MATERIALS AND METHODS

The experimental material comprised of five inbred lines of maize: ZPL-11/6 and NS-1445 from Serbia, F-7R and W-37A from U.S. and BL-47 from Bosnia, and their hybrids (20) created on the basis of diallel mating design with reciprocals. All the genotypes were of a dent type with a standard grain quality. Analyzed inbred lines represented FAO maturity groups 300 and 400. The experimental design was a randomized complete block design with four replications and it was applied at the trial field of Agricultural Institute Banja Luka during 2005. and 2006. year. The experimental unit was one row for each entry, 6 m long and 0.7 m apart, with plant to plant distance of 0.24 m. Standard cultural and agronomic practices generally used were applied. Measurments on plot basis were recorded on the following agronomic traits: grain yield (t/ha), ear length (cm), ear diameter (cm), number of kernel rows *per* ear, number of kernels *per* row. Grain yield evaluation was performed by measurment of ears mass for each elementary plot using average sample from each replication, in order to calculate grain yield with 14% moisture ha^{-1}. Analyses of other above mentioned traits were conducted using 10 ears per genotype from each replication.

Calculated means for analysed traits were used to estimate general combining ability (GCA) effects of the inbred lines and specific combining ability (SCA) effects for the crosses, including reciprocity effects. Analyses of combining ability were performed following Griffing's Method I (which includes parents, F_1 hybrids and reciprocal crosses) and Model I (fixed) of diallel analysis (GRIFFING, 1956) using a modification of the program (BUROW and COORS, 1994).

RESULTS AND DISCUSSION

Analyses of variance revealed that mean square values were significant ($P < 0.01$) for the genotypes for all traits under study (Table 1). Effect of a year was highly significant ($P < 0.01$) for grain yield and number of kernels *per* row and significant ($P < 0.05$) for ear length. Interaction genotype x year was highly significant ($P < 0.01$) for grain yield and significant ($P < 0.05$) for number of kernels *per* row. Effect of a replication was insignificant for all analysed traits and suggested uniformity of a soil and agronomic practice used.

Table 1. Analyses of variance of 20 crosses among 5 inbred lines for grain yield and yield components.

Source of variation	df	Mean squares				
		GY	EL	ED	KRE	KR
Replication	3	0,21	0,26	0,01	0,02	0,79
Genotype (G)	24	52,13**	21,01**	0,44**	39,63**	292,60**
Year (Y)	1	25,60**	3,30*	0,03	0,05	50,71**
G x Y	24	1,96**	1,28	0,04	0,03	2,79*
Error	147	0,54	0,84	0,03	0,26	1,67

* Significant at P < 0.05.

** Significant at P < 0.01.

GY-grain yield; EL-ear length; ED-ear diameter; KRE- number of kernel rows *per* ear; KR-number of kernels *per* row.

Combining ability analysis showed significant (P < 0.01) GCA and SCA mean squares for all analysed traits (Table 2). Reciprocity effect mean squares were significant (P < 0.01) for grain yield, number of kernel rows *per* ear and number of kernels *per* row for both years, but for ear length only in 2006., showing that inheritance of these traits govern not only nuclear but also plasmagenes. Significant (P < 0.05) mean square for reciprocity effect was confirmed for ear length in 2005. and it was insignificant for ear diameter in both years, and led us to conclusion that only nuclear genes paricipated in the inheritance of ear diameter.

From the GCA/SCA relation for grain yield, ear length and ear diameter, which is less than 1, we can conclude that these traits were under larger influence of nonadditive genetic effects (dominance and epistatic deviations) for the studied genotypes in both years (Table 2). Similiar results of gene determination for grain yield was documented by other authors (KALA *et al*., 2001; ŽIVANOVIĆ *et al*., 2005b; SAN VINCENTE *et al*., 1998; GLOVER *et al*., 2005; IRSHAD-UL-HAQ *et al*., 2010). GCA/SCA relation for the number of kernel rows *per* ear was much larger than 1, what led us to conclusion of greater influence of additive rather than nonadditive gene effects and selection would be effective in improving this trait. This is consistent with studies of other authors (ŽIVANOVIĆ *et al*., 2005a; SRDIC *et al*., 2007; ŽIVANOVIĆ *et al*., 2007; ABOU-DEIF, 2007; WANNOWS *et al*., 2010; BOĆANSKI *et al*., 2010). Number of kernels *per* row showed GCA/SCA relation little larger than 1, what led to conclusion that additive and nonadditive gene effects are of the same importance in inheritance of this trait.

The largest significant (P < 0.01) positive GCA effects for grain yield were observed for the inbred lines NS-1445, in both years, and F-7R in 2005. (Table 3), suggesting they contributed good alleles and their importance in grain yield improvement. W-37A and BL-47 showed large significant (P < 0.01) negative GCA effects for grain yield. NS-1445 showed significant (P < 0.01) positive GCA effect for ear length suggesting it contributed good alleles for ear length. BL-47 had the largest negative significant (P < 0.01) GCA efect for ear length and can be used in maize breeding for reducing ear length. The largest negative significant (P< 0.01) GCA effect for ear diameter was detected for W-37A. BL-47 and F-7R showed largest positive significant (P < 0.01) GCA effects for number of kernel rows *per* ear suggesting usufulness in breeding programmes for the increase of this trait. W-37A, ZPL-11/6 and NS-1445 showed significant (P < 0.01) negative GCA effects for number of kernel rows *per* ear in both years. The largest positive significant (P < 0.01) GCA effect for number of kernels *per* row showed NS-1445 in both years and along with the ZPL-11/6 represented the best general combiner for the increase of this trait. BL-47 showed largest negative significant (P< 0.01) GCA effect for number of kernels *per* row in both years.

Table 2. Observed mean squares from ANOVA analyses of general combining ability (GCA) and specific combining ability (SCA) of five inbred lines and their hybrid combinations for grain yield and yield components.

Yaer	Source of variation	df	Mean squares GY	EL	ED	KRE	KR
2005.	GCA	4	20,568**	8,945**	0,248**	97,600**	240,887**
	SCA	10	65,238**	15,281**	0,329**	6,670**	225,512**
	Reciprocity effect	10	3,087**	1,563*	0,097	2,434**	10,377**
	Error	72	0,673	1,083	0,050	0,268	1,573
2006.	GCA	4	16,667**	12,827**	0,377**	95,999**	299,734**
	SCA	10	44,554**	24,499**	0,744**	5,893**	248,198**
	Reciprocity effect	10	2,794**	3,465**	0,173	2,925**	6,368**
	Error	72	0,444	0,622	0,093	0,272	1,545
GCA/SCA		2005.	0,315	0,585	0,753	14,632	1,068
		2006.	0,374	0,523	0,507	16,923	1,208

* Significant at P < 0.05.

** Significant at P < 0.01.

GY-grain yield; EL-ear length; ED-ear diameter;

KRE- number of kernel rows *per* ear; KR-number of kernels *per* row Only ZPL-11/6 x W37-A and W37-A x BL-47 of ten hybrid combinations haven't shown significant SCA effects for grain yield in both years (Table 4). NS-1445 x BL-47 produced the largest significant (P < 0.01) SCA effect for grain yield in both years (Table 4) and insignificant reciprocity effect. It is the conformation of the earlier acknowledged fact that large SCA effect often includes one parent with large GCA effect and another with small GCA (GLOVER *et al*., 2005.). The largest significant (P < 0.01) reciprocity effect for grain yield was observed for the cross F-7R x BL-47 in both years (Table 5), and the grain yield had larger value when line F-7R was used as a female parent. Stated is the conformation of importance of plasmagenes in grain yield inheritance. In ZPL-11/6 x F-7R hybrid combination with significant (P < 0.01) reciprocity effect in both years donor of favorable plasmagenes was ZPL-11/6. Significant (P < 0.05) reciprocity effects for grain yield were observed for F-7R x W-37A in both years (Table 5).

Table 3. General combining ability (GCA) effects of five maize inbred lines for grain yield and yield components.

	GY		EL		ED		KRE		KR	
Parents	2005.	2006.	2005.	2006.	2005.	2006.	2005.	2006.	2005.	2006.
ZPL-11/6	0,232	-0,182	-0,316	-0,092	0,048	-0,043	-0,341**	-0,321**	1,495**	1,722**
F-7R	0,686**	0,382*	-0,422	-0,314	0,093	0,108	1,369**	1,319**	-0,406	-0,110
W-37A	-0,844**	-0,429**	0,337	0,129	-0,100*	-0,142*	-0,577**	-0,551**	-0,869**	-1,187**
NS-1445	0,602**	0,914**	0,660**	0,887**	0,018	0,013	-2,141**	-2,141**	3,124**	3,358**
BL-47	-0,676**	-0,684**	-0,258	-0,610**	-0,058	0,063	1,689**	1,694**	-3,343**	-3,783**
SE	± 0,183	± 0,149	± 0,233	± 0,176	± 0,050	± 0,068	± 0,116	± 0,117	± 0,280	± 0,278
LSD 0.05	0,365	0,297	0,465	0,351	0,100	0,136	0,231	0,233	0,559	0,555
LSD 0.01	0,485	0,395	0,617	0,466	0,132	0,180	0,307	0,310	0,742	0,736

Significant at P < 0.05. ** Significant at P < 0.01.

GY-grain yield; EL-ear length; ED-ear diameter; KRE- number of kernel rows *per* ear; KR-number of kernels *per* row. LSD- Least significant difference for the difference between two GCA effects

Table 4. Specific combining ability (SCA) effects of the hybrid combinations for grain yield and yield components.

	GY		EL		ED		KRE		KR	
Hybrids	2005.	2006.	2005.	2006.	2005.	2006.	2005.	2006.	2005.	2006.
ZPL-11/6 x F-7R	0,849**	1,159**	***0,490***	0,469	0,079	-0,014	0,126	0,256	1,081*	1,176*
ZPL-11/6 x W-37A	0,233	0,358	0,338	-0,282	0,131	0,059	0,372	0,276	0,060	-1,076*
ZPL-11/6 x NS-1445	1,458**	0,530*	0,825*	1,381**	-0,050	0,121	0,086	0,066	2,681**	3,744**
ZPL-11/6 x BL-47	1,208**	1,066**	0,156	0,935**	0,034	0,105	0,256	0,256	3,594**	4,376**
F-7R x W-37A	2,001**	1,125**	0,820*	1,675**	0,074	0,091	-0,138	-0,314	4,031**	3,720**
F-7R x NS-1445	1,620**	1,797**	1,305**	1,723**	0,075	0,034	-1,099**	-1,024**	4,490**	4,913**
F-7R x BL-47	1,674**	0,835**	0,259	0,217	0,154	0,464**	1,771**	1,616**	2,242**	2,669**
W-37A x NS-1445	1,047**	1,106**	0,318	-0,133	0,167	0,184	0,422*	0,471*	-0,091	-0,096
W-37A x BL-47	0,002	0,044	0,025	0,249	-0,010	-0,035	-0,658**	-0,589**	-1,782**	-1,334**
NS-1445 x BL-47	2,045**	1,957**	1,088**	0,643*	0,179*	0,161	0,681**	0,651**	4,221*	3,058*
SE	± 0,318	± 0,258	± 0,403	± 0,305	± 0,087	± 0,118	± 0,200	± 0,202	± 0,486	± 0,481
LSD 0,05	0,634	0,515	0,804	0,608	0,174	0,235	0,399	0,403	0,970	0,960
LSD 0,01	0,842	0,683	1,067	0,808	0,230	0,313	0,530	0,535	1,287	1,274

* Significant at P < 0.05; ** Significant at P < 0.01.

GY-grain yield; EL-ear length; ED-ear diameter; KRE- number of kernel rows *per* ear; KR-number of kernels *per* row; LSD- Least significant difference for the difference between two SCA effects.

Hybrid combination F-7R x NS-1445 showed largest positive significant (P < 0.01) SCA effect for ear length in both years (Table 4), with no significant reciprocity effect. Five hybrid combinations haven't shown significant SCA effects for ear length (Table 4). Reciprocity effects were eminent in hybrid combinations ZPL-11/6 x F-7R in 2005. (P < 0.05) and in 2006. (P < 0.01) followed by W-37A x NS-1445 (P < 0.05) in both years (Table 5).

Table 5. Reciprocity effects of the hybrid combinations for grain yield and yield components.

Hybrids	GY		EL		ED		KRE		KR	
	2005.	2006.	2005.	2006.	2005.	2006.	2005.	2006.	2005.	2006.
ZPL-11/6 x F-7R	1,079**	0,520*	0,850*	1,341**	0,090	0,055	-0,225	-0,250	1,056*	0,165
ZPL-11/6 x W-37A	-0,195	0,450	0,142	0,026	0,096	0,056	0,175	0,350	0,859	-0,189
ZPL-11/6 x NS-1445	-0,086	0,247	0,065	-0,291	-0,099	-0,089	-0,375*	-0,300	-1,650**	-1,194**
ZPL-11/6 x BL-47	0,472	0,892	-0,347	0,579*	0,151*	-0,007	-0,575**	-0,725**	0,121	1,460**
F-7R x W-37A	-0,625*	0,519*	0,216	-0,495	0,135	-0,021	0,575**	0,700**	0,309	0,230
F-7R x NS-1445	0,745*	-0,064	0,031	-0,485	-0,156	-0,002	0,550**	0,500**	-0,779	-1,144*
F-7R x BL-47	0,816**	1,336**	-0,185	0,450	-0,006	-0,145	-1,300**	-1,375**	2,014**	1,099*
W-37A x NS-1445	-0,649*	0,266	0,734*	0,557*	0,062	0,032	0,375*	0,425*	0,516	0,937*
W-37A x BL-47	0,306	0,179	0,535	0,932**	0,084	0,039	-0,125	-0,150	0,316	0,201
NS-1445 x BL-47	0,547	-0,005	0,424	0,499	0,104	0,027	0,100	0,150	1,805**	0,924*
SE	± 0,290	±0,236	± 0,368	± 0,279	± 0,079	±0,108	± 0,183	± 0,184	± 0,443	±0,439
LSD 0,05	0,578	0,471	0,734	0,557	0,158	0,215	0,365	0,367	0,884	0,876
LSD 0,01	0,768	0,625	0,975	0,739	0,209	0,286	0,485	0,487	1,173	1,163

* Significant at P < 0.05; ** Significant at P < 0.01; GY-grain yield; EL-ear length; ED-ear diameter; KRE- number of kernel rows *per* ear; KR-number of kernels *per* row.; LSD- Least significant difference for the difference between two reciprocity effects.

Only NS-1445 x BL-47 of all hybrid combinations achieved significant (P < 0.05) positive SCA effect in 2005. and F-7R x L-47 significant (P < 0.01) positive SCA in 2006. for ear diameter (Table 4). Reciprocity effect was insignificant for SCA effect for ear diameter in both years (Table 5).

The largest significant (P < 0.01) positive SCA effect for number of kernel rows *per* ear was observed for F-7R x BL-47 hybrid combination (Table 4). Both lines had largest positive GCA effects and represent good general combiners for this trait. NS-1445 x BL-47 also showed large positive significant (P < 0.01) SCA effect for number of kernel rows *per* ear in both years, though NS-1445 showed bad GCA effect for this trait.

Hybrid combinations F-7R x NS-1445 and W-37A x BL-47 showed significant (P < 0.01) negative SCA effects for number of kernel rows *per* ear in both years. The largest significant (P < 0.01) reciprocity effect was recorded in F-7R x BL-47 in both years. Significant (P < 0.01) higher number of kernel rows *per* ear was achieved when BL-47 line was used as a female parent, and opposite case was documented for grain yield.

Hybrid combination F-7R x NS-1445 showed largest positive significant (P < 0.01) SCA effect for number of kernels *per* row in both years (Table 4). W-37A x BL-47 showed highest negative significant (P < 0.01) SCA effect for number of kernels *per* row in both years. The largest significant (P < 0.01) reciprocity effect was observed for ZPL-11/6 x NS-1445 for number of kernels *per* row in both years (Table 5).

Received April 14th, 2010
Accepted December 6th, 2010

REFERENCES

ABOU-DEIF, M.H. (2007): Estimation of gene effects on some agronomic characters in five hybrids and six populations of maize (*Zea mays* L.). World J. Agric. Sci., *3* (1), 86-90.

BECK, D.L., S.K. VASSAL and J. CROSSA (1990): Heterosis and combining ability of CIMMYT' s tropical early and intermediate maturity maize germplasm. Maydica, *35*, 279-285.

BETRÁN, F.J, T. ISAKEIT and G. ODVODY (2002): Aflatoxin accumulation of white and yellow maize inbreds in diallel crosses. Crop Sci., *42*, 1894-1901.

BHATNAGAR, S., F.J. BETRÁN and L.W. ROONEY (2004): Combining abilities of quality protein maize inbreds. Crop Sci., *44* (6), 1997-2005.

BOĆANSKI, J., Z. SREĆKOV, A. NASTASIĆ, M. IVANOVIĆ, I. ĐALOVIĆ and M. VUKOSAVLJEV (2010): Mode of inheritance and combining abilities for kernel row number, kernel number per row and grain yield in maize (*Zea mays* L.). Genetika, *42* (1), 167-176.

BUROW, M.D. and J.G. COORS (1994): A microcomputer program for the simulation and analysis of diallel crosses. Agron. J., *86*, 154-158.

CROSSA, J., S.K. VASIL and D.L. BECK (1990): Combining ability study in diallel crosses of CIMMYT' s tropical late yellow maize germplasm. Maydica, *35*, 273-278.

ČVARKOVIĆ, R., G. BRANKOVIĆ, I. ČALIĆ, N. DELIĆ, T. ŽIVANOVIĆ and G. ŠURLAN-MOMIROVIĆ (2009): Stability of yield and yield components in maize hybrids. Genetika, *41* (2), 215-224.

FALCONER, D.S. and T.C. MACKAY (1996): Introduction to quantitative genetics. 4th ed. Longman, London.

GLOVER, M.A., D.B WILLMOT., L.L. DARRAH, B.E. HIBBARD and X. ZHU (2005): Diallel analyses of agronomic traits using Chinese and U.S. maize germplasm. Crop Sci., *45*, 1096-1102.

GRIFFING B. (1956): Concept of general and specific combining ability in relation to diallel crossing systems. Aust. Journ. Biol. Sci., *9*, 463-493.

IRSHAD-UL-HAQ, M., S.U. AJMAL, M. MUNIR and M. GULFARAZ (2010): Gene action studies of different quantitative traits in maize. Pak. J. Bot., *42* (2), 1021-1030.

KALLA, V., R. KUMAR and A.K. BASANDRAI (2001): Combining ability analysis and gene action estimates of yield and yield contributing characters in maize. Crop Res. Hisar. *22* (1), 102-106.

KANG, M.S., Y. ZHANG and R. MAGARI (1995): Combining ability for weevil preference of maize grain. Crop Sci., *35*, 1556-1559.

KIM, S.K. and S.O. AYALA (1996): Combining abilitiy of tropical maize germplasm in West Africa II. Tropical vs Temperate x Tropical origins, Maydica, *41*, 135-141.

MALIK, S.I., H.N. MALIK, N.M. MINHAS and M. MUNIR (2004): General and specific combining ability studies in maize diallel crosses. Int. J. Agri. Biol., *6* (5), 856-859.

REVILLA, P., R.A. MALVAR, M.E. CARTEA, P. SOENGAS and A. ORDAS (2002): Heterotic relationships among European maize inbreds. Euphytica. *126*, 259-264.

SAN VINCENTE, F.M., A. BEJARANO, C. MARIN and J. CROSSA (1998): Analysis of diallel crosses among improved tropical white endosperm maize populations. Maydica, *43*, 147-153.

SECANSKI, M., G. TODOROVIC, G. SURLAN-MOMIROVIC, T. ZIVANOVIC, M. BABIĆ (2010): Inbred lines of different cycles of selection as donors of favourable alleles for the improvement of F-1 maize hybrids. Genetika, *42* (2), 339-348.

SPRAGUE, G.F. and L.A. TATUM (1942): General vs. specific combining ability in single crosses of corn. J. Amer. Soc. Agron., *34*, 923-932.

SRDIC, J., Z. PAJIC and S. DRINIC-MLADENOVIC (2007): Inheritance of maize grain yield components. Maydica, *52* (3), 261-264.

VASAL, S.K., G. SRINIVASAN, G.C. HAN and C.F. GONZALES (1992): Heterotic patterns of eighty eight white subtropical CIMMYT maize lines. Maydica, *37*, 319-327.

WANNOWS, A.A, H.K. AZZAM and S.A. AL-AHMAD (2010): Genetic variances, heritability, correlation and path coefficient analysis in yellow maize crosses (*Zea mays* L.). Agric. Biol. J. N. Am., *1* (4), 630-637.

XINGMING, ***F***., T. JING, H. BIHUA and L. FENG (***2001): Analyses of*** combining ability and heterotic groups of yellow grain quality protein maize inbreds. 7th Eastern and Southern Africa Regional Maize Conf., 11-15 February, 143-148.

ZIVANOVIC, T., M. SECANSKI and G. TODOROVIC (2005): Components of genetic variability and heritability of the number of rows per ear in silage maize. Biotechnology in Animal Husbandry, *21*, 109-121.

ŽIVANOVIĆ, T., M. SEČANSKI, G. ŠURLAN-MOMIROVIĆ and S. PRODANOVIĆ (2005b): Combining abilities of silage maize grain yield. J. Agric. Sci., *50* (1), 9-18.

ŽIVANOVIĆ, T., S. VUČKOVIĆ, S. PRODANOVIĆ and G. TODOROVIĆ (2006): Evaluation of inbred lines as sources of new alleles for improving elite maize hybrid. Cereal Res. Comm., *34* (1), 941-948.

ŽIVANOVIĆ, T., R. ĐORĐEVIĆ, S. DRAŽIĆ, M. SEČANSKI and M. KOSTIĆ (2007): Effects of recombinations on variability and heritability of traits in maize populations with exotic germplasm. Biotechnology & Biotechnological Equipment, *21* (2), 229-234.

KOMBINACIONE SPOSOBNOSTI INBRED LINIJA KUKURUZA ZA PRINOS ZRNA I KOMPONENTE PRINOSA

Tomislav ŽIVANOVIĆ[1], Gordana BRANKOVIĆ[1], Slavko RADANOVIĆ[2]

[1]Poljoprivredni fakultet Univerziteta u Beogradu, Katedra za genetiku, oplemenjivanje biljaka i semenarstvo, Beograd, Srbija
[2] Poljoprivredni Institut Republike Srpske, Banja Luka, Bosna i Hercegovina

I z v o d

Metodom dialelnog recipročnog ukrštanja utvrđene su kombinacione sposobnosti pet inbred linija kukuruza i njihovih hibridnih kombinacija za prinos zrna, dužinu klipa, prečnik klipa, broj redova zrna i broj zrna u redu u 2005. i 2006. godini. Ustanovljene su značajne vrednosti OKS i PKS za sve ispitivane osobine u obe proučavane godine. Odnos između OKS i PKS, pokazuje da dominantno delovanje gena ima preovlađujuću ulogu u nasleđivanju prinosa zrna, dužine klipa i prečnika klipa, dok aditivno delovanje gena ima veći značaj u nasleđivanju broja redova zrna. Najbolju OKS za prinos zrna, dužinu klipa i broj zrna u redu pokazala je linija NS-1445, koja je ujedno imala i najslabiju OKS za broj redova zrna. Najbolju OKS za prečnik klipa pokazala je linija F-7R. Najbolju OKS za broj redova zrna pokazala je linija BL-47 u obe proučavane godine, a ujedno je imala i najslabiju OKS za prinos zrna i za broj zrna u redu. Najveću vrednost PKS za prinos zrna pokazao je hibrid NS-1445 x BL-47 u obe proučavane godine, koji je osim toga, kao i hibrid F-7R x NS-1445, pokazao značajne vrednosti PKS i za sve ostale osobine, osim prečnika klipa. To je dokaz da pojedine hibridne kombinacije koje uključuju jednog roditelja sa dobrim OKS i drugog roditelja sa lošim OKS, mogu imati izuzetno dobre performanse. Zbog toga bi prilikom testiranja selekcionog materijala, korisno bilo zadržati i one genotipove koji pokazuju loše OKS, a ujedno imaju fenotipski poželjne osobine. Ustanovljeno je da recipročno ukrštanje utiče na efekat PKS za sve ispitivane osobine, osim prečnika klipa. To ukazuje, da osim nuklearnih gena i plazma geni imaju važnu ulogu u nasleđivanju kvantitativnih osobina kukuruza. Najveću razliku u vrednosti PKS za prinos zrna između direktnog i recipročnog ukrštanja ostvario je hibrid F-7R x BL-47 u obe proučavane godine. Pri tome su značajno veći prinosi zrna ostvareni korišćenjem linije F-7R kao ženskog roditelja. Suprotno prinosu, ovaj hibrid je imao značajno veći broj redova zrna sa linijom BL-47 na poziciji ženskog roditelja.

Primljeno 14. IV. 2010.
Odobreno 06. XII. 2010.