http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 7 (8): 1390-1393, 2004
ISSN 1028-8880

Investigations on the Heritability of Seed Cotton Yield, Yield Components and Technological Characters in Cotton (*Gossypium hirsutum* L.)

[1]Sema Başbag and [2]Oktay Gencer
[1]Field Crops Department, Agricultural Faculty, Dicle University, Diyarbakır -Turkey
[2]Field Crops Department, Agricultural Faculty, Çukurova University, Adana-Turkey

Abstract: This study was carried out to determine the yield, yield components and the quality characters of two cotton cultivars Ogosta 644 and Sayar 314 and their generations of F_1, F_2, BC_1P_1, BC_1P_2 obtained by crossing them in the years between 1996-1998 in Diyarbakır. In the study, the number of boll per plant, seed cotton weight of per boll, seed cotton yield, plant height, rate of first picking, ginning turnout, 100 seed weight, fibre fineness, fibre length and fibre strength were determined and heterosis, heritability, F_2 depression, F_2 deviation were estimated. As a result, it was determined that seed cotton weight of per boll, 100 seed weight, fibre fineness and fibre strength had high heritability degrees, the number of bolls per plant had lower heritability degrees, while the other characters had moderately heritability degrees. The characters which were high heritability degrees have been suggested some possibilities in obtaining required genotypes by selection in early generations (F_2, F_3); delayed selection which had low heritability strongly recommended for some characteristics.

Key words: Cotton, yield components, heterosıs, heritability degree, back crossing

INTRODUCTION

Cotton is used in many fields such as cellulose, oil and soap industry, feeding animals and explosive material production etc. besides being the most important raw material of the textile industry.

Many breeding studies have been performed in order to improve the yield and the quality of cotton which is of a great importance for the economy of Turkey.

The main purpose of these breeding studies is to develop varieties of high yield and quality those can be adapted to the regions like other plants. It is very important to obtain the breeding method for the breeders to have knowledge about the genetic structure of the material.

Miller and Marani[1] reported high heterosis on lint yield but low heterosis on boll weight and earliness index but also they reported additive genes could have effect on boll weight fibre yield and percentage of fibre.

Baker and Verhalen[2] were carry out heritability studies with ten *G. hirsutum* L. and reported some heritability values that estimated from 0.28 to 0.57 for ginning turnout, from 0.45 to 0.51 for fibre fineness and from 0.41 to 0.66 for fibre strength properties.

Kayaoglu[3] estimated positive heterosis with on the properties of the plant height, seed-cotton weight, seed yield, seed-cotton index and fibre length but negative heterosis on the properties the ginning turnout, the number of bolls per plant, the fibre fineness and the fibre strength.

Gencer[4] reported the estimated some heterosis valves as 24.6, -5.30 , l8.7, 12.5, -0.9 and 17.0%, respectively, with regard to the number of bolls per plant, the seed cotton weight of per boll, the seed-cotton yield, the first hand seed-cotton value, the ginning turnout and the 100 seed weight; and also superior dominance in terms of the number of bolls per plant and the 100 seed weight, while he estimated partial dominance with respect to the seed-cotton weight per boll and the ginning turnout.
Ghulam *et al.*[5] investigated heritability of some characteristic of yield and quality, it is reported that 23.65% heterosis and 15.72% heterobeltiosis.

Tariq *et al.*[6] revealed that they estimated low heritability with respect to the seed cotton yield and the seed-cotton weight, but high heritability with respect to the ginning turnout and the fibre characteristics; superior dominance was important in terms of the seed-cotton yield, the boll weight and the ginning turnout, while the additive gene effect was important on 100 seed weight, the fibre index and the fibre length.

This study was conducted to examine yield criteria and heritability of fibre technological characteristics in F1,

Corresponding Author: Serma Başbag, Field Cops Department, Agriculture Faculty, Dicle University, Diyarbakir-Turkey

F_2 and back-cross generations (BC_1P_1 and BC_1P_2) that were formed as a result of cross-breeding between Sayar 314, the standard variety of The South Eastern Anatolia Region and the early Ogosta 644; in order to shed light on further studies to be carried out for different purposes.

MATERIALS AND METHODS

This study was conducted in the South-eastern Anatolia Agricultural Institute, Experiment Fields, Sayar 314, being the standard cotton variety of the region along with Ogosta 644, whose earliness was estimated in the previous introduction studies and F_1 and F_2 obtained by crossbreeding each other back-crossing (BC_1P_1) of the first parent and the second back-crossing (BC_1P_2) of generations were used as the material.

The varieties used as the material were sown in 4 rows of 10 m length of parcel with 1x0.5 m distances in crossbreeding field in 1996. The sowing was done by hand with seed bed method all of the year.

In 1997, back-cross and F_2 generations were obtained from sowing F1 with back-cross parents. In 1998, parents were sown 12 m length of parcel in four replications, according to F_1 (one row), F_2 (two rows) and back-cross generations (three rows) random block trial design. Then plot yields were translated to kg/da.

Fertilization was applicated as 70 kg N ha^{-1} pure nitrogen and 70 kg P_2O_5 ha^{-1} 20-20-0 compose fertilizer from in sowing and also 70 kg N ha^{-1} of urea fertilizer with the first irrigation was applicated. The harvesting was carried out two different time by hand.

RESULTS AND DISCUSSION

As shown in Table 1, there are three different groups among the genotypes in terms of the number of bolls per plant; Ogosta 644 parent and BC_1P_1 are in the same group; Sayar 314, the standard variety of the region, had the highest degree; BC_1P_2 was in the last group. This case, for the characteristics of the number of bolls per plant; it will be more useful to postpone the selection to the next generations.

About the seed cotton weight of per boll, BC_1P_1 (back-cross generation of Sayar 314) was in the first group and P_2 was in the last group while F_1, F_2 and BC_1P_2 generations were between the two groups. Sayar 314, was the longest among the other genotypes in terms of the plant height; however, F_2 was the shortest. The rate of first picking which was important early maturity character, BC_1P_2 showed the highest degree, while P_1 parents where showing the lowest with regard to this character. The other generations were among these groups.

Two different groups were occurred about the ginning turnout. Both parents (P_1 and P_2) and BC_1P_1 were in the first group, but F_1, F_2 and BC_1P_2 were in the second group in terms of the ginning turnout. It might be due to the similarities of the parents relative to the ginning turnout reflected to the generations.

The highest value for 100 seed weight was estimated in F_1 generations, followed by F_2 and BC_1P_2, However, P_1, P_2 and BC_1P_1 were in the second and also in the same group. There were two different groups among the investigated generations about the fibre fineness. BC_1P_2 was obtained the thinnest fibre generation. BC_1P_2 had the most length fibre and F_1 and F_2 genotypes followed this. The fibre of Ogosta 644 (P_2), which was used as superior parent in cross-breeding, was shorter than all the other generations. BC_1P_1 was determined as the lowest in terms of the fibre strength, while BC_1P_2 was determined as the strongest. However, F_2 generation showed resistance of fibre strength in both parents. This case mean that there was a positive transgressive segregation.

The highest heterosis value was estimated in the seed-cotton weight and the seed-cotton yield with regard to the investigated characteristics; and 100 seed weight followed this, respectively (Table 2). The fact that heterosis and heterobeltiosis values were significant revealed that the strength and the dominance of F1 were significant in these characteristics. Negative heterosis values were estimated in the number of bolls per plant and the ginning turnout.

Heterobeltiosis values were parallel to heterosis values in the generations. The highest heterobeltiosis value was estimated for the rate of first picking This was followed by the seed-cotton weight of per boll, seed-cotton yield, 100 seed weight, the fibre strength and the fibre length, respectively. On the other hand, negative heterobeltiosis values for the number of boll per plant, plant height and the ginning turnout characteristic were estimated.

A negative and low level depression was estimated in terms of the ginning turnout, while a significant F_2 depression was estimated in terms of the number of bolls per plant. The rate of first picking, fibre fineness, the seed cotton yield, the seed cotton weight of per boll, the fibre strength and 100 seed weight followed this, respectively. However, in the fibre length low level was seen F_2 depression.

The highest F_2 deviation was estimated for the number of bolls per plant. This was followed by the plant height, the ginning turnout and the fibre fineness, respectively. On the other hand, a negative F_2 deviation was determined in terms of the rate of first picking, seed cotton yield, 100 seed weight, the fibre length and the fibre strength.

Table 1: Mean comparison of yield and quality characteristics investigated in generations and obtained groups

Investigated characteristics	P_1	P_2	F_1	F_2	BC_1P_1	BC_1P_2	LSD
No. of bolls (boll/plant)	42.17a	38.00ab	36.68b	31.57c	39.68ab	32.00c	3.77
Seed-cotton wt. (g/boll)	4.98c	4.40d	5.68ab	5.25bc	5.97a	5.38bc	0.55
Seed-cotton yield (kg/da)	317.46b	287.03c	364.20a	350.77a	345.73a	310.50bc	27.32
Plant height (cm)	101.07a	98.28ab	95.78bc	92.36c	98.38ab	95.63bc	4.00
Rate of first picking (%)	58.71e	64.12d	74.12bc	70.23c	77.55ab	80.24a	5.26
Ginning turnout (%)	38.17a	38.05a	36.71b	36.71b	38.12a	35.85b	1.03
100 seed weight (g)	9.59b	9.52b	10.46a	10.26a	9.84b	10.25a	0.34
Fibre fineness (mic.)	4.47ab	4.53ab	4.63ab	4.53ab	4.80a	4.35b	0.43
Fibre length (mm)	26.30b	25.78b	27.58a	27.50a	26.63ab	27.63a	1.04
Fibre strength (g/text)	19.55b	18.65c	21.10a	20.58ab	18.33c	21.23a	1.53

P_1:Sayar 314, P_2 :Ogosta 644, BC_1P_1: back-cross generation Ogosta 644, BC_1P_2: back-cross generation Sayar 314

Table 2: Estimated values of heterosis, heterobeltiosis, F_2 depression, F_2 deviation and some variance with regard to investigated characteristics in generations

Investigated characteristics	Ht	Hb	F_2 Dep.	F_2 Dev.	V_E	V_A	V_D	Hbs
No. of bolls (boll/plant)	-9.21	-14.92	16.57	18.19	6.72	4.61	1.97	0.29
Seed-cotton wt. (g/plant)	20.99	13.95	3.82	-7.38	0.04	0.32	0.04	0.82
Seed-cotton yield (kg/da)	20.61	13.93	4.39	-5.21	5.06	24.46	-21.62	0.61
Plant height (cm)	-3.88	-5.33	3.78	5.53	11.43	11.88	3.32	0.68
Rate of first picking (%)	23.75	15.22	5.71	-3.77	8.94	32.40	-13.74	0.59
Ginning turnout (%)	-3.65	-4.53	-0.31	1.51	0.73	0.13	-2.24	2.13
100 seed weight (g)	9.49	9.97	1.99	-2.58	0.03	-013	0.68	0.78
Fibre fineness (mic.)	3.65	9.00	4.52	0.75	0.04	0.63	0.04	0.90
Fibre length (mm)	5.93	4.48	0.43	-3.52	0.45	3.84	-5.55	0.53
Fibre strength (g/text)	10.68	7.99	3.43	-2.37	0.32	5.55	0.12	0.90

Ht: Heterosis, Hb: Heterobeltiosis, F_2 Dep: F_2 Depression, F_2 Dev: F_2 Deviation, V_E:Environmental Variance, V_A: Additive Variance, V_D : Dominant Variance, Hbs : Brood Sense Heritability

The most significant environmental variance (V_E) about the characteristics which were investigated was estimated for the plant height and the rate of first picking, number of bolls per plant, the seed cotton yield, the fibre strength followed this, respectively. However the environmental variance was determined as very low level in terms of the seed cotton weight of per boll, 100 seed weight and the fibre fineness characteristics.

The additive variance (V_A) was estimated as follows: It was very high in rate of first picking and seed cotton yield and plant height but it was low level in seed cotton weight of boll per plant, ginning turnout and fibre fineness and also in 100 seed weight negative marked additive variance was estimated. Dudley and Moll[7] approved that the negative variance and the heritability degrees would be published regarding that they were likely to be interpreted.

A significant but negative dominant variance (V_D) was estimated in terms of the seed cotton yield and rate of first picking the ginning turnout and the fibre length; a positive dominant variance was estimated in terms of the plant height, 100 seed weight and the fibre strength; and a low dominant variance was estimated in terms of the seed cotton weight and the fibre fineness.

A significant heritability was estimated in terms of the seed-cotton weight, 100 seed weight, the fibre fineness and the fibre strength; an moderately heritability degree was estimated in terms of the seed-cotton yield, the plant height, the fibre length and a low heritability degrees was estimated in terms of the number of bolls per plant.

When a general assessment of the investigated characteristics it would be more useful to begun selection in cotton of breeding programme in the early generations (F_2, F_3) especially in the characteristics of seed cotton weight of bolls the ginning turnout, 100 seed weight, fibre fineness, seed cotton yield and fibre strength which had significant heritability degrees; but about the characteristics such as number of bolls per plant per plant, the fibre length and the plant height (due to the significant environmental variance) it should be more useful to began in later generations (F_4, F_5).

REFERENCES

1. Miller, P.A. and A. Marani, 1963. Heterosis and combining ability in diallel crosses of cotton. Crop Sci., 8: 299-303.
2. Baker, J.L. and L.M. Verhalen, 1975. Heterosis and combining ability for several agronomic and fiber properties among selected lines of cotton (*G. hirsutum* L.). Cotton Grow. Rew., 52: 209-223.
3. Kayaoglu, I.A., 1976. Adana Kosullarında Deltapine 15/21 Pamuk Çesidinin Diallel Melezlerinde Verim ve Kalite ile Ilgili Baslıca Özelliklerin Kalıtımı Üzerinde Arastırmalar.

4. Gençer, 0., 1980. G. *hirsutum* L. ve G.*barbadense* L. Türlerinden Sekiz Pamuk Çesidinin Diallel Melezlerinde Verim ve Kalite Ile Ilgili Baslıca Özelliklerin Kalıtımı Üzerinde Arastırmalar. Bitki Islahı Sempozyumu 1979 Tarımsal Arastırma Genel Müdürlügü Yayınları 1: 3 1-38. Izmir.
5. Ghulam, M., H. Sacedul, H. Shan and H. Gul, 1989. Estimation of hybrid vigour for some quality traits in intro-hirsutum diallel cross of cotton. Plant Breed. Abst., 59: 51.
6. Tariq, M., M.A. Khan, H.A. Sadaqat and T. Jamil, 1992. Genetic component analysis in upland cotton. J. Agric. Res., 30: 439-445.
7. Dudley, J.W. and R.H. Moll, 1969. Interpretation and use of estimates of heritability and genetic variances in plant breeding. Crop Sci., 9: 257-262.