https://doi.org/10.71252/2177-34912025720005
ISSN: 2177-3491
revista Ceres

Combining genetic potential for early maturitty and grain yield in soybean

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Editors:
Rogério Vieira
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Submitted: September 25th, 2024.
Accepted: January 11th, 2025.

ABSTRACT

The aim of the work was to employ general and specific combinatorial capacity to select possible genetic bases and parents that meet the agronomic ideotype of soybean precocity and grain yield. The experiment was conducted at the Regional University of the State of Rio Grande do Sul. The experimental design used was that of augmented blocks, with interspersed controls, with treatments distributed in four blocks allocated throughout the experiment. To reduce pod insertion height, specific breeding strategies are suggested. For the ideal plant height, line 195 is selected. Lines 262 and 286 are chosen for their early maturity traits, while lines 893 and 661 are selected to improve grain weight per plant. These selections aim to enhance plant growth and yield. The general and specific combining capacity allows the selection of additive and complementary gene constitutions for insertion height of the first pods with the parents Massal Maradona RR 15b70 IPRO, plant height with HO Puricá x HO Jacuí IPRO, precocity through TMG 7262 RR x 15b70 IPRO, grain yield attributes through NS 6700 IPRO x BMX Valente 6968 RSF and DM 7.0 BMX Magna x BMX Ativa RR.

Keywords: Best Linear Unbiased Prediction, Genetic Designs, Genotype Selection, *Glycine max* L.

INTRODUCTION

Grain yield in soybean (*Glycine max* L) is strongly influenced by the strategies and methods used during genetic improvement practices, which, combined with new management technologies, contribute to the expansion of new areas, reduction of production costs, development tolerance to insect pests and diseases, as well as satisfactory responses to climate change.[1] Some research reveals that genetic improvement prioritizes obtaining early soybean cultivars with high productive potential[2]. Therefore, parents with great competitive ability, yield, quality and adaptation should be prioritized.[3] The aim is to bring together high genetic potential when planning crosses, which must demonstrate genetic complementarity for the fraction of genes determining grain yield.[4]

Given the large number of available parents and the difficulty in obtaining superior genetic constitutions with high potential, diallel analysis is presented as a tool to indicate possible alternatives that could enhance the genetic gain of soybean. Knowing the phenotypic, genetic and environmental contributions of each soybean character is essential, however, it is crucial to highlight the combinatorial capacity, gene action and inheritance or maternal effect involved. By unfolding the effects, the general (GCC) and specific (SCC) combination capacity is obtained. The GCC refers to the average performance of the parents based on the average additive effects, without highlighting maternal or paternal tendencies. On the other hand, the SCC is based on the adjustment of the specific additive effects of the parent, as well as its maternal genetic contribution, attributing effects or inheritance, being only dependent on the generation of improvement in which diallel analysis is applied.[5]

Understanding the probability of inheriting genes through offspring is vital for breeding, as estimates of combinatorial capabilities must be weighted by the degree of heterozygosity present in the progenies and the non-additive nature of certain traits.[2,5,6] Some studies identified the possibility of using diallel analysis to reduce the soybean cycle, others defined that the basis of soybean yield is built by correct information in this methodology. Furthermore, the authors used combinatorial capacity estimates to obtain progenies tolerant to Asian rust. However, no research has based the obtaining of soybean cultivars on the diallel analysis of F3 progenies based on the selection of the soybean agronomic ideotype, which is based on early plants, with high formation of reproductive nodes in the main stem, pods and grains, as well as, the correct partitioning of up to 40% of these in the lateral branches, these attributes together meet the logic of obtaining a highly productive cultivar, which exceeds six tons of grains per hectare, using fewer inputs and scarce resources from the production environment.

In this context, this work aimed to employ general and specific combinatorial capacity to select possible genetic bases and parents that meet the agronomic ideotype of soybean precocity and grain yield.

MATERIAL AND METHODS

The experiment was carried out in the municipality of Ijuí located in the state of Rio Grande do Sul, in the area of the Regional University of the Northwest of the State of Rio Grande do Sul (28°23’37.1” S and 53°56’40.5” W). The soil is classified as Distroferric Red Latosol.[7] According to Köeppen, the climate is characterized as Cfa - humid subtropical.[8]

The experimental design used was that of augmented blocks, with interspersed controls, with treatments distributed in four blocks allocated throughout the experiment. 1449 soybean lines inherent to the F3 segregating generation (75% inbreeding) were sown (table 1). Four commercial cultivars were used as controls, namely: VTOP RR®, BMX ZEUS IPRO, Credenz CZ 2607 XTD – BASF Agro and NS 4823 RR, arranged in four repetitions in a common manner in each block. Sowing took place in the first half of October 2022, using 18 seeds per linear meter. Sowing was carried out manually with N-P-K base fertilizer in the 03-21-21 formulation, insect pest management was carried out preventively, with the aim of minimizing biotic effects on the results of the experiment.

The experimental units were two meters long, spaced 50 centimeters apart. Cultural treatments were carried out only to control insect pests, according to the needs of the crop. The variables measured were insertion height of the first pod (IHFP, cm), plant height (PH, cm), cycle (cycle, days of sowing to harvest), days to flowering (DF, days), grain weight per plant (GWP, grams), number of grains per plant (NGP, units), number of pods per plant (NPP, units). A total of 10 random plants of each line were evaluated to determine the PH, GWP, NGP and NPP variables.

The data obtained were subjected to the assumptions and the normality and homogeneity of residual variances were verified. To estimate the variance components and genetic parameters (REML), the model y = Xr + Za + Wf + Sb + e was used; Where it is considered that y: is the data

Table 1: Genealogy of F3 segregating lines, maternal parent (MP), paternal parent (PP) and number of lines

Populations F_2	MP	PP	No. of lines
IRC001	DM 7.0 BMX Magna RR	Fundacep 66 RR	112
IRC002	DM 5.8 BMX Apolo RR	Fundacep 66 RR	11
IRC003	DM 7.0 BMX Magna RR	Monasca RR	6
IRC005	ROOS Camino RR	FPS Paranapanema RR	55
IRC007	DM 5.8 BMX Apolo RR	MAR.M4 Condor BRANQ	17
IRC008	DM 5.8 BMX Apolo RR	FPS Urano RR	2
IRC009	FPS Paranapanema RR	Fundacep 65 RR	1
IRC011	BMX Potência RR	MAR.M4 Condor BRANQ	20
IRC012	FPS Netuno RR	DM 5.8 BMX Apolo RR	70
IRC013	DM 7.0 BMX Magna RR	DM 5.8 BMX Apolo RR	63
IRC017	FPS Júpiter RR	Monasca RR	54
IRC020	NS 4823 RR	Rota 54 IPRO RR	2
IRC021	TMG 7062 RR	NS 6700 RR	200
IRC022	NS 6700 RR	BMX Ativa RR	9
IRC025	Massal	Maradona	34
IRC026	Massal	Maradona	1
IRC028	Massal	Maradona	3
IRC029	Massal	Maradona	5
IRC031	NS 5958 RR	Maradona	71
IRC033	MAR M4 Condor BRANQ	Na 5909 RR	11
IRC034	NS 5958 RR	NS 6700 RR	95
IRC035	BMX Força RR	Maradona	8
IRC036	DM 5.8 BMX Apolo RR	TMG 7166	1
IRC037	NS 5909 RR	Maradona	67
IRC038	NS 6700 RR	Maradona	2
IRC039	TMG 7166 RR	Maradona	15
IRC040	BMX Turbo RR	TMG 7166 RR	27
IRC041	Massal	Massal	3
IRC042	BMX Valente 6968 RSF	ROOS Avance RR	7
IRC043	DM 5958 RSF IPRO 5.8	BMX Alvo DM 5.9 RR	5
IRC044	BMX Turbo RR	M 5947 IPRO	106
IRC045	Massal	Massal	7
IRC046	5855 RSF IPRO ELITE	BMX Alvo DM 5.9 RR	50
IRC047	BMX Ponta IPRO 7166	Na 5909 RR	2
IRC048	ROOS Avance	M 5892 IPRO	1
IRC049	BMX Ponta IPRO 7166	SYN 1564 IPRO	88
IRC050	BMX Potência	BRSMG Nova Fronteira	7
IRC051	NS 6209 RR	M 6210 IPRO	1
IRC052	M 6410 IPRO	CZ 15b70 IPRO	24
IRC053	HO Pirapó IPRO	BRSMG Nova Fronteira	7
IRC054	SYN 1561 IPRO	M 6210 IPRO	11
IRC055	TMG 7262 RR	CZ 15B70 IPRO	37
IRC056	HO Purica IPRO	HO Amaboy IPRO	17
IRC057	TMG 7260 IPRO	BMX Fibra IPRO	13
IRC058	TMG 7260 IPRO	BMX Fibra IPRO	71
IRC059	M 6210 IPRO	DM 6563 RSF IPRO	4
IRC060	HO Jacui IPRO	HO Purica IPRO	67
IRC061	M3	M4	1

vector, f: is the vector of non-additive (random) effects, a: is the vector of additive (random) effects, b: is the vector of effects assigned to the blocks, and: is the vector of errors or residues (random), the saved letters are presented as incidence matrices of the indicated effects.[9] Next, *Deviance* analysis was performed with the restricted maximum likelihood ratio with significance based on the x^2 test at 5% probability. With the estimates of the variance components, the best unbiased predictors (BLUP) for general and specific combinatorial capacity were predicted using the Selegen software.[9]

Principal component analysis (PCA) was used to determine the contribution of each trait to the total variation stratified by parent effects for the base populations. The K-means algorithm was used to define the clustering of progenies, the analyzes were carried out using the R software.[10]

RESULTS AND DISCUSSION

Based on the phenotypic information, principal component analysis was carried out, focusing on the grouping of parents based on the proximity between the analyzed variables. It is observed greater proximity of the maternal parents TMG 7262 RR and HO Jacuí IPRO, with emphasis on the insertion height of the first pods (Figure 1). For a thousand grain weight, the maternal parent NA 5909 RR stood out, in contrast, the number variables of pods per plant and number of grains per plant revealed that the maternal parents DM 5.8 BMX Apolo RR, ROOS Camino RR, FPS Júpiter RR and FPS Solar IPRO were superior. The parents Maradona and BMX Força RR presented a longer cycle and days to flowering. Taller plants were observed when using the parents M 6410 IPRO and DM 6563 RSF IPRO. When evaluating the paternal parents, an increase in the cycle was observed in the FPS Paranapanema RR and DM 6563 RSF IPRO parents. In addition, increase in the number of grains per plant for TMG 7166 RR, Fundacep 66 RR and DM 6563 RSF IPRO.

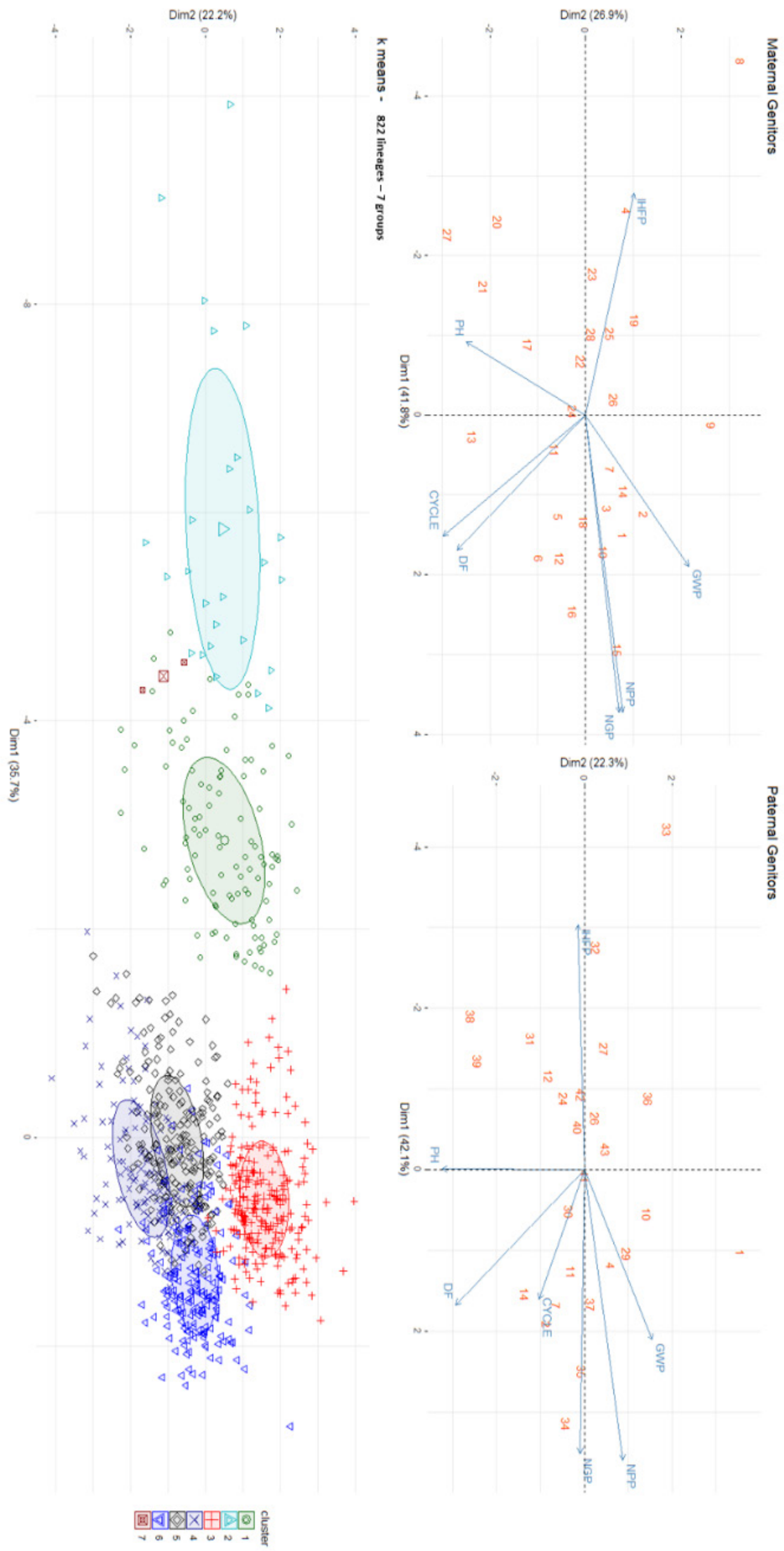
K-means clustering revealed the existence of seven clusters. The first brought together 168 lines, with the highest frequency coming from the maternal parent DM 7.0 BMX Magna RR and the paternal parent NS 6700 IPRO (Figure 1). The second grouped 114 lines with preference for the maternal parent TMG 7823 RR and paternal parent NS 6700 IPRO, the third combined 75 lines with greater contribution from the maternal parent FPS Solar IPRO and paternal parent Maradona. The maternal DM 5958 RR and paternal DM 5.8 BMX Apolo RR parents grouped 164 lines. The fifth cluster brought together 106 lines with prominence from the maternal parent HO Jacuí IPRO and paternal parent Maradona, the sixth cluster resulted in the meeting of 54 lines formed by the maternal parent DM 7.0 BMX Magna and paternal parent NS 6700 IPRO, as well as the seventh cluster with 135 lines originating from the maternal parent HO Jacuí IPRO and paternal parent NS 6700 IPRO.

The general mean for insertion height of the first pods was 18.05 centimeters. According to Silva,[11] the ideotype varies from 10 to 15 centimeters. Low variability is considered for this character (H^2: 0.34), with only 23% being heritable with additive effects, and large environmental effects are proven. Plant height averaged 85.70 centimeters and had low genetic variability. The objective is to have smaller plants for better use and efficiency of yield components. The cycle revealed a general mean of 168 days with very low variability (H^2: 0.27), with only 17% heritable arising from additive effects.

Days to flowering revealed 69 days of general mean with potential for selection, expressing greater variability (H^2: 0.47), with 34% of heritable additive genetic effects. The grain weight per plant revealed a general mean of 34.81g, with low total genetic variability (H^2: 0.14) and only 6% of heritable additive effects, which could compromise the success of selection in this segregating generation. The number of grains in the plant expressed low genetic variability (H^2: 0.13), with only 5% additive effects and a general mean of 164.98 grains. Similar behavior was expressed for the variable number of pods per plant with 74.20 pods average.

When using the BLUP analysis methodology, maximum precision is obtained when selecting superior genotypes.[12] When considering the choice of parents with greater potential, the general combination capacity based on the insertion height of the first pods is observed: the parents DM 5.8 BMX Apolo RR with 18.18 centimeters and NS 6700 IPRO with 18 .05 centimeters showed the potential to reduce this character (Table 3). With an emphasis on reducing plant height, the parents with additive genetic potential were TMG 7823 RR with 86.19 centimeters and BMX Potência RR with 85.70 centimeters.

The search for cycle reduction is one of the objectives of the genetic improvement program, concomitantly with this, the parents with the greatest potential were TMG 7662 RR and TMG 7823 RR with 168 days. Indirectly contributing to the reduction of the cycle, a shorter vegetative period is



IHFP: insertion height of the first pod (cm), GWP: grain weight per plant (g), NPP: number of pods per plant (units), DF: days to flowering (days), cycle (days), PH: plant height (cm).

Figure 1: Blipot principal component analysis for maternal parents and paternal parents and K-means clustering for 822 lines grouped into seven clusters

Table 2: Variance components and genetic parameters, additive variance (Va), residual variance (Ve); phenotypic variance (Vp), narrow-sense heritability (h²), broad-sense heritability (H²), for the characters height of insertion of the first pod (IHFP, cm), plant height (PH, cm), cycle, days to flowering (DF, days), grain weight (GWP, g), number of grains per plant (NGP) and number of pod per plant (NPP)

REML	IHFP	PH	CYCLE	DF	GWP	NGP	NPP
Va	12.99*	142.65*	41.79*	28.62*	75.17*	1574.67*	269.50*
Vp	42.00	451.80	169.39	64.68	647.53	16798.42	2708.00
h²	0.23	0.23	0.17	0.34	0.06	0.05	0.05
H²	0.34	0.34	0.27	0.47	0.14	0.13	0.13
Gerenalmean	18.05	85.70	168.14	69,14	34.81	164.98	74.20

*significance based on 5% probability using the χ^2 test.

Table 3: General combination capacity with emphasis on agronomic ideotype for insertion height of the first pod (IHFP), plant height (PH), cycle, days to flowering (DF), grain weight per plant (GWP), number of grains per plant (NGP) and number of pod per plant (NPP)

IHFP (cm)				PH (cm)			
Parents	a[1]	G[2]	BLUP[3]	Parents	a[1]	G[2]	BLUP[3]
DM 6563 IPRO	-2.04	0.8763	18.93	ROOS Camino RR	-6.45	3.22	88.93
FPS Júpiter RR	-2.12	0.7905	18.84	BMX Alvo RR	-7.34	2.92	88.63
Massal	-2.29	0.7049	18.76	CZ 15b70 IPRO	-8.84	2.59	88.30
DM 6563 RSF IPRO	-2.39	0.6212	18.67	DM 7.0 BMX Magna	-9.05	2.28	87.98
BMX Ponta IPRO 7166	-2.73	0.5329	18.58	NS 6700 IPRO	-9.30	1.97	87.68
DM 7.0 BMX Magna RR	-3.04	0.4412	18.49	FPS Paranapane-ma RR	-9.98	1.67	87.37
BMX Turbo RR	-3.26	0.3486	18.40	Massal Mara-dona	-11.75	1.33.	87.04
BMX Ponta IPRO 7166	-3.94	0.2440	18.29	BMX Ponta IPRO 7166	-16.09	0.91	86.61
DM 5.8 BMX Apolo RR	-4.50	0.1308	18.18	TMG 7823 RR	-16.81	0.48	86.19
NS 6700 IPRO	-5.49	0.0000	18.05	BMX Potência RR	-20.52	0.000	85.70
CYCLE (days)				DF (days)			
Parents	a[1]	G[2]	BLUP[3]	Parents	a[1]	G[2]	BLUP[3]
BMX Força RR	-1.37	1.56	169.70	HO PIRAPÓ	1.73	1.38	70.53
BMX Ponta IPRO 7166	-1.37	1.47	169.62	SYN 1561 IPRO	-2.27	1.27	70.42
BMX Fibra	-1.78	1.38	169.53	DM 7.0 BMX Magna	-2.63	1.17	70.32
TMG 7260	-1.78	1.30	169.44	M 6210 IPRO	-3.36	1.04	70.19
BRSMG Nova Fronteira	-2.49	1.20	169.34	FPS Urano RR	-3.47	0.92	70.07
HO Pirapó	-2.49	1.10	169.25	NS 6700 IPRO	-3.80	0.80	69.95
HO Jacuí IPRO	-2.92	1.00	169.15	Fundacep 66 RR	-4.22	0.68	69.83
CZ 15b70 IPRO	-11.40	0.70	168.84	TMG 7262	-5.90	0.52	69.67
TMG 7262 RR	-12.16	0.39	168.54	CZ 15b70 IPRO	-6.10	0.36	69.51
TMG 7823 RR	-16.64	0.00	168.14	TMG 7823 RR	-15.25	0.000	69.14

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IHFP (cm)				PH (cm)			
GWP (gramas)				NGP			
Parents	a[1]	G[2]	BLUP[3]	Parents	a[1]	G[2]	BLUP[3]
BMX Valente 6968 RSF	10.59	10.59	45.41	BMX Ativa RR	65.40	65.40	230.39
BMX Ativa RR	10.49	10.54	45.36	BMX Valente 6968 RSF	.42	52.40	217.39
NS 6700 IPRO	8.36	9.82	44.63	FPS Júpiter RR	37.42	47.41	212.39
FPS Júpiter RR	6.77	9.05	43.87	BMX Ponta IPRO 7166	34.03	44.06	209.05
BMX Ponta IPRO 7166	6.71	8.58	43.40	DM 7.0 BMX Magna	33.20	41.89	206.88
FPS Solar IPRO	6.70	8.27	43.09	FPS Solar IPRO	31.64	40.18	205.17
TMG 7823 RR	5.61	7.89	42.71	DM 5.8 BMX Apolo RR	27.66	38.39	203.38
BMX Ponta IPRO 7166	5.36	7.57	42.39	NS 6700 IPRO	17.37	35.76	200.75
Fundacep 66	4.82	7.27	42.09	NA 5909 RG	16.99	33.68	198.67
BMX Turbo RR	4.41	6.98	41.80	BMX Turbo RR	12.94	31.60	196.59

NPP			
Parents	a[1]	G[2]	BLUP[3]
BMX ATIVA RR	23.64	23.64	97.84
FPS JÚPITER RR	19.93	27.79	95.99
BMX Valente 6968 RSF	19.62	21.06	95.27
FPS Solar IPRO	14.01	19.30	93.51
DM 5.8 BMX Apolo RR	13.33	18.11	92.31
DM 7.0 BMX Magna	11.69	17.04	91.24
NS 6700 IPRO	10.71	16.13	90.34
BMX Ponta IPRO 7166	9.16	15.26	89.47
NA 5909 RG	7.41	14.39	88.59
Monasca RR	4.86	13.44	87.64

[1]a: additive effects; [2]G: total genetic effects; [3]BLUP: Best Linear Unbiased Prediction.

sought through the days to flowering, making it possible to obtain precocity through the parents CZ 15b70 IPRO and TMG 7823 RR with 69 days. The parents that increased the grain weight per plant are BMX Valente 6968 RSF and BMX Ativa RR with more than 45 grams. For the number of grains per plant, the objective is to use BMX Ativa RR and BMX Valente 6968 RSF, which resulted in more than 217 grains per plant. When the focus is to increase the number of pods per plant, BMX Ativa RR and FPS Júpiter RR should be prioritized with more than 95 units per plant.

The specific combining capacity (SCC) demonstrated that to reduce the insertion height of the pod, there is potential for selection through lines 311 and 300 arising from the crossing of the maternal parent Maradona and the paternal parent NS 6700 IPRO (Table 4). To obtain the plant height ideotype, line 195 is selected, resulting from the hybridization of the maternal parent HO Puricá RR and the paternal parent HO Jacuí IPRO, and line 651 obtained by the complementarity of the maternal parent DM 5958 RR and the paternal parent Massal Maradona RR.

The search for precocity reveals that lines 262 and 286 must be selected, both originating from crosses between the maternal parent TMG 7262 RR and the paternal parent 15b70 IPRO. Reducing the number of days to flowering can be achieved by hybridizing the maternal parent TMG 7823 RR and the paternal parent NS 6700 IPRO. The increase in yield potential must be measured by the grain weight per plant, which expresses specific genetic effects for the cross between the maternal parent NS 6700 IPRO and the paternal parent BMX Valente 6968 RR through the selection of lines 893 and 661 (Table 5). The number of grains per plant and pods per plant can be maximized through the specific crossing of the maternal parent DM 7.0 BMX Magna and BMX Ativa RR as pollen donor, with

Table 4: Specific combination capacity with emphasis on the agronomic ideotype for insertion height of the first pods (IHFV, cm), plant height (PH, cm), cycle and days to flowering (DF, days)

IHFV (cm)			PH (cm)		
Crossing	a[1]	Blup	Crossing	a[1]	Blup
372- DM 5.8 BMX Apolo RR X DM 7.0 BMX Magna	14.22	17.1468	1177- Massal Maradona RR X DM 5958 RR	88.12	91.4228
986- DM 5.8 BMX Apolo RR X DM 7.0 BMX Magna	14.22	17.1432	912- HO Puricá X HO Jacuí IPRO	88.11	91.4123
394 DM 5.8 BMX Apolo RR X DM 7.0 BMX Magna	14.21	17.1396	470- Massal Maradona RR X DM 5958 RR	88.07	91.4017
1285- DM 5.8 BMX Apolo RR X DM 7.0 BMX Magna	14.20	17.1360	795- HO Puricá X HO Jacuí IPRO	88.06	91.3912
371- DM 5.8 BMX Apolo RR X DM 7.0 BMX Magna	14.19	17.1324	1072- Massal Maradona RR X DM 5958 RR	88.05	91.3807
51- DM 5.8 BMX Apolo RR X DM 7.0 BMX Magna	14.13	17.1287	368- Massal Maradona RR X DM 5958 RR	88.04	91.3702
56- DM 5.8 BMX Apolo RR X DM 7.0 BMX Magna	14.13	17,1250	1076- Massal Maradona RR X DM 5958 RR	88.04	91.3598
58- DM 5.8 BMX Apolo RR X DM 7.0 BMX Magna	14.13	17.1214	812- HO Puricá X HO Jacuí IPRO	88.03	91.3495
311- Massal Maradona RR X NS 6700 IPRO	14.11	17.1177	195- HO Puricá X HO Jacuí IPRO	88.02	91,3392
300- Massal Maradona RR X NS 6700 IPRO	14.10	17.1140	651- DM 5958 RR x Massal Maradona RR	88.00	91.3288
CYCLE (days)			DAYS TO FLOWERING (days)		
Crossing	a[1]	Blup	Crossing	a[1]	Blup
64- TMG 7262 RR x CZ 15b70 IPRO	156.49	168.5465	578- TMG 7823 RR x NS 6700 IPRO	59.5489	68.5245
1289- TMG 7262 RR x CZ 15b70 IPRO	156.45	168.5317	580- TMG 7823 RR x NS 6700 IPRO	59.5489	68.5135
259- TMG 7262 RR x CZ 15b70 IPRO	156.12	168.5164	193- TMG 7823 RR x NS 6700 IPRO	59.5468	68.5052
224- TMG 7262 RR x CZ 15b70 IPRO	156.10	168.5012	486- TMG 7823 RR x NS 6700 IPRO	59.5317	68.4915
267- TMG 7262 RR x CZ 15b70 IPRO	156.07	168.4860	588- TMG 7823 RR x NS 6700 IPRO	59.5286	68.4805
273- TMG 7262 RR x CZ 15b70 IPRO	156.07	168.4708	734- TMG 7823 RR x NS 6700 IPRO	59.5151	68.4695
287- TMG 7262 RR x CZ 15b70 IPRO	156.07	168.4557	293- TMG 7823 RR x NS 6700 IPRO	59.5095	68.4586
256- TMG 7262 RR x CZ 15b70 IPRO	156. 06	168.4406	1181- TMG 7823 RR x NS 6700 IPRO	59.5067	68.4477
262- TMG 7262 RR x CZ 15b70 IPRO	156.0639	168.4255	1062- TMG 7823 RR x NS 6700 IPRO	59.5055	68.4368
286- TMG 7262 RR x CZ 15b70 IPRO	156.0639	168.4105	191- TMG 7823 RR x NS 6700 IPRO	59.4851	68.4259

[1]a- additive effects

Table 5: Specific combining capacity with emphasis on agronomic ideotype for grain weight per plant (GWP), number of grains per plant (NGP), number of pods per plant (NVP)

GWP (grams)			NGP		
Crossing	a[1]	Blup	Crossing	a[1]	Blup
893- NS 6700 IPRO x BMX Valente 6968 RSF	44.91	44.9124	536- DM 7.0 BMX Magna RR x BMX Ativa RR	218.76	218.7601
661- NS 6700 IPRO x BMX Valente 6968 RSF	44.83	44.8735	243- - DM 7.0 BMX Magna RR x BMX Ativa RR	218.13	218.4480
1111- NS 6700 IPRO x BMX Valente 6968 RSF	44.74	44.8322	542- - DM 7.0 BMX Magna RR x BMX Ativa RR	216.77	217.8896
20- NS 6700 IPRO x BMX Valente 6968 RSF	44.74	44.8109	517 - DM 7.0 BMX Magna RR x BMX Ativa RR	216.48	217.5394
1362- NS 6700 IPRO x BMX Valente 6968 RSF	44.71	44.7908	534 - DM 7.0 BMX Magna RR x BMX Ativa RR	216.32	217.2669
856- NS 6700 IPRO x BMX Valente 6968 RSF	44.69	44.7752	1355 - DM 7.0 BMX Magna RR x BMX Ativa RR	215.85	217.0561

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Continuation

GWP (grams)			NGP		
Crossing	a[1]	Blup	Crossing	a[1]	Blup
176- NS 6700 IPRO x BMX Valente 6968 RSF	44.54	44.7427	244- DM 7.0 BMX Magna RR x BMX Ativa RR	215.48	216.8323
1367- NS 6700 IPRO x BMX Valente 6968 RSF	44.51	44.7138	1217 - DM 7.0 BMX Magna RR x BMX Ativa RR	214.70	216.5658
969- NS 6700 IPRO x BMX Valente 6968 RSF	44.46	44.6866	334- DM 7.0 BMX Magna RR x BMX Ativa RR	214.54	216.3411
1216- NS 6700 IPRO x BMX Valente 6968 RSF	44.43	44.6611	1242- - DM 7.0 BMX Magna RR x BMX Ativa RR	214.40	216.1477

NVP		
Order of crossings	a[1]	Blup
243- DM 7.0 BMX Magna RR x BMX Ativa RR	93.65	93.6567
542- DM 7.0 BMX Magna RR x BMX Ativa RR	93.55	93.6045
20- NS 6700 IPRO x BMX Ativa RR	93.02	93.4114
541- FPS Solar IPRO x FPS Júpiter RR	92.81	93.2622
244- DM 7.0 BMX Magna x BMX Ativa RR	92.67	93.1444
1080- FPS Solar IPRO x FPS Júpiter RR	92.60	93.0544
1393- FPS Solar IPRO x FPS Júpiter RR	92.55	92.9832
536- DM 7.0 BMX Magna x BMX Ativa RR	92.48	92.9213
534- DM 7.0 BMX MagnA x BMX Ativa RR	92.39	92.8629
1384- FPS Solar IPRO x FPS Júpiter RR	92.39	92.8160

[1]a:effects aditivos

selection directed by lines 536 and 243, and 243 and 54.

The analysis of the principal components revealed dissimilar trends in the behavior of the parents regarding the direction of the crossing and the positioning as maternal or paternal parent. For restricted sense heritability, it was observed that the variable days to flowering stood out with h^2:0.34. The general combining capacity (GCC) revealed that the parents that meet the agronomic ideotype were NS 6700 IPRO for insertion height of the first pod, BMX Potência RR for plant height, TMG 7823 RR for cycle and days to flowering, BMX Valente 6968 RSF for the grain weight per plant, and BMX Ativa RR for the number of grains per plant and number of pods per plant. For specific combination capacity, it is observed that the cross between the parents Massal Maradona RR x NS 6700 IPRO meets the ideotype for insertion height of the first pods, for plant height it reveals HO Puricá RR x HO Jacuí IPRO, for the cycle view TMG 7262 RR x CZ 15b70 IPRO, days to flowering look for TMG 7823 RR x NS 6700 IPRO, grain weight per plant NS 6700 IPRO x BMX Valente 6968 RSF and number of grains per plant and number of pods by plan it is envisaged to interbreed DM 7.0 BMX Magna x Ativa RR.

CONCLUSION

The search for the selection of the agronomic ideotype can be obtained by the joint effect of genetic components and parameters combined with multivariates stratified for the effects of the parents.

The general and specific combining capacity allows the selection of additive and complementary gene constitutions for insertion height of the first pods with the parents Massal Maradona x RR 15b70 IPRO, plant height with HO Puricá x HO Jacuí IPRO, precocity through TMG 7262 RR x 15b70 IPRO, grain yield attributes through NS 6700 IPRO x BMX Valente 6968 RSF and DM 7.0 BMX Magna x BMX Ativa RR.

In this context, it is possible to use assertive genetic constitution to minimize the onerous production cost and enhance the yield and sustainability of soybeans.

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