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STABILITY PARAMETERS FOR SEED YIELD OF SESAME BLENDS AND THEIR COMPONENT LINES

BY

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ABSTRACT

This study was undertaken to evaluate a practical method that describes the relative worth of genotypes in blend combinations. Six pure lines (three from branched types and three from non- branched types) were compared when grown as a sole pure lines and in difference blend combinations in ratios of 3:1, 1: 3 and 1: 2: 3 in nine environments (3 locations and 3 years) to evaluate phenotypic stability for seed yield/fed. The three blend lines from branched type were (1 MGS_8:3 MGS_{15}), (1 MGS_8:3 MGS_{25}) and (3 MGS_8:2 MGS_{15}:1 MGS_{25}) and the three blend lines from non-branched type were (1 $Shandweel_3$ 2 $Shandweel_5$ 3 $Sohag_1$), (3 $Shandweel_3$ 2 $Shandweel_5$ 1 $Sohag_1$) and (2 $Shandweel_3$ 3 $Shandweel_5$ 1 $Sohag_1$). All blends were stable according to phenotypic stability method and had high mean performance in seed yield/fed. Blend responses (expressed as deviation of the blend yield from pure – stand component average) ranged from – 18.9 to 12.4% and from – 19.4 to 4.7 % for branched and non – branched types, respectively. The three blend of the branched types and the three blends of the non-branched type exhibited positive blend response for yield/fed.

Key words: blend varieties, stability, blend response, sesame.

INTRODUCTION

Sesame (*Sesamum indicum* L) is an important oil seed crop being cultivated in the tropics and the temperate zone of the world for its edible oil, protein content and quality vitamins and amino acids. Sesame has received increasing interest as a source of good quality vegetable oil with antoxidative constituents (i. e. sesaminol, seamolinol and tocopherol) and as an excellent source of protein in developing countries.

Yield improvement is a major interest of plant breeders. The beneficial competition between two crop species is often incorporated into farming systems that protect the farmer in developing countries against crop failures. Less recognized, but also of great consequence, is the competition that occurs between contrasting genotypes within a single crop species.

The growing blends of already existing cultivars, has been recognized as a viable way to increase and stabilize the yield of self crop pollenated. Much information can be obtained by studying the effects of blending two or more genotypes in sample mixtures. Smithson and Lenne (1996) reported that the varietal mixtures are presently a viable strategy for sustainable productivity in subsistence agriculture. In their opinion, mixtures have potential for improvement without sacrifice of diversity and are an important resource for future global food production. They added that blends may have an expanding role in modern agriculture in situations where qualitative unforminty is not of girding priority. Most of the studies of blends, or mixtures, in self – pollinated crops have shown a slight advantage in yield or outyield the highest component. Allard and Adams (1969) indicated that average of wheat increased by 6% when surrounded by plant of another varieties. Mixtures in wheat yield have been reported to have outyielded and were more resistance to stress conditions than the mean of their components in a pure- stand. Gill *et al.* (1984) Mundt *et al.* (1995) and Walsh and Noonan (1998). Many researchers study the performance of blends in barley, of them Per Kolster and Olavstoten (1989), Castiblanco *et al.* (1991), Mundt *et al.* (1994) and Einfeldt *et al.* (2005) found that the mixture varieties had positive effects on yield and disease control. Mixture or blend varieties in soybean have discussed by several workers, for exaple: Schutz and Brim (1967), Schweitzer *et al.* (1986) and Gizlice *et al.* (1989) reported that blends of soybean varieties showed superiorrity in yield as compared with pure line component averages. Tarhuni and Mc Nilly (1990) and Megahed (1999) studied the performance of *Vicia faba* cultivars in monocultures as compared with their mixtures or blends. Mixtures of cultivar combinations were higher in seed yield plot $^{-1}$ than means of the component cultivars grown in monoculture. Commercial mixture of wheat, peanut and soybean have found practical applications in USA and various other parts in world.

In the present investigation, we have studied mixtures of sesame lines to determine the relative yield of mixtures and pure stand and to establish the phenotypic stability of these blends as well as the their component.

MATERIALS AND METHODS

Eighteen experiments were conducted at Giza, Mallwi and Shandweel Agricultural Research Stations (ARC) during three successive summer seasons 2005, 2006 and 2007. Six diverse genotypes that represent adapted sesame lines and cultivars were selected for this blend evaluation study. These were MGS_8, MGS_{15} and MGS_{25} (branched type) and $Shandweel_3$, $Shandweel_5$ and $Sohag_1$ (non – branched type). The origin and pedigree of these six entries are shown in Table (1).

Table (1): Pedigree of the sesame genotypes studied.

Genotypes	Origin	Pedigree
Branched type		
MGS_8	Egypt	A line selected from line 38 × line 574
MGS_{15}	Egypt	A line selected from line 82 × Giza 32
MGS_{25}	Egypt	A line selected from line 130 × line 592
Non – branched type		
$Shandweel_3$	Egypt	A line selected from Giza 32 × N.A130
$Shandweel_5$	Egypt	A line selected from line B21 × line 574
$Sohag_1$	Egypt	A line selected from Giza 32 × N.A413

The six entries were grown in pure stand for each of them and were blended at ratio 3:1 and 1:2:3 in all possible combinations so that 12 blends for each of the branched and non-branched types were developed, as follows:

1- Group one of experiments:

This group included 3 branched type lines (Table 1) and 12 bland combinations among them as shown in the following scheme:

Pure stand treatment

Branched type

MGS_8 (A)

MGS_{15} (B)

MGS_{25} (C) 3

Mixture (blend) treatment

3 MGS_8 + 1 MGS_{15}

1 MGS_8 + 3 MGS_{15}

MGS_8 + 1 MGS_{25}

1 MGS_8 + 3 MGS_{25}

3 MGS_{15} + 1 MGS_{25}

1 MGS_{15} + 3 MGS_{25}

1 MGS_8 + 2 MGS_{15} + 3 MGS_{25}

2 MGS_8 + 1 MGS_{15} + 3 MGS_{25}

3 MGS_8 + 2 MGS_{15} + 1 MGS_{25}

1 MGS_8 + 3 MGS_{15} + 2 MGS_{25}

2 MGS_8 + 3 MGS_{15} + 1 MGS_{25}

3 MGS_8 + 1 MGS_{15} + 2 MGS_{25}

2 – Group two of experiments:

Included three non – branched type lines (Table 1) and 12 blend combinations as shown in the following pattern:-

Non – branched type

Shandweel$_3$ (D)
Shandweel$_5$ (E)
Sohag$_1$ (F)

3 Shandweel$_3$ + 1 Shandweel$_5$
1 Shandweel$_3$ + 3 Shandweel$_5$
3 Shandweel$_3$ + 1 Sohag$_1$
1 Shandweel$_3$ + 3 Sohag$_1$
3 Shandweel$_5$ + 1 Sohag$_1$
1 Shandweel$_5$ + 3 Sohag$_1$
1 Shandweel$_3$ + 2 Shandweel$_5$ + 3 Sohag$_1$
2 Shandweel$_3$ + 1 Shandweel$_5$ + 3 Sohag$_1$
3 Shandweel$_3$ + 2 Shandweel$_5$ + 1 Sohag$_1$
1 Shandweel$_3$ + 3 Shandweel$_5$ + 2 Sohag$_1$
2 Shandweel$_3$ + 3 Shandweel$_5$ + 1 Sohag$_1$
3 Shandweel$_3$ + 1 Shandweel$_5$ + 2 Sohag$_1$

Each individual treatment was entry were grown in a randomized complete block with four replications at nine environments (3 location × 3 years). Plot area was 10 m^2 (5 rows 4 meter long).Distance between rows was 50 cm and distance between hills within row was 20 cm for ranched type and 10 cm for non- branched type with 1 plant for branched type and tow plants for non - branched type left per hill after thinning. Cultural practices were done according to recommendations. The three guarded rows were harvested and evaluated for seed yield in ardab fed $^{-1}$.

Phenotypic stability analysis was computed according to Eberhat and Russell (1966). These components were calculated for every tested blends and pure line to compare the relative stability of blends or pure lines. Two stability parameters were calculated, b, the regression of the performance of each blends or pure lines under different environments on the environment means over all genotypes and S^2d, mean squares of deviation from linear regression. The expression of blend responses was calculated as deviations of blend yields from the means of components in pure stands according to Gizlice *et al.* (1989).

RESULTS AND DISCUSSION

Mean performance:

Result in Table (2) shows the mean of seed yield fed-^{1}. (ard) for twelve branched blends and their branched pure lines, in nine environments. Result shows significant differences among pure lines and their blends in all environments. The seed yield of pure lines over nine environments ranged from 5.6 to 6.4 ard fed $^{-1}$. The MGS$_{15}$ was the highest in seed yield in the pure stand over different environments.

Range among blends in seed yield/fed over different environments was 4.9 – 6.5 ard fed $^{-1}$. The blend (1A with 3 B) gave the highest seed yield but difference from the of other two combination were insignificant. The highest seed yield of pure stand was shown by MGS$_{15}$ (i. e., B).

The mean of seed yield fed $^{-1}$. (ard) for twelve non-branched blends and their three non-branched pure lines in solid stands grown, in nine environments are presented in Table (3). There is no significant difference among pure stands of the three main cultivars over different environments. Three blend lines (1 D + 2 E + 3 F), (3 D + 2 E + 1F) and (2 D + 3 E + 1 F) were the highest in seed yield with insignificant difference among them over the nine environments. These blends were high by 6.5 %, 4.8 % and 3.1 % over their cultivars in the pure stand (D, E and F, respectively). From the previous data, the blending of the three non – branched lines at any ratio was better than blending of two lines at any ratio. These results are harmony with those obtained by Sumarno and Fehr (1980) and Cesar and Mundt (2000).

Gallandt *et al.* (2001). evaluated the performance of wheat mixtures and their pure line cultivars in wide range of environmental conditions. They found that mixtures were 1.5% higher yielding than the mean yield of their pure line cultivar components over all environments. Also, Mille *et al.* (2006) indicated that four – way mixtures in terms of grain yield, 1000 – grain weight, grain protein and disease leaf area reduction were better as predicted by performances of two – way mixtures than those of pure lines.

Table (2): Mean of seed yield in ardab fed^{-1} of 12 branched blends lines and their pure stands lines in nine environments.

Genotypes	Giza			Mallwi			Shandweel			Mean
	2005	2006	2007	2005	2006	2007	2005	2006	2007	
Pure lines										
MGS_8 (A)	6.7	5.8	4.1	4.1	5.3	4.6	5.8	4.7	6.7	5.6FG
MGS_{15} (B)	7.3	7.8	7.3	4.7	5.9	5.2	4.8	7.5	7.5	6.4AB
MGS_{25} (c)	7.2	6.1	6.0	4.0	5.7	4.7	6.1	5.4	6.0	5.7FG
Blends Combinations										
3A+1B	4.3	5.1	5.6	4.9	4.7	5.1	4.7	4.5	5.3	4.9H
1A+3B	7.6	7.9	8.2	4.8	4.9	4.7	5.8	7.3	7.6	6.5A
3A+1C	4.5	7.3	7.0	5.0	5.2	4.5	5.4	7.4	7.0	5.9 EF
1A+3C	4.5	7.8	8.0	4.6	6.5	5.1	4.9	7.7	8.3	6.4ABC
3B+1C	5.7	5.7	6.7	3.6	4.6	5.4	5.9	5.2	7.0	5.5G
1B+3 C	8.1	5.5	7.2	4.1	4.1	5.1	8.4	4.6	7.3	6.0DE
1A+2 B+3C	6.9	5.4	6.0	4.5	4.1	5.0	6.8	5.0	6.3	5.6G
2A+1B+3 C	7.7	5.3	5.6	3.7	4.3	5.3	7.9	4.7	6.0	5.6G
3A+2B+1C	7.7	6.4	7.5	4.4	4.3	5.0	8.0	5.8	7.7	6.3 BCD
1A+3B+2 C	4.9	5.0	5.5	4.3	4.3	5.2	4.9	5.0	5.6	5.0 H
2A+3B+1C	6.2	5.5	6.3	4.2	5.0	4.4	5.9	4.9	7.0	5.5 G
3A+1B+2C	7.6	4.9	5.4	4.0	5.0	5.0	6.8	4.5	6.5	5.5 G

Table (3): Mean of seed yield in ardab fed^{-1} of 12 non- branched blends combination and their pure stand lines in nine environments.

Genotypes	Giza			Mallwi			Shandweel			Mean
	2005	2006	2007	2005	2006	2007	2005	2006	2007	
Pure lines										
$Shandweel_3$ (D)	7.0	7.4	7.5	3.9	5.9	5.2	5.6	6.6	7.0	6.2 C
$Shandweel_3$ (E)	7.0	6.4	6.7	4.6	5.6	5.0	7.4	7.5	7.0	6.3 C
$Sohag_1$ (F)	6.6	6.6	7.5	4.2	6.4	5.3	7.0	7.1	7.4	6.4 C
Blends combinations										
3 D + 1 E	5.1	7.8	7.5	4.1	6.5	5.7	4.7	7.7	7.7	6.3 C
1 D + 3 E	5.2	6.2	6.0	3.9	5.3	5.5	5.2	5.6	5.8	5.4 E
3 D + 1 F	6.7	5.1	5.6	3.8	5.3	4.4	5.8	5.2	5.6	5.3 E
1 D+ 3F	5.5	6.0	6.0	4.4	4.4	5.0	5.4	4.8	4.7	5.1 E
3 E + 1 F	7.3	4.5	6.0	4.0	5.0	4.2	6.7	4.9	4.9	5.3 E
1 E + 3 F	5.7	7.5	7.6	3.9	4.2	4.7	5.9	8.2	8.0	6.2 C
1 D + 2 E+ 3 F	8.0	7.3	6.8	3.7	6.4	5.1	7.4	7.4	7.6	6.6 A
2 D + 1 E + 3 F	5.9	6.8	6.9	4.1	6.2	4.5	5.5	7.2	7.4	6.0 D
3 D + 2 E + 1 F	8.0	7.0	7.7	4.2	5.2	5.4	6.5	8.0	7.4	6.6 A
1 D +3 E + 2 F	4.7	6.8	8.0	3.8	6.5	5.5	4.7	7.6	7.8	6.2 C
2 D + 3 E + 1 F	7.0	6.4	6.7	4.6	5.6	5.0	7.4	7.4	7.0	6.6 A
3 D + 1 E + 2 F	6.6	6.6	7.5	4.2	6.4	5.3	7.0	7.1	7.4	6.3 C

Significant differences among means over locations and seasons are designated with different letters using $LSD_{0.05}$ value.

Stability parameters:

The two phenotypic stability parameters for seed yield in ardab fed $^{-1}$ of twelve branched/or non – branched blend lines and their pure lines in different environment are presented in Table (4).The performance of MGS_{15} (B) pure lines in branched type had highly mean value of seed yield. Meanwhile, the branched blend lines (1A + 3 B), (1 A + 3 C) and (3 A + 2 B + 1 C) showed high yield at nine the environments. On the other hand, the non – branched pure lines had approximately same seed yield over all environments. Whereas, three non – branched blend lines (1D + 2E + 3F), (3D + 2E + 1F) and (2 D + 3 E + 1 F) revealed the highest productivity over different environments. With regard to estimates of phenotypic stability parameters, all pure lines and blends in either the branched type or the non – branched one had regression coefficient estimates that did not differ significantly from unit (b = 1) but, it differed significantly from zero ($b \neq 0$) except blend (3 A + 1 B) in branched type and blends (1 D + 3 E), (3 E + 1 F) and (1 F + 3 E) in non – branched type at nine environments.

According to the criteria of Eberhat and Russell (1966), a stable preferred variety would have high mean performance, the regression of genotypes yield on environmental conditions did not differ significantly from unity and differed significantly from zero and the deviation from regression close to be zero (S^2d) . In branched type, one pure line (MGS_{15} (B)) and three blends (1A + 3 B), (1 A + 3 C) and (3 A + 2 B + 1 C) would be the most stable in all environments. With respect to non – branched type, all pure lines and three blends (1D + 2E + 3F), (3D + 2E + 1F) and (2 D + 3 E + 1 F) are considered the best entres in all environments. These results in are agreement with those obtained by Schilling *et al.* (1983), Gill *et al.* (1984), Smithson and Lenne (1996), Mundt (2002), Agrorastos and Goulas (2005) and Ceccarelli and Grando (2007). They reported that mixture of pure lines in self – pollinated crops has several advantages. Allard (1999) reported that simple physical mixtures of pure lines of inbreeders (e. g., barley, wheat, rice, phaseolus – beans) yielded more than the mean of their components and are often more stable (homeostatic) in performance than their components grown in pure stand. This suggests that heterogeneity often leads either to 1) phenotypic interactions that provide gains in performance and/or 2) mutual buffering or homeostasis that results in steadier performance.

Blend response:

Blend response is the deviations from the average of the component pure varieties for branched and/or non – branched types are shown in Table (5). Five of twelve branched blend lines and three of twelve non – branched lines exhibited positive blend response for seed yield fed^{-1}. Whereas, the differences were significant in 3 blends either in branched or in non – branched types. The range of blend response in branched type was from – 18.2 to 12.4 %. The blends (1A + 3 B), (1 A + 3 C) and (3 A + 2 B + 1 C) were the highest entries from branched type they were 4.7 %, 12.4 % and 6.3% higher than the pure lines component averages.

Range of non – branched type was from -19.4 to 4.7%. The blend combination of (3D + 2 E + 1 F) yielded either slightly or significantly better than the rest of non – branched blends. The mechanism of blend response is not well understood, but it is a subject of interest in the prediction of blending combinations. These results are in agreement with those obtained by Gizilica *et al.* (1989), Megahed (1999), Cesar and Christophr (2000) and Mille *et al.* (2006). Superior blend performance may prove to be desirable breeding objective in determinate sesame.

Table (4): Phenotypic stability parameters for seed yield fed $^{-1}$ (ard) of twelve branched/or non – branched blend lines and their pure lines in different environment.

Branched type					
Genotypes	$\bar{x}$	b	$T_b = 0$	$T_b = 1$	$S^2 d$
Pure lines					
MGS_8 (A)	5.6	1.22	6.4**	1.2	0.07
MGS_{15} (B)	6.4	1.12	2.5*	o.27	0.89
MGS_{25} (c)	5.7	0.99	3.9**	0.05	0.20
Blends combinations					
3 A + 1 B	4.9	0.11	0.75	4.4**	0.09
1 A + 3 B	6.5	1.6	4.2**	1.6	0.61
3 A + 1 C	5.9	0.75	1.4	0.46	1.24
1 A + 3 C	6.4	1.97	2.4**	0.05	0.21
3 B + 1 C	5.5	1.2	6.1**	1.0	0.09
1 B + 3 C	6.0	1.8	4.0**	1.8	0.92
1 A + 2 B + 3 C	5.6	1.1	4.0**	0.3	0.26
2 A + 1 B + 3 C	5.6	1.3	2.7**	0.6	1.02
3 A + 2 B + 1 C	6.3	1.8	6.6**	2. 9	0.25
1 A +3 B + 2 C	5.0	0.43	2.7**	- 3.7	0.01
2 A + 3 B + 1C	5.5	1.1	7.5**	0.9	0.01
3 A + 1 B + 2 C	5.5	1.3	2.9**	0.3	0.64
Non – branched type					
Pure lines					
$Shandweel_3$ (D)	6.2	1.3	6.8**	1.5	0.1
$Shandweel_3$ (E)	6.3	1.1	5.2**	0.38	0.11
$Sohag_1$ (F)	6.4	1.2	10.8**	1.9	- 0.1
Blends combinations					
3 D + 1 E	6.3	1.2	2.7**	0.47	1.0
1 D + 3 E	5.4	0.62	3.9**	2.4 *	0.0
3 D + 1 F	5.3	0.74	3.1**	1.1	0.18
3 D+ 1F	5.1	0.40	1.8	2.7**	0.16
3 E + 1 F	5.3	0.66	1.5	0.79	0.95
1 E + 3 F	6.2	1.7	4.8**	2.0 *	0.63
1 D + 2 E+ 3 F	6.6	1.4	6.0**	1.9	0.21
2 D + 1 E + 3 F	6.0	1.3	5.6**	1.2	0.15
3 D + 2 E + 1 F	6.6	1.4	6.8**	1.2	0.13
1 D +3 E + 2 F	6.2	1.3	2.9**	0.63	1.0
2 D + 3 E + 1 F	6.6	1.1	3.2**	0.36	0.62
3 D + 1 E + 2 F	6.3	1.4	5.1**	1.4	0.29

*,** significant at 0.05 and 0.01 levels of probability, respectively.

Table (5): Mean blending yield, pure line component yield and blend response in branched and non – branched blend lines in different environments.

Blends identity	Blends mean	Pure lines component mean	Blend response: Difference ard/fed	Blend response: %
Branched type				
3 A + 1 B	4.9	5.8	-0.91**	-15.6
1 A + 3 B	6.5	6.2	0.29**	4.6
3 A + 1 C	5.9	5.6	0.27	4.7
1 A + 3 C	6.4	5.7	0.71**	12.4
3 B + 1 C	5.5	6.3	-0.74**	-11.8
1 B + 3 C	6.0	5.9	0.16	2.7
1 A + 2 B + 3 C	5.6	5.9	-0.39**	-6.5
2 A + 1 B + 3 C	5.6	5.8	-0.19	-3.3
3 A + 2 B + 1 C	6.3	5.9	0.38**	6.3
1 A +3 B + 2 C	5.0	6.1	-1.1	-18.2
2 A + 3 B + 1C	5.5	6.0	-0.54**	-9.0
3 A + 1 B + 2 C	5.5	5.8	-.0.26	-4.5
$LSD_{0.05}$			0.29	
Non-branched type				
3 D + 1 E	6.3	6.3	0.0	0.0
1 D + 3 E	5.4	6.3	-0.91**	-14.4
3 D + 1 F	5.3	6.3	-1.0**	-16.2
1 D+ 3F	5.1	6.4	-1.2**	-19.4
3 E + 1 F	5.3	6.4	-1.1**	-16.9
1 E + 3 F	6.2	6.4	-0.23	-3.5
1 D + 2 E+ 3 F	6.6	6.4	0.26**	4.1
2 D + 1 E + 3 F	6.0	6.4	-0.30**	-4.7
3 D + 2 E + 1 F	6.6	6.3	0.30**	4.7
1 D +3 E + 2 F	6.2	6.4	-0.23	-3.6
2 D + 3 E + 1 F	6.6	6.3	0.27**	4.2
3 D + 1 E + 2 F	6.3	6.3	0.0	0.0
$LSD_{0.05}$			0.26	

*,** significant at 0.05 and 0.01 levels of probability, respectively

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مقاييس الثبات لمحصول البذور فى مخلوط سلالات السمسم والسلالات النقية المكونة لها

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أجرى هذا البحث لدراسة الثبات المظهرى والتفاعل البيئى لصفة محصول البذور/فدان لخلطات من سلالات السمسم النقية بنسب مختلفة والسلالات االنقية المكونة لها لطرازان من السمسم (المتفرع وعديم التفريع) فى تسع بيئات لكل طراز (ثلاث مواقع وهى محطة بحوث الجيزه، محطة بحوث ملوى، محطة بحوث شندويل خلال الأعوام ٢٠٠٥، ٢٠٠٦، ٢٠٠٧). و قد استخدم ستة سلالات نقية من السمسم (ثلاث سلالات من الطراز المتفرع و ثلاث سلالات من الطراز عديم التفريع) خلطت هذه السلالات بجميع التوافيق الممكنة بالنسب (٣: ١ و٣:١ و ١: ٢ :٣) لكل طراز على حده. وقد أ ظهرت الخلطات (١ م ج س$_{٨}$ + ٣ م ج س$_{١٥}$) ، (ام ج س$_{٨}$ + ٣ م ج س$_{٢٥}$) ، (٣ م ج س$_{٨}$ + ٢ م ج س$_{١٥}$ + ١ م ج س$_{٢٥}$) من الطراز المتفرع والخلطات (١ شندويل$_{٣}$ + ٢ شندويل$_{٥}$ + ٣ سوهاج$_{١}$)،(٣ شندويل$_{٣}$ + ٢ شندويل$_{٥}$ + ١ سوهاج$_{١}$) ، (٢ شندويل$_{٣}$ + ٣ شندويل$_{٥}$ + ١ سوهاج$_{١}$) من الطراز عديم التفريع ثباتا للظروف البيئية المختلفة وبقدرة محصولية عالية طبقا لمقاييس الثبات. وقد تراوحت استجابة الخلط (الفرق بين محصول المخلوط ومتوسط السلالات النقية المكونة له) من – ٩،١٨ إلى ٤،١٢ % و من – ٤،١٩ إلى ٧، ٤ % للطرز المتفرعة وعديمة التفريع على التوالى. وقد كانت استجابة الخلط موجبه للمحصول فى خمس خلطات من الطرز المتفرع وثلاث خلطات من الطرز عديم التفريع.