

# Physiological Quality in Seeds Obtained by Topcrosses Between Vegetable Soybean and Grain Type

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## ABSTRACT

Attempts were made to study the gene introgression for high physiological quality from adapted cultivars in the vegetable soybean (exotic). Promising results were obtained for all topcrosses, with increased in germination percentage in majority. General mean of the germination percentage in topcrosses with large seeds exotic parental showed an increase from 28 to 46%, and topcrosses with small seeds exotic parental, from 54 up to 60%, both cases compared to self pollinated exotic parental. Related to variance, the topcrosses showed higher values than the self pollinated exotic parental, showing to be possible the selection of promising materials.

**Key words:** soybean, *Glycine max*, topcross, physiological quality in seeds, vegetable soybean.

## INTRODUCTION

Soybean production is about 30 million tons per year in Brazil (Agriannual, 1998), occupying the second position after corn, in terms of grains production, being behind just of the corn. Most of soybean is exported in the form of deflated bran. Recently an increase in the interest of the soybean employment in the human feeding occurred to supply the deficiencies of protein in destitute population from Brazil (Carrão-Panizzi, 1987).

In the oriental countries, soybean consumption for human food directly exist at three thousand years, even so in spite of the high quality nutritional, this doesn't have great acceptance in the Brazilian menus, mainly due the unfamiliarity of the existence of a specific category destined to the human consumption, denominated as soybean type food. The soybean type food includes two subgroups: the first of the vegetable soybean with big seeds (weight of hundred seeds (HSW) larger or equal to 20g), one and the second type broto/nattô with HSW smaller or equal to 10g, mentioned by Vello, 1992.

A problem presented by soybean type food is the fast germination loss and vigor (Santos, 1988), the physiological quality becomes a preoccupying factor in the improvement of this group (vegetable soybean), whose size of the seeds also predisposes the seeds to the mechanical and physiological damages during the crop and the storage (Vermetti, 1983). Wien & Kueneman (1981) observed that progenies with seeds of smaller size, in comparison with the one of larger size, were better in the storage, preserving the qualities of germination and vigor, and differences also exist among them in the deterioration rate after the crop, affecting the physiological quality (Green & Pinnell, 1968; Paschal & Ellis, 1978). Sung (1992) observed that in the field occurred a larger percentage of emergency in a faster way for the smaller seeds. An interesting data was observed by Rao & Sharma (1985) studying the germination and its correlations with other characters, the germination in the field presented a positive correlation of 0,017 with seed size, this value is low, even so it should be explored with appropriate methods of selection.

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A possible solution to deal with conservation problem could be the gene introgression for high physiological quality of the seeds from two adapted cultivar (Doko and FT-2), Doko with late cycle and FT-2 with high precocity, efficient strategy according to Kiihl & Garcia (1989) and Kaster et al. (1989), both cultivars present enough physiological quality to serve of reference in the genetic improvement, searched for this character. In the work of Guerra et al. (1999) the results indicated that some soybean food type can be competitive in terms of production in relation to the adapted grain type, this fact is important, therefore in this way, in many soybean food type will have only the necessity to correct physiological quality problem in the seeds, not the productivity.

## MATERIAL AND METHODS

Genetic material employed in this experiment included 118 genotypes, everybody with seeds of same age and maintained in the storage in similar conditions, being: 72 topcrosses obtained by crossing of 41 exotic materials of big seeds and 3 of small seeds crossings with the two cultivars adapted Doko and FT-2, in that research it was used the generation F<sub>4</sub> and its 46 parental.

The genotypes were subdivided in two experiments in random blocks design, the first with 6 repetitions of the 72 progenies E<sub>1</sub>, the second formed by 2 repetitions of the 46 parentals, sowing on March 13, 1991, the experimental plot was composed by 3 lines with

4 hills each, totality 12 spaced hills of 0,6m among and inside of lines.

In sowing, 12 seeds were placed in each hill, the counting of emerged plants number was accomplished to the 14 days after sowing and registered, with emergency data were estimated the averages to Field Emergency Percentage (FEP) for each genotype, being adopted these values as an indicative of the physiological quality of the seeds. Also was estimated the variance for each genotype, value this, indicative of the potential of each crossing in producing a segregating transgressive of interest.

## RESULTS AND DISCUSSION

None of the exotic big seeds parental overcame in this experiment the parental Doko in field emergency percentage (FEP), while four parentals (Pluto, PI 165676, Biloxi 252N and Tarhell Black) were superior in the experiment realized for Destro (1991), a possible explanation could be in relationship the environmental conditions, causing a different behavior among the experiments, because the involved exotic materials possess low adaptation to our conditions, where any alteration can contemplate in a behavior different from experiments.

The obtained results (Table 1) indicated that the averages of the topcrosses are promising, an increase was observed in the percentage of germination average in various topcrosses in comparison at the exotic feminine parental, where the best performance were of the topcrosses involving the parental: Ivaí crossed with Doko (FEP=54%), relatively to the parental Ivaí self-cross (FEP=5%) and Hampton crossed with Doko (FEP=50%), relatively to the parental Hampton self-cross (FEP=6%), this fact shows that the progenies inherited genes for better physiological quality of the seeds from adapted parental, confirming the recommendation about the use of these for Kaster et al. (1989) as breeding for the character in study.

Some crossings presented FEP values smaller than the exotic parental employed, undesirable fact, but it is explained by the fact that some of the exotic parental chosen already presented high physiological quality of seeds, and the crossing of these with the adapted parental not improved for FEP character, examples observed in the Table 1 are: Tamba crossed with Doko and FT-2; Aliança Preta crossed with Doko; Biloxi crossed with Doko and FT-2; TN #4 x PI 230970 F<sub>7-4</sub> crossed with Doko and FT-2, in all those crossings occurred a decrease in FEP, however due to variance presence (Table 1) segregated transgressives can be selected with promising FEP, inside in this genotypes.

Existed genotypes in self-cross and also in crossings with values very similar to FEP, the obtained plants didn't inherit on the average the genes of adaptability from Doko or FT-2 parental,

therefore, a new process of topcrosses to obtain a larger progenies number can be interesting, increasing the possibility of the presence of at least a progeny with better FEP. As examples in the Table 1 can make an appointment to genotypes: Nimame crossed with FT-2 and its self-cross; PI 165672 crossed with Doko and self-cross; PI 230977 crossed with Doko, FT-2 and self-cross, among others.

For the variance values occurred the tendency of the progenies overcome yours parents, as example the crossing PI 230977-sel with Doko presented variance of 995 among the progenies, while the parental PI 230977-sel showed variance of 450. All the obtained variances presented in the Table 1 are promising, the higher values facility the selection of at least one interesting progeny for the program continuity.

Some topcrosses presented smaller variance values in relation to the parental feminine self-cross, with 10 cases in the total, being the most expressive cases for the topcrosses Stewart x Doko and Yamagataken x FT-2. These great variance values in the parental can indicate a strong environmental effect acting in the character in study, due its to have low heritability between 3 and 29% (Green & Pinnell, 1968), what without doubt can induce the selection mistakes, therefore the process should be accomplished in a cautious way (discerning), testing the materials by more years and environments before taking place the selection, even so the variances presented by the topcrosses are an indicative of the possibility about the transgressive segregated existence that can its useful for the continuity of the selection process.

**Table 1** - Field emergency percentage, averages obtained for until 72 plants for the obtained progenies of the crossings with Doko and FT-2, the self-crosses and until 24 plants for the parentais.

Parental	Averages			Variances		
	Self-cross	Doko	FT-2	Self-cross	Doko	FT-2
Adapted males:						
Doko	73			213		
FT-2	57			259		
Large seeds females:						
Aliança Preta	52	47	a	511	874	a
Araçatuba	30	51	23	656	550	598
Biloxi 252N (BRA 001201)	65	57	58	431	829	652
Cherokee	21	47	a	446	604	a
FC 31-665	36	53	a	395	582	a
Hakucho	07	36	38	81	704	750
Hampton	06	50	39	86	774	633
Hogyoku	18	38	52	292	603	456
Ivaí	05	54	a	49	672	a
Japão-1	25	38	37	327	750	792
Japão-2	13	34	36	161	533	690
KS # 3 x Akiyoshi F <sub>7,2</sub>	39	46	58	609	723	571
KS-473 x SJ <sub>2</sub> -F <sub>7</sub>	36	51	44	297	595	364
Kurakake	30	44	a	548	755	a
Late Giant	11	26	36	147	468	723
Majós	26	40	a	571	489	a
Mammoth Yellow	13	27	a	298	559	a
Miyashipoken	17	31	31	414	597	481
Nimame	37	a	33	554	a	701
PI 80.441	23	47	47	385	820	790
PI 91.725-3	24	56	58	416	719	636
PI 165.672	40	46	a	378	801	a
PI 165.676	29	53	45	379	659	607

PI 229.320	18	41	54	482	751	584
PI 229.343	04	29	40	58	513	662
PI 230.977	52	52	55	382	1030	682
PI 230.977-sel.	29	60	49	450	995	806
PI 243.514	05	a	43	44	a	756

(cont.)

**Table 1** - (cont.) Field emergency percentage, averages obtained for until 72 plants for the obtained progenies of the crossings with Doko and FT-2, the self-crosses and until 24 plants for the parentais.

Parental	Averages			Variances		
	Self-cross	Doko	FT-2	Self-cross	Doko	FT-2
PL-1	02	a	38	47	a	601
Pluto	51	63	55	555	682	704
Stewart	44	56	a	675	470	a
Tadacha	45	55	a	471	584	a
Tamba	56	41	39	691	571	755
Tarheel Black	61	a	58	700	a	636
TK # 5 x Unknown-F <sub>7</sub>	43	41	53	678	678	630
TMV	14	50	62	217	655	669
TN # 4 x PI 230.970 F <sub>7-1</sub>	17	56	57	328	563	788
TN # 4 x PI 230.970 F <sub>7-4</sub>	54	46	42	706	561	802
Wolverine	01	42	a	16	711	a
Yamagataken	27	36	41	736	628	562
64-64 x KS-473	15	53	54	161	840	612
Small seeds females:						
IAC Santa Maria-702	85	66	a	318	485	a
Imperial	37	60	59	311	646	500
PI 80.459	39	60	69	254	563	482

a: crossings for which were not obtained seeds.

The Table 2 show the FEP average and variance average to 41 exotic parental (37 with big seeds and 4 with small seeds) self-crosses and in crossing with Doko and FT-2, could be observed that crossings involving parental with big seeds elevated the FEP average to lineages of 28 for 46%, intermediary values between the exotic lineage with large seeds (28%) and the adapted parental (65%) and for the small seeds of 54 in self-cross for more than 60% in crossing, a great progress for the character, behavior similar to the obtained for Destro (1991), and the crossings involving the materials with small seeds approached a lot of the observed for the two adapted parental.

For the averages of the variances, the crossings with Doko and FT-2 presented promising values for the new lineage selection, and in the crossings involving the exotic parental with big seeds was observed the largest values, 673 and 656 respectively, representing a great variability. In the crossings with small seeds parental has smaller variance averages (565 and 491), but this doesn't signify that inside of these crossings doesn't exist variability, on the contrary, it exist. The crossings presented superior variability in comparison at the lineage *per se*, reflecting an increase of the genetic base in the tested materials, fact wanted in an improvement program (Vello, 1992).

**Table 2** - Medium values and of variances of field emergency percentage for the parental and for the topcrosses of large and small seeds.

General Mean	Mean of Variances
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	Self-cross	Doko	FT-2	Self-cross	Doko	FT-2
Adapted	65			236		
Larges	28	46	46	386	673	656
Smalls	54	62	64	294	565	491

## CONCLUSIONS

For the obtained results can be observed that promising results were reached for the field emergency percentage (FEP) in various topcrosses, and the problem about low physiological quality was outlined in almost everybody, existing enough variability inside for selection of at least a progeny in the case where the FEP average was not favorable.

## RESUMO

Esforços foram feitos para estudar o efeito da introgressão de genes para alta qualidade fisiológica de sementes de cultivares adaptados na soja alimento (considerados exóticos). Resultados promissores foram obtidos para todos os topocruzamentos, com aumento na porcentagem de germinação na maioria dos materiais avaliados. A média geral da porcentagem de germinação nos topocruzamentos com parentais exóticos de sementes grandes mostraram aumentos de  $\bar{X}$  a 46%, e topocruzamentos com parentais exóticos de sementes pequenas de 54 a mais de 60%, ambos os casos comparados com os parentais exóticos auto fecundados. Em relação a variância, os topocruzamentos apresentaram valores maiores do que os parentais exóticos auto fecundados, mostrando a possibilidade de seleção de soja alimento com sementes com maiores porcentagens de emergência.

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