DIALLEL ANALYSIS AND CORRELATION BETWEEN AGRONOMIC TRAITS OF TROPICAL MAIZE PROGENIES UNDER TWO NITROGEN LEVELS

Authors: João Cândido de Souza[1], Rafael Parreira Diniz[2]

[1] Adjunt professor at Universidade Federal de Lavras, Lavras/MG, Brazil; cansouza@dbi.ufla.br
[2] Post Doctoral Student at Centro Nacional de Pesquisa de Mandioca e Fruticultura Tropical, Cruz das Almas/BA, Brazil; rafadiniz_rpd@yahoo.com.br

INTRODUCTION

Nitrogen use efficiency (NUE) of plants is an active area of study in agricultural research. This is because reduction in the input of nitrogen fertilizers in the production systems can lead to reductions in costs and reduction of environmental problems while creating more sustainable farming system.

OBJECTIVES

- ✓ Study the genetic control and characterize progenies $S_{0:2}$ regarding the NUE
- ✓ Verify, through correlations and relationships of cause and effect, whether there are differences between agronomic traits of maize plants grown in environments with low and high availability of nitrogen in the soil.

MATERIAL and METHODS

- ✓ Experiments were carried out at Universidade Federal de Lavras / Brazil
- ✓ Four progenies previously classified as responsiveness and tolerance to nitrogen were crossed in a complete diallel scheme

		RT 3	R_nT_n 8	R_nT_n 9	RT 11
RT	3	-	3 x 8	3 x 9	3 x 11
R_nT_n	8	8 x 3	-	8 x 9	8 x 11
R_nT_n	9	9 x 3	9 x 8	-	9 x 11
RT	11	11 x 3	11 x 8	11 x 9	-

→ ❖ F_1's

❖ Reciprocal crosses

- ✓ F_1's
- ✓ Reciprocal crosses
- ✓ 4 controls

→ ✓ RCBD → ✓ Low N

✓ 3 rep ✓ High N

❖ Agronomic traits mensured

- The leaves chlorophyll content
- Male and female flowering
- Stem diameter
- Plant height
- First ear height
- Plant healthy
- Stay-green
- Prolificacy
- Grain yield

❖ Yield components

- Ear weight
- Ear lenght
- Ear diameter
- Number of rows
- Number of kernels per row
- Kernel lenght
- Cob weight
- Cob diameter
- 1,000 kernel weight

❖ Statisticals Analyses

- ✓ Anova – individual and joint
- ✓ Griffing's method 1
- ✓ Pearson's correlation
- ✓ Path analysis

RESULTS

Table 1 Mean squares, significance and importance of GCA and SCA (GMD) in relation to diallel analysis for grain yield of genotypes grown in field experiments with two levels of nitrogen availability in the soil.

SV	DF	MS		
		Low N	High N	Joint Analysis
Genotypes (G)	(15)	16487698.79**	27992338.41**	42432115.08
GCA	3	1751661.07	8956563.23	7348298.69
SCA	6	39139551.79**	64087847.88**	100922986.24**
Reciprocal (R)	6	1203864.64	1414716.53	1483152.11
Environments (E)	1	-	-	802422.17
G x E	(15)	-	-	2047922.12
GCA x E	3	-	-	3359925.61
SCA x E	6	-	-	2304413.43
R x E	6	-	-	1135429.06
Error Individual	38	822749.50	2940306.30	-
Error Joint	76	-	-	1881528.00
GMD ($[2k^2cgc/(2k^2cgc+k^2cec)]$)		0.005	0.022	0.0135

Table 2 Classification of the progenies and synthesized hybrids in the complete diallel in relation to what was expected and what was observed with regard to the use of nitrogen.

	Guedes et al. (2011)		Guedes et al. (2015)			
	Top Cross	*Per se*	Progenies ($S_{0:2}$)		Progenies $S_{0:2}$	
			Expected	Observed	Expected	Observed
L3	RT	RT	RT	RT	RT	R_nT
L8	R_nT_n	R_nT_n	R_nT_n	R_nT_n	R_nT_n	RT
L9	R_nT_n	R_nT_n	R_nT_n	R_nT_n	R_nT_n	RT
L11	R_nT_n	RT	R_nT_n	RT	RT	R_nT
			Hybrids ($S_{0:1}$)		Hybrids ($S_{0:2}$)	
(3x8)	-	-	R_nT/RT_n	R_nT	R_nT/RT_n	R_nT_n
(8x3)	-	-	-	-	R_nT/RT_n	R_nT_n
(3x9)	-	-	R_nT/RT_n	RT	R_nT/RT_n	RT_n
(9x3)	-	-	-	-	R_nT/RT_n	RT_n
(3x11)	-	-	R_nT/RT_n	RT	RT	R_nT_n
(11x3)	-	-	-	-	RT	RT_n
(8x9)	-	-	R_nT_n	RT_n	R_nT_n	RT
(9x8)	-	-	-	-	R_nT_n	RT
(8x11)	-	-	R_nT_n	RT	R_nT/RT_n	RT
(11x8)	-	-	-	-	R_nT/RT_n	RT_n
(9x11)	-	-	R_nT_n	RT	R_nT/RT_n	R_nT_n
(11x9)	-	-	-	-	R_nT/RT_n	R_nT

Table 3 Estimate of direct (D) and indirect effects (I) of agronomic traits through path analysis of maize plants developed in low N availability in the soil.

EFFECT		EH	SD	PH	PH	SG	PROL	MF	FF	CC
D	GY	0.14	0.13	-0.11	0.09	-0.30	0.05	0.12	-0.47	0.02
I	EH	-	0.08	-0.00	0.13	-0.07	0.01	-0.08	-0.09	0.00
I	SD	0.07	-	-0.00	0.08	-0.07	0.02	-0.04	-0.06	0.03
I	PH	0.00	0.00	-	0.00	-0.02	0.02	-0.00	-0.01	0.02
I	PH	0.08	0.05	-0.00	-	0.05	0.01	-0.04	-0.05	-0.00
I	SG	0.14	0.16	-0.05	0.18	-	0.04	-0.07	-0.10	-0.02
I	PROL	0.00	0.01	-0.01	0.01	-0.00	-	-0.00	-0.01	0.10
I	MF	-0.06	-0.04	0.00	-0.06	-0.02	-0.00	-	0.10	-0.00
I	FF	0.29	0.21	-0.07	0.29	-0.16	0.13	-0.41	-	0.05
I	CC	0.00	0.00	-0.00	-0.00	0.00	0.00	-0.00	-0.00	-
*R^2	0.79									
&VRE	0.45									

CONCLUSIONS

The non-additives effects were more important and stable for the nitrogen use efficiency when assessing grain yield.

The classification of hybrid progenies was not stable when it advanced a generation of self-pollination.

The female flowering for low-N environment presented a direct effect on grain yield.

Financial Support

CAPES FAPEMIG CNPq Conselho Nacional de Desenvolvimento Científico e Tecnológico