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THE GENETIC PERFORMANCE OF SOME CONTINUOUSLY VARIABLE CHARACTERISTICS OF PEA UNDER DIFFERENT LOCATIONS

BY

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ABSTRACT

The combined analysis of variance over the Upper and Lower Egypt locations indicates significant differences between locations for all the studied traits. Highly significant differences among the effect of genotype x location interaction were detected for all studied traits except pod length. It would be necessary to test genotypes in more than one environment with great emphasis on location testing in the general breeding program to select the best genotype suitable for particular environment. There is an urgent demand for breeding of new genotypes with higher yield of better quality under the Upper Egypt conditions. Victory Freezer and Master B cvs. could be used directly or through breeding program in improving pea productivity under the investigation regions. The maximum significant heterosis in desirable direction was recorded for fresh pod yield/fedd followed by earliness in El-Gharbia (Lower Egypt) location and both fresh pod yield/fedd. and number of seeds/pod in Upper Egypt. Different types of dominance were exhibited in both locations for all traits except plant height, pod length and number of pods/plant, which exhibited partial dominance in all crosses of both locations. The predominance of additive and additive x additive types of gene action were not influenced by environmental changes and intra population selection would only be effective for improving the earliness. However, the improvement in either plant height or number of pods/plant in El-Gharbia location may be achieved by delaying the selection to later generation when dominance gene actions disappear and the additive gene accumulation increase through recurrent selection.

INTRODUCTION

Pea (*Pisum sativum* L.) is considered one of the most important crops for both local consumption and exportation. Many efforts are devoted nowadays to increase its productivity through genetical improvement. The improvement of pea yield depends upon a better understanding of the type of gene action controlling yield and its attributed components. Since the breeder practices selection in one environment and his selections are grown commercially in other ones, evaluation of breeding materials under different environments is necessary. Under the conditions of investigation regions, previous studies were directed mainly to either evaluating limited number of selected cultivars in different environments or studying the type and extent of gene action controlling certain traits (Shalaby, 1974; Zayed, 1988 & 1998; Zayed and Faris, 1998; Abdou *et al.*, 1999a&b; Zayed *et al.*, 1999; Ibrahim, 2002; Mahmoud, 2004). The aims of the present study are to determine the response of some parental and F1 populations of pea to locality changes as well as the effects of genotype x environment interaction. Among the objectives, also was to study the type of gene action controlling yield and its contributing characters in F1and F2 populations, and consequently identify the most efficient breeding procedure leading to maximum genetic improvement for these quantitative characters under both Upper Egypt and Delta (Lower Egypt) regions

MATERIALS AND METHODS

Two field trials were carried out at two different locations which differ in soils and climatic factors i.e, private farm (new reclaimed soil, Qeft, Qena governorate) in Upper Egypt region and farm of El-Gemmeza Research Station, (clay soil, Gharbia governorate) in Delta region during the seasons of 1999/ 2000, 2000/2001 and 2002/2003. Three cultivars of pea (*Pisum sativum* L.) namely Lincoln, Victory Freezer and Master B were used. The three parents were crossed on 1999/2000 and 2000/2001 seasons to produce seeds of the following 4 F_1's with at least 120 seed were obtained per F_1 hybrid:
Cross 1-Lincoln (P1) x Master B (P3)
Cross 2-Master B (P3) x Lincoln (P1)
Cross 3-Master B (P3) x Victory Freezer (P2)
Cross 4-Victory Freezer (P2) x Master B (P3)

Next season (2001/2002), F1 plants were grown to produce F2 populations' seeds. Additional F1 hybrids were, also, obtained during that season (2001/2002) by sowing the parents and crossing took place by hand pollination. In the winter season of 2002/2003 (3rd week of October) seeds of parents, F1 hybrids and F2 populations were planted at both location [Qena (L1) and Gharbia (L2) governorates] in a randomized complete block design with three replications to evaluate these populations. Each of the parents and F1 hybrids were represented by a single row, while the F2 population was represented by 6 rows per plot. The row was 70 cm. wide and 5 meters long (about 20 plants/row). All cultural practices were applied according to the recommendations of Ministry of Agriculture. The individual plants of the investigated populations were screened for the following traits: plant height, flowering date, both fresh pod length (cm) and width (mm), number of both seeds/pod and pods/plant as well as fresh pod yield (ton/feddan).

Statistical analysis:

The data of parental and F1 genotypes were subjected to statistical analysis for each location separately according to Steel and Torrie (1980) and combined over both locations in order to study the locality effect and the relative magnitude of genotype x location interaction. The combined analysis of variance was calculated as outlined by Little and Hills (1975). Estimates of variance components, both phenotypic (PCV) and genotypic (GCV) coefficients of variability and heritability percentage were obtained from the mean squares of the combined analysis of variance according to the methods described by Burton (1952).

Estimates of the arithmetic and geometric gene action were calculated according to Powers and Lyon (1941). Relative potence of gene set was used to determine the direction of dominance according to Mather and Jinks (1971).

RESULTS AND DISCUSSION

The studied genotypes exhibited significant variability in all characters examined at both locations of study. Comparison of L1 and L2 locations, indicated the superiority of L_2 over L_1 in most of genotypes for all studied traits.

Locality effect:

The combined analysis of variance over the two locations indicates significant or highly significant differences between locations for all the studied characters (Table 1). It is interested to note that, some genotypes behaved constantly at both locations, i.e., P3 with most traits, cross 1 and cross 2 in number of seeds/pod (Table 3). Some genotypes fluctuated from one location to another with certain traits, i.e., mean of days to flowering for P2 was 54.6 days in the first location while it was 49.2 days in the second one, in spite of having the same rank. Also, number of seeds/pod for the same parent was 4.6 in the first location and 7.3 seeds in the second. and nost of genotypes fluctuated in number of pods/plant from location to another. Highly significant differences among the effect of genotype x location interaction were detected for all studied traits except for pod length, reflecting the drastic effect of varying environments among locations besides the differential response of genotypes in these environments. However, the insignificant effect of G x L interaction for pod length makes it is possible to improve this trait through selection in both locations. Furthermore, location had the major effect on the relative genotypic potential of these traits, in which the genotype x location interaction was highly significant, these results indicate the importance of testing genotypes in more than one environment, i.e., year, location, with great emphasis on location testing to select the best genotype suitable for particular environment.

The best genotype which ranked the first in most vegetative and pod traits was genotype P3, in both locations followed by cross 3 in plant height and both length and width of pod in locality 1 while the cross 1 in the earliness and both length and width of pod in locality 1 and 2, respectively. Also, P2 and the cross 4 and cross 3 produced the heaviest yield in both locations, while cross 2 and P3 in locality 1 and 2, respectively. Chetia and Yadav 2003 reached similar results, and reported significant differences for all studied characters among the different pea genotypes, while the genotype x environment interaction was present for most traits. Abdou *et al.*, 1999 and Mahanta *et al.*, 2002 showed low environmental influence on the most of the studied pea traits .

Genetical effect:

The pertinent variance components in addition to genotypic (GCV) and phenotypic (PCV) coefficients of variability are presented in Table 2. Genetic variances (σ^2 g) were large in magnitude compared to error one (σ^2 e) in all studied traits, reflecting the genetic differences among genotypes. These results indicated that substantial amounts of genetic variance were detected for all characters. Moreover, it is obvious that $\sigma2$ g was large or comparable in magnitude compared to σ^2 g x l in all characters, representing the importance of genotypic variance in evaluation pea performance. Estimates of the phenotypic and genotypic coefficients of variability were determined with slight differences between them for all characters referring to highly genotypic variances and resulted in high or moderate estimates of broadsense heritabilities which, in turn, suggesting that phenotypic selection could be efficient. In this regard, Zayed *et al.*, 1999 found that the genetic variances (σ^2 g) were large in magnitude compared to error one (σ^2e) for most studied characters at both years reporting that substantial amounts of genetic variance were obtained for most characters in some environments. Ibrahim, 2002 and Sharma *et al.*, 2003 found that all characters, i.e., yield per plant, plant height, seeds/pod, pods/plant, flowering date and pod length exhibited significant variability, and the values of heritability, genetic advance and GCV for both pods/plant and yield/plant indicated that selection would be effective for further improvement., Our results were in accordance with these results of both authors. On the basis of the preceding results and discussion, there is an urgent demand for breeding of new genotypes with higher yields of better quality under the conditions of Upper Egypt and Delta. Finally, both parents 2 and 3 could be used directly or through breeding program in pea productivity under the investigation regions.

Mode of inheritance:

The range of the mid-parent heterosis and number of superior crosses showing significant desirable heterosis for each studied traits were examined and the results indicated that the expression of heterosis varied with crosses and characters investigated.

Table (1): Mean square values for Combined analysis of variance for studied traits in different genotypes cpuants and f1's over two locations

S.O.V	d.f	plant height	Flowering date	Pod length	Pod width	No. seeds	No. pods	Yield
Location (L)	1	40.697**	1477.6**	4.301*	2.746**	6.088**	201.83**	10.894**
Error (E_a)	4	0.052	0.1223	0.247	0.037	0.0101	0.060	0.008
Genotype(G)	6	385.21**	412.309**	7.419**	3.367**	6.589**	208.68**	1.793**
G x L	6	13.061**	105.699**	0.1562	0.748**	2.473	28.048**	0.602**
Error (E_b)	24	0.143	0.2197	0.108	0.026	0.0052	0.1802	0.0033

*, ** Significant at 0.05 and 0.01 % probability levels, respectively.

Table (2): Pertinent variance components, genotypic (GCV) and phenotypic (PCV) coefficients of variability and heritability % from combined analysis of variance for studied traits over two locations.

Parameter	plant height	Flowering date	Pod length	Pod width	No. seeds	No. pods	Yield
Genotypic variance σ^2 g	62.024	51.102	1.211	0.437	0.686	30.106	0.198
Phenotypic variance σ^2 p	64.202	68.718	1.237	0.561	1.098	34.781	0.299
Error variance σ^2 e	0.143	0.2197	0.108	0.026	0.005	0.180	0.003
Locality variance σ^2 l	1.316	65.330	0.197	0.095	0.172	8.275	0.490
Interaction σ^2 g x l	4.306	35.16	0.016	0.241	0.823	9.289	0.200
Phenotypic C. Variab. PCV	12.235	18.481	12.381	5.581	14.184	24.379	14.531
Genotypic C. Variab. GCV	12.026	15.937	12.250	4.922	11.211	22.682	11.840
Broad S. heritability H^2	96.6%	74.4%	97.9 %	77.8 %	62.5%	86.6%	66.4%

Table (3): Mean performance of parental, F1 and F2 pea populations for growth and quality characters in both L1 and L2 localities of study.

Trait Genotype		Plant Height		Flowering date		Pod Length		Pod width		No. seeds/ plan		No. pods/ Plant		Yelld	
		L1	L2	L1	L2	L1	L2	L1	L2	L1	L2	L1	L2	L1	L2
Parent 1		78.3	74.8	59.4	55.4	7.25	8.16	11.9	13.0	4.7	7.1	25.8	27	3.15	3.45
Parent 2		70.3	72.6	54.6	49.2	7.16	7.25	13.1	13.8	4.6	7.3	35.1	36.6	3.77	4.35
Parent 3		49.3	51.6	30.8	30.8	102	10.6	15.4	14.5	8.9	8.2	17.8	18.1	2.4	4.00
F_1 Population															
Cross 1		63.8	66.8	52.5	36.0	8.96	9.94	12.8	14.0	7.8	7.7	18.6	22.2	3.09	3.77
Cross2		65.1	66.3	53.9	33.7	8.09	9.78	12.8	13.5	7.9	7.8	18.8	22.0	3.18	3.69
Cross 3		61.8	68.4	52.8	33.3	9.10	9.67	13.3	13.6	7.6	8.1	18.9	29.0	3.56	5.29
Cross 4		63.0	64.7	52.6	34.0	8.97	9.76	13.1	13.5	7.5	8.2	19.0	29.9	3.62	5.34
F_2 Population															
Cross 1	Mean	73.8	55.9	60.0	49.0	6.31	8.57	12.4	13.2	4.35	5.82	29.7	28.9	3.37	4.44
	Rang	45.0	35.5	40.4	34.0	4.10	5.70	12.1	11.0	2.0	4.30	21.0	17.0	2.10	2.99
		91.0	75	70.0	60.0	8.20	12.0	12.8	18.0	7.0	8.80	48.8	34.0	4.20	5.94
Cross 2	Mean	68.3	66.7	60.9	44.5	5.80	9.54	12.3	11.6	4.4	7.85	28.7	23.9	3.42	4.41
	Rang	42.0	42.0	38.0	28.0	3.90	7.30	12.1	9.0	3.0	4.70	21.0	17.0	2.80	2.90
		80.0	89.0	70.0	60.0	7.90	11.0	12.8	16.0	6.0	9.50	47.0	30.0	4.40	6.64
Cross3	Mean	65.4	63.1	61.1	42.5	5.75	9.83	12.4	14.2	4.95	8.04	22.9	27.7	3.68	4.56
	Rang	30.0	42.0	39.0	25.0	4.80	7.0	11.9	11.9	3.0	6.22	15.0	17.0	3.10	3.11
		78.0	80.0	72.0	75.0	6.50	11.7	12.8	15.5	8.0	9.70	28.0	38.0	4.30	5.99
Cross 4	Mean	64.7	61.4	60.1	43.2	6.23	7.86	12.5	13.0	4.6	7.76	25.7	33.3	3.98	4.48
	Rang	31.0	50.0	31.0	28.0	5.40	4.50	11.4	8.9	3.0	6.00	21.0	20.0	3.40	3.00
		78.0	77.0	70.0	57.0	6.80	11.5	12.9	15.1	6.0	9.50	34.0	49.0	4.30	6.00

When the observed F1 mean for plant height of all crosses was compared with that of the two parents, there was a partial dominance towards the longest parent in both locations except cross 1 in Upper Egypt locality (L1) which lay between both parents. This would indicate, also, a positive heterosis of longest plant over the shortest one (Table 4) This was confirmed by potence ratio. indicating partial of dominance. A great variation was manifested in F2. indicating the existence of genetic and environmental variations affecting this trait. Highly significant heterosis for flowering date ranged from -14.9 % (cross 4 in L2) to 23.7 %(cross 3 in L1) for F1 hybrids over mid-parent was found. Desirable negative MP heterosis was observed in all crosses of locality 2, but non-of the crosses showed negative one in the locality 1 for this trait.

Regarding pod length, the magnitude of significant positive heterosis was up to 4.8 % in locality 1(Upper Egypt) and 9.7 % in locality 2 (Delta). Out of 4 crosses, cross 3 and cross 4 in both locations as well as cross 1 and cross 2 in locality 2, showed significant positive heterosis for this trait. The heterotic expression for pod width varied with extreme values ranging from -8.0 % to 1 7 % for both locations (Table 4)

Only one cross recorded significant positive MP heterosis in locality 2 All crosses of the first location and the remainder crosses of the second one showed significant negative MP heterosis The important direction of heterosis for this trait either in positive or negative depends on the breeder's point of view in respect to produce short or tall pods.

Table (4): Expected means of F1 and F2 populations and quantitative genetic parameters obtained for all studied traits.

Trait	cross	Arithmetic				Geometric mean				Heterosis		Potence ratio	
		F1		F2		F1		F2					
		L1	L2	L1	L2	L1	L2	L1	L2	L1	L2	L1	L2
Plant height	1	63.8	63.3	63.8	65.0	62.1	62.2	62.9	64.4	0.04	5.53**	0.00	0.30
	2	63.8	63.3	64.4	64.8	62.1	62.2	63.6	64.2	2.08	4.74**	0.09	0.26
	3	59.8	62.2	60.8	65.3	58.9	61.3	60.3	64.7	3.37**	9.97**	0.19	0.59
	4	59.8	62.2	61.4	63.5	58.9	61.3	60.9	63.0	5.38**	4.12**	0.31	0.25
Flowering	1	45.08	43.09	48.79	39.5	42.8	41.3	47.4	38.6	16.5**	-16.4**	0.50	-0.60
	2	45.08	43.09	48.99	38.4	42.8	41.3	47.6	37.3	17.4**	-21.7**	0.50	-0.80
	3	42.68	39.99	47.74	36.7	41.0	38.9	46.0	36.0	23.7**	-16.6**	0.90	-0.70
	4	42.68	39.99	47.64	37.0	41.0	38.9	36.4	36.4	23.3**	-14.9**	0.80	-0.60
Pod length	1	8.73	9.36	8.84	9.64	8.60	9.28	8.78	9.60	2.7	6.3**	0.20	0.50
	2	8.73	9.36	8.86	9.57	8.60	9.28	8.79	9.53	3.0	4.5**	0.20	0.40
	3	8.68	8.90	8.89	9.29	8.55	8.75	8.82	9.20	4.8**	8.7**	0.30	0.50
	4	8.68	8.90	8.83	9.39	8.55	8.75	8.76	9.24	3.3*	9.7**	0.20	0.50
Pod width	1	13.6	13.8	13.2	13.9	13.5	13.7	13.1	13.9	-6.4**	1.7*	-0.49	0.28
	2	13.6	13.8	13.2	13.6	13.5	13.7	13.2	13.6	-6.0**	-2*	-0.47	-0.39
	3	14.2	14.1	13.7	13.9	14.2	14.1	13.7	13.9	-6.7**	-3.8**	-0.82	-1.45
	4	14.2	14.1	13.7	13.8	14.2	14.1	13.6	13.8	-8.0**	-5.6**	-1.00	-1.80
No. seeds	1	6.78	7.64	6.29	7.68	6.43	7.61	6.09	7.76	15.1**	1.2	0.48	0.16
	2	6.78	7.64	7.36	7.71	6.43	7.61	7.15	7.70	17.2**	1.9*	0.54	0.36
	3	6.77	7.75	7.18	7.94	6.43	7.74	5.98	7.93	12.1**	4.9**	0.39	0.81
	4	6.77	7.75	1.15	9.97	6.43	7.74	6.96	7.96	11.2**	5.7**	0.36	0.96
No. pods	1	21.8	22.5	20.2	22.4	21.4	22.1	19.90	22.10	-14.7**	-1.62	-0.80	-0.08
	2	21.8	22.5	20.3	22.3	21.4	22.1	20.10	22.00	-13.8**	-2.5	-0.75	-0.13
	3	26.4	27.4	22.7	28.2	25.0	25.7	21.70	27.30	-28.5**	5.9**	-0.87	0.18
	4	26.4	27.4	22.7	28.6	25.0	25.7	21.80	27.70	-28.2**	9.3**	-0.86	0.28
Yield	1	2.77	3.73	2.93	3.75	2.75	3.72	2.91	3.74	11.5**	1.1	0.85	0.15
	2	2.77	3.73	2.93	6.71	2.75	3.72	2.96	3.70	14.7**	-1.0	1.09	-0.14
	3	3.09	4.18	3.32	4.73	3.01	4.17	3.27	4.70	15.3**	26.7**	0.69	6.34
	4	3.09	4.18	3.35	4.76	3.01	4.17	3.30	4.72	17.3**	21.8**	0.78	6.64

*, ** Significant at 0.05 and 0.01 % Probability levels, respectively

Heterosis for number of seeds/pod varied from 1.2 % to 17.2 % when both locations are considered non-of the crosses showed negative MP heterosis in any locations for this trait. For number of pods/plant, the most important yield component, significant positive heterosis was up to 9.3 % over MP. Two crosses in El-Gharbia location (L2) showed positive MP heterosis and all crosses of Qena location (L1) exhibited significant negative heterosis. Concerning fresh pod yield/fedd., significant heterosis up to 26.7 % over MP was recorded. Out of the studied crosses, 4 in Qena location and 2 in El-Gharbia showed positive heterosis for fresh pod yield

As shown in Table 4, the most important MP heterosis was exhibited for yield (both locations) followed by number of seeds/pod and earliness in Qena and El-Gharbia locations, respectively The maximum significant heterosis in desirable direction (26.7%) was recorded for yield followed by earliness (21 7 %) in El-Gharbia location (L2) and both yield per feddan (17.3 %) and number of seeds/pod (17 2 %) in Qena location Similar findings were reported by Lejeune-

Henaut *et al.*, 1992, Prakash *et al.*, 1993, Sarawat *et al.*, 1994 and Tyagi and Srivastava, 2003.

Potence of gene set (Table 4), which measure the average degree of dominance over all loci, was found to be less than unity for plant height, pod length and number of pods/plant (all crosses) in both locations and for number of seeds per pod and flowering date in Qena and El-Gharbia location, respectively. This revealing that such traits showed partial dominance. However, the potence ratio was greater than unity for pod width and yield (2 crosses) in El-Gharbia, indicating the role of overdominance in the inheritance of these traits. On the other hand, complete dominance was found in the inheritance of flowering date, pod width, yield (one cross for each trait) in Qena location and number of seeds/pod (one) in El-Gharbia. These results agree with those reported by Zayed, 1988, Srivastava and Singh, 1988, Rana and Gupta, 1994; Zayed, 1998 and Zayed and Faris, 1998.

As shown in Table 3, transgressive segregations were observed in both directions of the F2 populations (all crosses) for all characters in El-Gharbia locality except yield (crossl) and number of pods/plant (cross 4) which have tendency towards the better parent as well as plant height, flowering date (cross1) and pod length (cross 2) which segregated in direction of the worst parent. In the mean time, transgressive segregations were, also, observed in both directions of the F2 populations in Qena region for plant height (all crosses), yield and number of pods/plant (cross 1) and tendency towards the high yielding parent (crosses 2,3 and 4) and number of pods/plant (cross2). On the contrary, F2 populations for flowering date, number of seeds/pod, pod length (all crosses), pod width (crosses 3&4) and number of pods/plant (cross 3) segregated in direction of the worst parent in Upper Egypt region. Significant differences were observed in comparing the observed F2 means vs. the arithmetic geometric means (Table 4), indicating that additive and non-additive genetic variances were involved in the genetic behaviour of pod length, pod width, number of seeds, yield (all crosses) and number of pods/ plant (crosses 1&2) in both locations, as well as plant height in cross 2 and cross 4 (Qena region) and cross3 (El-Gharbia region). Therefore, the existence of both additive and dominance effects demonstrated that a considerable amount of readily fixable variations present and available for the plant breeder to manipulate.

On the other side, the observed F2 means in flowering date (all crosses) and number of pods/ plant (cross 4) in both locations, plant height (crosses 1&3) and number of pods/ plant (cross 3) in Qena as well as plant height (cross 2) in El-Gharbia were, relatively, close to the calculated arithmetic mean than to the geometric mean, indicating that additive gene effects were mostly important than other types of gene action. Also, F2 mean of plant height (crosses 1&4) and number of pods (cross 3) in El-Gharbia were closer to the geometric mean rather than the arithmetic one indicating that dominant gene effects mainly controlled the inheritance of these two traits. These results are on line with Singh 1995, Singh *et al.*, 2001; Kummar and Jain, 2002; Sawicki and Baros, 2002 and Singh and Mishra, 2003.

Finally, it could be concluded that the magnitude of additive and additive x additive types of gene action for plant height (cross1) and number of pods/ plant (cross3) varied from one location to another. On the other hand, the predominance of additive gene action for flowering date was detected in both locations for all crosses, indicating that additive and additive x additive types of gene action were not influenced by environmental changes and intra population selection would only be effective for improving the earliness. However, the improvement in any of both plant height and number of pods/plant in El-Gharbia may be achieved by delaying the selection to later generation when dominance gene actions disappear and the additive gene accumulation increase through recurrent selection. These results are in harmony with those obtained by Sharma *et al.*, 2000; Singh *et al.*, 2001 and Kaur *et al.*, 2003.

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دراسة السلوك الوراثى لبعض الصفات الكمية فى البسلة تحت ظروف بيئية مختلفة

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تمت دراسة أداء وطبيعة تفاعل التراكيب الوراثية مع البيئة وتقسيم التباين الى مكوناته والأهمية النسبية لكل مكون تحت ظروف منطقتي جنوب الصعيد (محافظة قنا)، منطقة الدلتا (محافظة الغربية) كما تم دراسة فعل الجين وتأثره بالبيئات المختلفة. وقد أوضحت النتائج مايلى:

١–وجود اختلافات معنوية بين التراكيب الوراثية المختلفة لكل الصفات المدروسة، كما وجدت اختلافات معنوية بين المناطق قيد الدراسة.

٢– كان التفاعل بين التراكيب الوراثية والمناطق GxL عالى المعنوية فى كل الصفات ماعدا طول القرن.

٣– من مقارنة التباين الوراثى وتباين الخطا وكذلك معامل الاختلاف الوراثى والبيئى تبين وجود وفرة كبيرة من الاختلافات الوراثية بين الأصناف والهجن لكل الصفات

٤–جدير بالملاحظة ان بعض التراكيب الوراثية أظهرت سلوكا ثابتا ومستقرا فى المنطقتين لبعض الصفات مثل الصنف ماستر فى التبكير وعدد القرون فى النبات وكذلك الصنف فيكتورى فريزر فى طول القرن وايضا الهجين ٢،١ لصفة عدد البذور.

ومن ناحية أخرى تذبذبت قيم بعض الأصناف من منطقة لأخرى مثل الصنف فيكتورى فريزر الذى أزهر بعد ٥٥ يوما تقريبا فى جنوب الوادى بينما كان مبكرا نوعا حيث أزهر بعد ٤٩ يوما فقط فى الدلتا .

٥–ظهرت أنواعا مختلفة من السيادة الجينية ذات تأثير على كل الصفات فى المنطقتين ماعدا صفة ارتفاع النبات وطول القرن وعدد القرون فى النبات التى كان التأثير فيها للسيادة الجزئية فى المنطقتين فى كل الهجن.

٦–ظهر تأثير فعل الجين المضيف واضحا على صفة الإزهار فى المنطقتين لكل الهجن المدروسة مما اظهر ان فعل الجين المضيف والتفوق لم يتأثرا بالتغيرات البيئية فى التعبير عن الصفة.

٧ -أظهرت الدراسة انه لتحسين صفة ارتفاع النبات وعدد القرون فى منطقة الدلتا لابد من تأخير الانتخاب لأجيال متأخرة بعد زيادة فعل الجين المضيف.

يمكن استخدام الصنف ماستر والصنف فيكتورى فريزر مباشرة أوخلال برامج تربية لتحسين الإنتاجية تحت ظروف منطقتى الدراسة.