Expressions of Hybrid Vigour in Some Yield Attributes of Egusi Melon (*Colocynthis citrullus* L)

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Abstract

This study which was carried out in the experimental plot of Faculty of Agriculture, University of Nigeria, Nsukka was aimed at determining the heterosis of some yield attributes in "Egusi" melon. The inbred lines used were Nsukka Blue (B), Nsukka White (W), Nsukka Elongated(E), Ovim I (Ov.1), W.SE. B.SE and Sewere types. Crosses made were; BXW, ExW, Sewere x W.SE, Ov.1x W.SE and Ov.I x B.SE. The F_1 showed positive heterosis in most of the yield attributes studied. It was however, higher in heterosis over mid parent value than heterosis over better parent value. Heteroses of F_1 over mid parent on seed yield/plant of 151.8, 140, 138.8, 98.8 and 49.4 were obtained from the F_{1S} of crosses Ov.1x W.SE, B x W, Ov.1x B.SE, Sewere x W.SE and E x W, respectively. Estimates of heterosis of F_1 over better parent gave 139%, 120.9%, 98.1%, 65.6% and 11.9% for crosses Ov.1x W.SE, Ov.1x B.SE, Sewere x W.SE, B x W and E x W, respectively.

Keywords: "Egusi" melon, Heterosis, Hybrid vigour.

Introduction

"Egusi" melon (*Colocynthis citrullus* L.) is a member of the Cucurbitaceae family. It is grown for its seed which is rich in oil and protein (Achu, M. B, et al 2005). It is very important in Nigeria and many other African countries where the seeds are used in preparing assorted dishes. The "Egusi" melon despite its important is among the group of crops referred by Okigbo (1975) as neglected crops of West African origin. Recently a number of researches has been carried out on some aspects of its agronomy. However, there is still paucity of information on the crop genetics and breeding. This work is designed to identify some useful genetic attributes for the formulation of breeding methods for improvement of the crop.

Heterosis is the increased vigour or superiority of an F_1 over the better of its parents or at least over the mean of the two parents. Heterosis was explained by the over dominance hypothesis proposed by Shull (1952) and East (1936).They reported that there is a physiological stimulus to development that increases with diversity of the uniting gametes, so that when crosses are made between parents of different origin, a greater vigour is expected than in parents that are closely related. Uguru (1998) explain the over dominance theory on the bases of the superiority of heterozygosity over homozygosity, whereby the individual with the greatest number of heterozygous alleles shows greatest vigour.

Heterosis provides a means for increasing crop yield and quality .It has therefore been used in the improvement of different agronomic attributes in many crops. The present study was initiated to determine the level of hybrid vigour in five crosses using seven inbred lines of "Egusi" melon.

Materials and Methods

The research was carried out in the Department of Crop Science experimental farm, University of Nigeria, Nsukka (Latitude 06° 52' North, Longitude 07° 24' East altitude of 447m above sea level).

The materials used in the study consisted of seven inbred lines of "Egusi" melon; Nsukka Blue (B), Nsukka White (W), Nsukka Elongated (E), Ovim I (Ov-I), Sewere, W.SE and B.SE. Crosses were made as follows; B x W, E x W, Sewere x W.SE, OV-1x W.SE and OV-1 x B.SE. The F_1s were selfed and crossed to their respective parents to obtain the F_2s, BC_1s and BC_2s.

The inbred parents and F_{1s} were evaluated in randomized complete block design (RCBD) with three replications. Analysis of variance (ANOVA) to test for genotypic effect was performed according to the procedures outlined by Steel and Torrie (1980) for randomized complete block design. Separation of means for statistical significance was by the F – LSD procedures described by Obi (1990). NPK fertilizer 20: 10: 10 was applied at the rate of 200kg/ha at three weeks after seedling emergence. At maturity the fruits were gathered and later processed to extract the seeds.

The following yield attributes were measured; number of fruits/plant, fruit yield/plant(kg), average fruit weight, seed yield/plant(g), number of seeds/plant, seed yield/fruit(g), number of seeds/fruit and 100-seed weight.

Test for Heterosis: Estimates of heterosis of F_1 over the mid parental value (H_{MP}) and heterosis of F_1 over the better parent value(H_{BP}) were obtained according to the procedure described by Uguru (2005),

$$H_{MP} = \frac{\overline{F_1} - MP}{MP} x \frac{100}{1} \%$$

$H_{BP} = \frac{\overline{F}_1 - BP}{BP} x \frac{100}{1}$% Where MP = mid parental values, BP = better parent value and $\overline{F}_1$ = mean of F_1s.

Results

Estimates of heterosis of the F_1 over the mid-parent mean (H_{mp}): The result in Table 1 shows the mean performance of the inbred parents and the hybrids. The analysis of variance showed significant differences among these genotypes in all the attributes measured.

The result presented in Table 2 shows that positive heterosis over the mid parent mean was recorded in all the crosses on number of fruits/plant. It was significant and high on crosses B x W, OV-1 x B.SE and Ov.1 x B.SE and very low and non-significant on crosses E x W and Sewere x W.SE. On fruit yield/plant all crosses showed positive heterosis (Table 2). Cross B x W showed highest heterosis on this attribute and was followed by cross OV-1 x W.SE while other crosses showed low heterosis. Only Ov.1 x B.SE showed non-significant heterosis on these attributes. Low heterotic values were recorded on all crosses on average fruit weight. They were however positive except cross OV-1 x B.SE that showed significant negative heterosis. All the crosses had significant and very high positive heterosis in seed yield/plant with the exception of cross E x R. In fact crosses B x W, OV-1 x W.SE and OV-1 x B.SE recorded heterosis of over 100%. Similar observation was made on number of seed/plant. The values on seed yield/plant were, however, higher (Table 2).

Low positive heterotic values were estimated on all the crosses on seed yield/fruit and number of seeds/fruit with the exception of cross Sewere x W.SE which had high heterotic value on these attributes. All the crosses showed very low but positive heterosis on 100-seed weight. Only Crosses E x W and Sewere x W.SE had significant heterosis in this attribute (Table 2).

Estimates of heterosis of the F_1 over the better parent (H_{bp}): The results presented in Table 3 shows that only crosses B x W, OV-1 x W.SE and OV-1 x B.SE had significant high heterosis on number of fruits/plant. Crosses E x W and Sewere x W.SE recorded low and non-significant heterosis. The later had negative heterosis. On fruit yield/plant all the crosses recorded positive heterosis, however, only crosses B x W and OV-1 x W.SE had high heterosis while E x W and Ov-I x B.SE had non significant heterosis. Very low and non-significant heterosis were recorded on average fruit weight on all crosses except Ov-I x B.SE. It was also negative in crosses E x W and OV-1 x B.SE. All crosses had positive heterosis on both seed yield/plant and number of seeds/plant. On these attributes heterosis was over 100% in crosses OV-1 x W.SE and OV-1 x B.SE and very low and non significant on cross E x W. Crosses B x W and Sewere x W.SE had high heterosis on these attributes. Heterosis of F_1 over better parent on seed yield/fruit was significant and high only in cross Sewere x W.SE and moderate in cross Ov.I x W.SE. Crosses B x W and OV-1 x B.SE recorded negative heterosis in this attribute. Heterosis was also low in all crosses in number of seeds/fruit and negative in crosses B x W and OV-1 x B.SE. The value obtained from cross Sewere x W.SE was however higher than what was recorded in other crosses. Crosses B x W and OV-1 x B.SE had negative heterosis in this attribute. Heterosis was low in 100-seed weight in all crosses. Crosses E x W, Sewere x W.SE and Ov-I x W.SE, however had positive heterosis while the other crosses recorded negative heterosis.

Discussion and Conclusion

The hybrids from the five crosses showed better performance than the mean parent performance in all the attributes measured with the exception of Ov-I x B.SE hybrid with negative heterosis in average fruit weight. The percentage heterosis was also high in most of the attributes but was highest on seed yield/plant and lowest on 100-seed weight. The better parents in the crosses showed better performance than their respective hybrids in some of the crosses. For instance hybrid B x W showed negative heterosis over the better parent in seed yield/fruit, number of seeds/fruit and 100-seed weight. Hybrid E x W showed negative heterosis over the better parent on average fruit weight. Hybrid Sewere x W.SE produced lower number of fruits/plant than the parent while hybrid OV-1 x B.SE had lower average fruit weight, seed yield/fruit, number of seeds/fruit and 100-seed weight than the better parent.

According to the over dominance hypothesis by Shull (1952) and East (1936), it is possible that crosses that showed higher heterosis were made from combination of parents of more diverse origin. They noted that high hybrid vigour is obtained from parents that are not closely related (Allard, 1980).This is the reason for the very high heterosis recorded in seed yield/plant by crossing OV-1 and W.SE. The OV-1 is a cultivar from the southeastern Nigeria while the W.SE is a cultivar from the western part of Nigeria. On the other hand the low hybrid vigour recorded by E x W hybrid could be attributed to the fact that both parents were selected from the same population and are therefore of the same origin.

The "Egusi" melon is grown for its seeds. The hybrid with high vigour in seed production will be adopted for improvement programme of the crop. The OV-1 x W.SE hybrid had highest seed yield/plant among the five hybrids. On other yield attributes this hybrid performed comparably well and is recommended. Other hybrids such as B x W and OV-1 x B.SE could also be considered for increase in seed yield.

Table 1: Mean performance of the inbred parents and their hybrids in the crosses

Genotypes	No. of fruits/ plant	Weight of fruits/plant (kg)	Average fruit weight(kg)	Seed yield/plant (g)	No. of seeds/plant	Seed yield/fruit (g)	No. of seeds/fruit	100-seed weight(g)
B	1.52	1.78	1.27	20.32	167.80	14.40	111.90	12.31
W	2.44	2.91	1.31	53.66	406.80	24.10	185.40	13.30
E	2.00	1.70	0.80	26.70	222.20	14.40	122.70	11.90
Sewere	2.50	1.89	0.90	37.50	296.70	16.90	132.00	13.00
Ov-I	2.10	2.50	1.30	41.70	329.50	22.00	172.30	12.90
W.SE	1.90	1.90	1.00	37.50	303.00	21.60	174.82	12.40
B x SE	3.00	2.50	0.80	35.60	336.10	10.50	99.00	10.50
B x W	3.95	5.18	1.34	88.84	686.90	23.40	178.10	13.10
E x W	2.50	3.10	1.20	60.00	449.60	24.80	186.70	13.70
Sewere xW.SE	2.20	2.50	1.10	74.80	539.40	35.10	260.13	14.40
Ov-I x W.SE	3.30	4.20	1.30	99.70	773.60	31.40	243.20	13.00
Ov-I x B.SE	5.50	2.60	0.90	92.10	758.90	18.70	154 00	12.20
F-LSD (0=0.05)	**0.45**	**0.36**	**0.14**	**8.47**	**62.84**	**4.10**	**29.77**	**0.37**

Table 2: Estimates of Heterosis of F_1 over the mid parental (Hmp) in yield attributes in the five crosses

Crosses	No. of fruits/plant	Fruit yield/plant(Kg)	Average fruit weight(g)	Seed yield/ plant(g)	No. of seeds/plant	Seed yield/fruit (g)	No. of seeds/fruit	100-seed weight (g)
Blue x White	99.49*	120.43*	3.88^{ns}	140.17*	139.06*	21.39*	17.04*	2.33^{ns}
Elongated x White	2.15^{ns}	34.93*	14.81*	49.37*	42.96*	29.02*	21.02*	8.23*
Sewere x W.SE	1.83^{ns}	28.95*	20.32*	98.88**	79.90*	82.10**	69.58**	9.66*
Ov–1 x W.SE	66.75*	89.95**	13.16*	151.84**	144.62**	43.26*	40.12*	2.33^{ns}
Ov –1 x B.SE	99.60**	4.36^{ns}	-6.93*	138.84**	128.04**	15.47*	13.54*	4.54^{ns}

** = significant at 0.05 probability level; ** = significant at 0.01 probability level; ns = non significant*

Table 3: Estimates of Heterosis of F_1 over the better parent (H_{bp}) in yield attributes in the five crosses

Crosses	No. of fruits/plant	Fruit yield/plant(Kg)	Average fruit weight (g)	See yield/plant g)	No. of seeds/plant	Seed yield/fruit (g)	No. of seeds/fruit	100-seed weight (g)
Blue x White	61.89*	78.01**	2.29^{ns}	65.56*	68.83*	-2.91^{ns}	-3.92^{ns}	-1.65^{ns}
Elongated x White	11.95^{ns}	6.19^{ns}	-6.06^{ns}	11.87^{ns}	10.52^{ns}	3.20^{ns}	0.45^{ns}	2.78*
Sewere x W.SE	-9.35^{ns}	26.94*	13.17^{ns}	98.09**	78.04**	62.20*	48.80*	7.13*
Ov–1 x W.SE	60.68*	69.80**	3.28^{ns}	138.98**	134.79**	42.81*	38.10*	0.62^{ns}
Ov –1 x B.SE	69.36*	3.53^{ns}	-25.40*	120.88**	125.80**	-14.71^{ns}	-10.62^{ns}	-5.13*

- *= significant at 0.05 probability level; ** = significant at 0.01 probability level ;ns = non significant*

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