SCOTT-KNOTT CLASSIFICATION IN TWO CULTIVATION EPOCHS FROM TOPCROSSES AMONG FOOD TYPE AND GRAIN TYPE SOYBEAN

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INTRODUCTION

Exist a soybean (*Glycine max* (L.) Merrill) classification in two groups in agreement with yours principal uses: the first group, denominated grain type is employed manly in the bran and oil production, with medium grain size (one hundred seed weight (HSW) varying among 10 at 19 g), however have undesirable flavor; the second group is denominated food type, with flavor taste, constituted by two subgroups, the first with HSW smaller than 10 g, consumed in the sprouts form and natto (fermented) and the second with HSW presenting 20 g or more, being consumed directly by human principally in the immature pod form (R6 stage from the Fehr & Caviness scale (1977)) how snack, being denominated vegetable soybean, green soybean or edamame; presenting also the subgroups denominated sweet soybean (kuromame) and salad soybean (Vello, 1992).

The main characteristics presented by the vegetable soybean are big seeds; sweetened flavor (similar to the nuts); carbohydrate content high; without or smaller undesirable smell (Rackis et al., 1979; Carrão-Panizzi, 1989; Orf, 1989; Vello, 1992) and smaller anti-nutritional factors content, principally the Bowmann Birk and Kunitz anti proteases (Orf, 1989), characters existent in Japanese and Chinese genotypes principally; such genotypes have been introduced in Brazil for the improvement of the soy being sought the human feeding, because the soybean cultivate in Brazil is from the type grain with medium size seeds (PCS between 10 and 19 g) and flavor bitter, astringent, besides of the high lipoxigenases tenor and anti nutritional substances presence.

Recently is appearing in Brazil a new category of producer food type soybean with big seeds to assist at the interesting growth in Brazil to the direct human feeding and for export for oriental countries and, also, to the United States and Australia.

A problem existent in the exotic genotypes is the non adaptability to the Brazilian conditions (Santos, 1988). A possible solution is the crossing among exotic genotypes with adapted type grain genotypes, aiming to meet in a same plant the genes to the direct human consumption characteristics, presents in the exotic genotypes, with the genes to tolerance at the photoperiod, high productivity and high seed physiologic quality from the adapted genotypes. The research objective was to compare the topcrosses performance among food type with grain type soybean by Scott-Knott classification in two environments.

MATERIAL AND METHODS

The genetic material involved in this research were 24 progenies in the $F_{9:4}$ generation, originated from 15 topcrosses among large seeds exotic lineages (soy type food) that participated as feminine parentals with two adapted masculine cultivars (Doko and FT-2), seeking the association among food type characteristics from exotic parentals with adaptability from adapted parentals. The employed checkers were: IAC PL-1, Tamba, Late Giant and Nimame.

The research was installed in field conditions in the experimental areas from the Department of Genetics/ESALQ/USP, in Piracicaba, located at 22°42'33'' of South latitude and 47°38'00'' of West longitude and 540 m of altitude. The environments were: Piracicaba-summer (PV), with sowing on November 15, 1996; Piracicaba-autumn (PU), with sowing in March 07, 1997. The experiments were conducted in the randomized blocks design with two replications stratified in two groups with 12 experimental lineages and the checkers. Ten hills constituted the plot.

The evaluated characters were: **NDM**: number of days to maturity, counted from emergency until maturity (stadium R_8 in the scale from Fehr & Caviness, 1977); **PHM**: plant height in the maturity, in cm, measured as the distance between the soil and the inflorescence insertion most distant from main stem, analyzed on R_8 stage; **L:** lodging, evaluated in the maturity based in the scale of visual notes, varying from note 1 (plant erect) until 5 (plant totally lying); **PWV**: pod width by visual score, applied in the middle of distal locus, note based in scale from 1 (narrow pod) until 5 (release pod), analyzed on R_8 stage; **IPY**: individual plant yield, in grams, evaluated after pod threshing of the individual plants; **HSW**: one hundred seed weight, in grams, calculated taking the weight of 100 seeds per individual plant. **AV**: agronomic value, evaluated in the maturity, corresponding to a global index including productivity, general vigor of the plant, sanity, leaves retention, green stem presence/absent, a visual scale from notes was used varying from note 1 (bad plant) until 5 (great plant);

In the characters with significant differences by the test F ($P < 0,05$) to the treatments effect, the averages grouping was promoted by Scott & Knott method (1974) for each environment, for more details see Scott & Knott (1974) and Pacova (1992).

RESULTS AND DISCUSSION

In the summer environment (PV) the notes to pod width by visual score (PWV) varied from 2 at 3,5, similar at the autumn environment (PU) with 2,1 at 3,3, in this case there were not great changes in the amplitude and in the found values, what indicates that there was not environmental influence, in most of the evaluated materials the variation is very little, except to six topcrosses (1, 7, 10, 16, 20 and 24) with averages presenting a difference of 0,6 or more among averages. The best performance in the two tested environments were presented by the 2, 7, 14, 15, 16, 21 progenies and the checker IAC PL-1, these materials had the better behavior staying in the group A in the Scott-Knott classification in both tested environments.

The averages values found for the agronomic value character (AV) were different in the two environments, because in PV the means treatments were among 1,8 at 2,8 and in the environment PU among 1 at 1,8, indicating that in the stressful environment (PU) all the topcrosses presented values very inferior in relation at the appropriate environment (PV). The character AV presented different behavior for the topcrosses among the two environments, although in the environment PU only two groups were formed, but the progenies 10, 13 and 14 presented good performance in the two environmental conditions.

A particularity to the lodging (L) is that are wanted the groups with smaller values, representative from the less prostrated plants, the environment PV presented values from 2,4 at 4,5, while in the environment PU the width was from 1,3 at 4,1, in the environment PU the tendency were less prostrated plants, excepting the treatments 6 and 10, owed mainly to the smallest

development of the same ones. With relationship to the lodging (L) the best performance was presented by the progenies from the group B (smaller values), in the case to the two environments, the constant materials were: 2, 4, 5, 14, 15 and 20, while the others progenies varied from group.

In the environment PV the averages from number of days to maturity (NDM) exhibited values among 105 at 141 days, and in the environment PU among 100 at 120 days, showing the progenies tendency to decrease in the cycle in the autumn conditions. Interesting behavior was observed to NDM, where the most precocious materials were: 2, 7 and 16, with less than 110 days of cycle. The progenies 2, 5, 10 and 11 is later in the PU conditions in relation to PV, what is strange, because the tendency is larger precocity in PU conditions.

To the character plant height in the maturity (PHM) in the PV environment the averages were among 37 at 81 cm and in the environment PU among 24 at 72 cm, indicating that in the stressful conditions the plants development is prejudiced, with the plants developing less in height. Many topcrosses maintained good classification in the two environment conditions, and the best were 3 and 13, besides the topcrosses 11, 18 and 22, these progenies presented interesting PHM in the two environments, with PHM above 50 cm. Half of the tested materials stayed in similar classifications in the two conditions.

The individual plant yield (IPY) is one of the characters more influenced by environmental conditions, and in the environment PV the averages were among 38 at 161 grams and in the environment PU among 4 at 51 grams, a expressive reduction, being able to restrict the cultivation in the autumn conditions, because the production lowers can make unfeasible an appropriate economical return from the culture. All the evaluated materials presented similar behavior, reducing the production in the autumn conditions. Existed six topcrosses whose behaviors was interesting, the 3, 9, 12, 13, 18 and 24, with more than 100 grams in PV and 37 grams in PU.

The environment PV allowed the maxim expression to the seeds size character (HSW) with the averages variation among 13 at 28 grams. In the environment PU the averages were among 17 at 25 grams, with the maximum difference observed among the tested environments in the topcrosses 11 and 16. Expressive environment effect was not observed to cause great alteration in the topcrosses averages, in this case, eleven topcrosses stayed in the best classifications in the two environments (6, 7, 8, 12, 13, 14, 15, 18, 21, 23, 24), and one checker (Tamba), while the topcrosses 1, 2, 3, 5, 11, 16, 17, the checkers IAC PL-1 and Céu Azul to fell of the group A in PV for the group B in PU. The topcrosses 4 and 9 that were of the group A in PU presents bad performance in PV. The topcross 10 presented strange behavior, with increase in the medium size of the seeds (of 13 for 18 grams) from PV to PU environment.

Quadre 1. Means[1] (m) and classifications[2] (c) by Scott-Knott test from evaluated characters[3] in topcrosses among food type and grain type soybean, with base in repetitions averages (10 hills) from Piracicaba-summer (PS), sowing in 15/11/96 and Piracicaba-autumn (PA), sowing in 07/03/97.

Characters:	PWV				AV				L				NDM				PHM				IPY				HSW			
	PS		PA		PS		PA		PS		PA		PS		PA		PS		PA		PS		PA		PS		PA	
	m	c	M	c	m	c	m	c	m	c	m	c	m	c	m	c	m	c	m	c	m	c	m	c	m	c	m	c
Checkers:																												
Céu Azul	2,8	B	2,9	A	2,2	B	1,2	B	3,7	A	2,2	B	127	C	106	B	60	B	36	C	88	C	9	B	21	D	17	B
IAC PL-1	3,0	B	3,0	A	1,9	C	1,0	B	4,0	A	1,3	B	132	B	111	A	49	C	24	D	118	B	4	B	26	B	19	B
Tamba	2,9	B	3,2	A	2,0	C	1,0	B	4,1	A	2,6	B	128	C	114	A	61	B	31	D	119	B	4	B	25	C	21	A
Nimame	2,6	C	3,1	A	2,1	B	1,5	A	4,2	A	2,5	B	119	D	107	B	45	C	39	C	55	D	22	B	16	E	20	B
Progenies:																												
1	2,2	D	2,8	A	2,1	B	1,2	B	3,7	A	3,4	A	121	D	100	B	69	B	42	C	99	B	11	B	21	D	20	B
2	3,2	A	2,8	A	2,0	C	1,1	B	3,2	B	1,5	B	106	F	108	B	39	C	29	D	38	D	12	B	24	C	20	B

3	2,4	C	2,8	A	1,9	C	1,4	A	4,3	A	3,8	A	136	B	113	A	74	A	72	A	122	B	39	A	20	D	20	B
4	2,6	C	2,9	A	2,1	C	1,1	B	3,3	B	1,9	B	128	C	107	B	48	C	27	D	92	C	12	B	18	E	22	A
5	2,7	B	3,0	A	2,3	B	1,0	B	2,4	B	1,3	B	105	F	115	A	37	C	25	D	52	D	11	B	24	C	20	B
6	2,5	C	2,8	A	2,2	B	1,6	A	3,2	B	3,5	A	127	C	110	B	74	A	55	B	103	B	33	A	24	C	22	A
7	3,5	A	2,8	A	1,9	C	1,1	B	4,3	A	3,6	A	107	F	103	B	42	C	30	D	61	D	11	B	26	B	23	A
8	2,9	B	3,1	A	2,1	C	1,2	B	4,1	A	2,6	B	129	C	105	B	62	B	35	C	124	B	11	B	21	D	21	A
9	2,3	D	2,1	C	2,2	B	1,4	A	4,3	A	3,8	A	127	C	113	A	64	B	48	B	103	B	51	A	18	E	22	A
10	2,1	D	2,7	A	2,8	A	1,4	A	2,8	B	3,5	A	108	F	120	A	65	B	44	B	78	C	34	A	13	F	18	B
11	2,9	B	2,5	B	1,8	C	1,4	A	4,2	A	4,1	A	110	F	116	A	53	C	52	B	65	D	35	A	28	A	18	B
12	2,7	B	2,8	A	2,2	B	1,3	B	3,8	A	2,4	B	124	C	114	A	57	B	39	C	132	A	37	A	25	C	25	A
13	2,2	D	2,3	C	2,2	B	1,7	A	4,5	A	3,7	A	128	C	109	B	78	A	60	A	161	A	37	A	21	D	21	A
14	3,3	A	3,1	A	2,3	B	1,7	A	2,6	B	2,0	B	116	E	105	B	53	C	37	C	89	C	28	A	25	C	23	A
15	3,0	B	3,3	A	2,1	C	1,0	B	3,3	B	1,8	B	121	D	114	A	42	C	24	D	62	D	6	B	23	C	21	A
16	3,5	A	2,9	A	1,9	C	1,1	B	3,8	A	1,8	B	107	F	103	B	47	C	28	D	71	D	8	B	28	A	20	B
17	2,5	C	2,8	A	1,9	C	1,8	A	4,4	A	3,1	A	141	A	104	B	81	A	44	B	121	B	27	A	21	D	18	B
18	2,1	D	2,3	C	1,9	C	1,6	A	4,2	A	4,1	A	133	B	109	B	64	B	56	B	114	B	40	A	21	D	21	A
19	2,1	D	2,6	B	1,9	C	1,4	A	4,4	A	2,4	B	132	B	104	B	73	A	40	C	88	C	20	B	18	E	18	B
20	2,4	C	3,0	A	2,3	B	1,3	B	2,4	B	1,4	B	125	C	113	A	48	C	28	D	105	B	16	B	17	E	20	B
21	3,1	A	3,3	A	2,1	C	1,0	B	3,6	A	2,5	B	127	C	114	A	46	C	25	D	102	B	4	B	21	D	22	A
22	2,0	D	2,2	C	2,3	B	1,3	B	4,3	A	3,7	A	126	C	115	A	67	B	50	B	134	A	36	A	17	E	19	B
23	2,3	D	2,6	B	2,0	C	1,1	B	4,2	A	2,2	B	127	C	108	B	59	B	34	C	90	C	21	B	21	D	21	A
24	2,2	D	2,8	A	2,1	C	1,6	A	3,9	A	2,9	A	136	B	114	A	62	B	44	B	151	A	45	A	20	D	21	A

1. Twenty plants averages by progeny (10 hills/replication x 2 replications) and 40 plants by checkers (10 hills/replication x 2 replications x 2 groups).
2. In the column, averages followed by the same letter belong to a common group, because they don't differ for the Scott-Knott grouping method to 5% of significance.
3. Characters: L = lodging, notes from 1 to 5; AV = agronomic value, notes from 1 to 5; NDM = number of days to maturity; PHM = plant height in the maturity, in cm; PWV = pod width by visual score, notes from 1 to 5; HSW = one hundred seed weight, in grams; IPY = individual plant yield, grams/hill of individual plant.

CONCLUSIONS

- The treatments answer differently to the environmental conditions from the two evaluated places, causing alterations in the behavior from the evaluated characters.
- The Scott-Knott classification allowed to identify that the two environments are different to each other.
- Some evaluated treatments present atypical behavior in relation to majority, should is evaluated carefully in different environments.

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