Yield, Combining Ability and Intervarietal Heterosis in Tomato Lines

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Abstract. The 190 diallel crosses from twenty tomato lines were evaluated in green house under a hydroponics system and were analyzed with the model II of Griffing (1956). Some of the lines considered in this work can be used in a breeding program because showed similar performance to that of commercial hybrids.

Introduction. The derivation of tomato hybrids requires an adequate selection of progenitors to generate high productivity and quality based on both the intervarietal heterosis (dominant effects) and the combining ability (additive effects). An advantage of this self-pollinated crop, is the possibility to obtain high performing homozygous lines, which can make it unnecessary the derivation of hybrids. The tomato breeding, in addition to fruit yield, emphasizes on the incorporation of disease resistance in addition to genes for fruit productivity. This situation would make it difficult the breeding. This study aimed to 1) select lines based on the estimation of general combining ability effects (GCA), specific combining ability effects (SCA), and quantify the additive and dominance variances and heterosis showed in the offspring of their crosses, and 2) to select hybrids whit high yield performance.

Materials and Methods. Twenty lines were used to do 190 diallel crosses; the offspring of the crosses were evaluated in randomized complete block design with three replications, in greenhouse conditions under a hydroponics system and were analyzed according to the method II of Griffing (1956) and the Best Linear Unbasied Predictors (BLUPS's) of the genetic effects were determined (Montesinos 2005). The fruit measured variables were: yield (of the first four clusters), size, total number, and firmness.

Results and Discussion. Lines were found that showed equal or longer fruit yield relative to what was observed from the commercial hybrids. Significant effects ($P \leq 0.05$) for crosses, GCA and SCA for the evaluated variables were observed as well.

Seventeen experimental hybrids showed higher ($P \leq 0.05$) commercial fruit yield per plant relative to what was observed from the three best parents and the Cid commercial hybrid; it was due to the significant effect of heterosis with respect to the best parent. When parents were contrasting in growth habit and fruit shape the effect of heterosis was longer.

Five parents had the greatest effect in GCA in fruit yield, and fruit length, and two more in fruit firmness; all of them can be used for a selection breeding scheme (Table 1), in according to the observed heritability values (Table 2).

Table 1. BLUP predictors for general combining ability effects of tomato lines selected. Griffing's Model II .

Variety	Fruit yield		Fruit number		Fruit diameter		Fruit length		Fruit firmness	
76	392	a	-0.73	f	0.43	ab	0.47	a	-2.2	g
10	343	ab	-0.97	fhi	0.53	a	0.38	ab	-1.64	fg
60	286	abc	-0.95	fh	0.38	ab	0.32	abc	-1.61	fg
43	236	abcd	2.42	a	0.03	de	0.25	bc	-0.72	cdef
76	392	a	-0.73	f	0.43	ab	0.47	a	-2.2	g
66	-15	f	-1.84	i	0.14	cd	0.16	cd	3.22	a
67	-13	f	-0.66	ef	-0.08	efg	-0.04	e	3.11	a
72	9	f	2.11	a	-0.09	efg	-0.27	f	-1.03	def

Table 2. Estimations of additive and dominance variance components, and heritability of five tomato characters evaluated in a Griffing's Model II.

Component of variance	Fruit Yield	Fruit number	Fruit diameter	Fruit length	Fruit firmness
σ^2_E	244738	9.6	0.6	0.7	6.0
σ^2_{GCA}	63469	2.3	0.1	0.1	3.1
σ^2_{SCA}	53394	0.7	0.0	0.0	4.0
σ^2_G	180332	5.3	0.2	0.2	10.3
σ^2_P	425071	14.9	0.8	0.8	16.3
σ^2_A	126938	4.6	0.2	0.2	6.2
σ^2_D	53394	0.7	0.0	0.0	4.0
h^2	30	31	22	19	38

Variances: σ^2_E error, σ^2_{GCA} GCA effects, σ^2_{SCA} SCA effects; σ^2_P phenotypical, σ^2_G genetic σ^2_A additive effects, σ^2_D dominance effects, h^2 heritability.

Several hybrids showed high heterosis effects (up to 30 % over the best parent), mainly associated with the size and number of fruits; although most of them had no fruit and plant type appropriate. Only five crosses had an adequate agronomic type an diseases resistance

References.

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