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CORRELATION, REGRESSION ANALYSIS OF SEED OIL CONTENTS IN RELATION TO MORPHOLOGICAL CHARACTERS IN COTTON

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ABSTRACT

Cotton is the backbone of Pakistan's economy. More than half of the export of Pakistan depends on cotton and cotton-based products. Morphological quantitative traits are important for estimation of cotton yield. In this regard, a study was conducted to evaluate the morphological responses on cotton crop at experimental farm of MNS-University of Agricultural Multan during the year 2019-2020. Four cotton varieties with different time windows (early, normal and late) were sown in a randomized complete block design (RCBD) in a split plot arrangement. Correlation and regression studies of cultivars of *Gossypium* and *Malvaceae* were analyzed for quantitative characters. Result revealed that significantly positive correlation of boll weight (r=0.211), seed volume (r=0.138), seed oil content (r=0.020) and negatively correlation with seed index (r= -0.005) was displayed by all traits with seed cotton yield, which showed that seed cotton yield was greatly influenced by all characters. Regression coefficients showed that a unit increase in seed index (b=71.375), seed volume (b=120.326), seed oil content (b=4.954) resulted into a proportional increased in seed cotton yield. In future, this study will helpful in selection program for improvement of cotton varieties towards the yield.

Keywords: Correlation, regression, seed index, seed oil content, seed cotton yield.

INTRODUCTION

Cotton crop is known as the "King of Fibers". It has unique position in Pakistan's agriculture and economy. Cotton was grown on area of 2.325 million hectare with the production of 10.7 million bales in 2018-19 (PCCC, 2019). Cotton accounts for 0.8% share in GDP and taken as a major source of foreign exchange; 9.88 billion US$ in 2018-19 (Pakistan Economic Survey, 2018-19). No doubt, there has been an increase in cotton yield but the potential yield is not achieved yet. There are many economic and social problems causing decline in cotton production including; unexpected rainfall at planting time, leaf curl virus, increased temperature at the stage of flowering, small landholdings and improper production technology (Zingore et al., 2011). Another reason behind the low yield is poor quality seed especially low germination of cotton seed. The mechanism of seed germination mainly affects the yield of the cotton (Hoffmaster

et al., 2003). Cotton yield depends upon the high germination and emergence rates in various environmental conditions (Bozbek et al., 2006).

Naturally, the cotton is a bushy type plant and its height varies with respect to available soil where it is grown, and also with different varieties. The growth arrangement of cotton is an indeterminate (Awan et al., 2011). It is grown for the determination to get fiber which is further used in the clothes. Along with fiber, the cotton is also used for fuel purpose which is extracted from the seed cotton. From the day of freedom, the cotton played a very vital role in the uplift of both agriculture sector and industrial sector because of its effective importance as a foreign exchange crop (Shabbir, 2007). The economy of Pakistan depends to larger scope on cotton. It is because the fiber provided by cotton help to run the textile industry. The cotton fiber and other commodities associated to cotton are valuable things to be exported and it brings a lot of foreign exchange.

There are different factors that affect cumulatively on the cotton crop and bring grave consequences on the final yield. The two of the most important factors of those are sowing date and seed germination. Both these factors, different sowing date and different seed germination, play a decisive role in the yield of cotton (Tahir et al., 2004). The sowing date is one of the most significant agronomic factors that plays a role in the estimation and determination of final yield of cotton crop (Ali et al., 2009). For example, the same variety grown on the different sowing dates give different output. It is because the weather pattern gets changed suddenly and unexpected environmental situations are prevailing nowadays due to climate change. Sometimes, if there is sunshine, in the next day there's a severe storm or thunderbolts and it's raining cats and dogs. So, the variety grown on different time face altered environment as compared to the variety that is sown on the later dates (Dong et al., 2006). Same is the case for the late sowing varieties which have to cope with various dissimilar set of weather conditions.

Rauf et al., (2005) proposed that the earliness in sowing of cotton crop enables the crop to complete it cycle when there is sufficient amount of moisture and nutrients are existing in the root zone and hence the picking of such early sown crop will be done early which will save the lint from unfavorable environmental conditions (Li et al., 2009). So, basically, it is the time from sowing to harvesting that makes the varieties crucial for the contribution toward output. Moreover, nowadays the different technologies are being used whether to increase the resistance of crop to the invaders like insect-pests and unexpected weather alterations or these efforts are made to increase or decrease the life span of cotton crop (Jalota et al., 2009). Some cultivars take more time to harvest then the others.

Huang et al., (2015) illustrated that the sowing time has a direct effect on the yield of cotton crop and on the total dry matter accumulated. Furthermore, sowing time also lessen the effect of temperature for the reason that the temperature has a substantial impact on the growth and yield parameters of cotton crop. When the temperature of the environment boosts up, the growth of the plant also boots up (Iqbal et al., 2003).

MATERIAL AND METHODS

Experimental Site and Design

Experimental research was conducted at the experimental site of the Institute of Plant Breeding and Biotechnology, MNS-University of Agriculture, Multan, Pakistan during the year 2019-2020. The geological position of experimental site was 31.15° N and 71.44° E. The experiment was laid out in three replications with (RCBD) with split plot arrangements. Two variable factors

were under study, i.e. the four cultivation dates (March 19, April 1, April 16, and May 2) in the main plot and four cotton varieties Bt. (IUB-13, MNH-1027 (IS-1), MNH-1050 ,MNH-875) was studied in the sub-plot.

All the standard agronomic practices were uniformly adopted for all the plots and sub plots. Data were recorded by the standard methods. The plants were tagged in each plot for observation boll weight (BW); seed index (SI); seed oil contents (SOC); seed volume (SV); cotton seed weight per plant (CSW/P) and seed cotton yield (SCY).

Procedure for Data Recording

Data were recorded on the morphological traits of cotton traits are boll weight (g), seed index (g), seed volume(cm^3), seed oil content (%) and seed cotton yield (g).

The boll weight (g) was determined by isolating the all-out seed cotton yield per plant by the number of bolls per plant (Zaho et al., 2012). The seed index was calculated by counting 100 seeds and weight in grams was recorded using an electronic balance. Seed volume was calculated by using the measuring cylinder having 50 ml water and put the seed. Then final volume was noted. The difference in volume was taken as seed volume. The cotton seed oil content (%) of each seed sample was measured by the Soxhlet method Kates (1972). The procedure is that a pre-prepared grinding sample and weight on a 150 ml analytical balance of Hexane are poured into a 250 ml bottom flask with boiling flakes. Soxhlet apparatus is set for extraction. About an hour after extraction, the round bottom flask is heated in the concentrator bath. The solvent is removed and excess water is dried off the vial. The extracted fat is the weight and the fat content in the sample is calculated. In ripening, the experimental crop was harvested manually by selecting the procedure the inner rows of each plot (Cetin & Bilgel, 2002). The selection was performed at noon to avoid moisture in the cotton of the seed cotton yields (10% moisture) were determined at maturity of each piece. To find the plant population initially calculate the sample area by using formula sample row length (f) x row to row spacing (f). And then plant population = (No of plants in a sample area / sample area) total area.

Statistical Analysis

Data were subjected to analysis of variance (ANOVA) using a split plot within a randomized complete block design according to procedures outlined by Steel et al., (1997). The simple correlations also were applied on data to found statistically significant relations. The regression analysis was calculated where the data were found statistically significant using XLSTAT Version 2014.5.03 package.

RESULTS AND DISCUSSION

Analysis of variance showed that significant differences were present for all the studied traits (Table 1) and made it possible to investigate further for statistical analysis.

Boll Weight and Seed Cotton Yield

Boll weight had high significant positive correlation with cotton seed weight per plant (r=0.811**). It displayed positive correlation with seed index (r=0.094), seed volume (r=0.115) and seed cotton yield (r=0.211). It has negative correlation with seed oil content (r-0.264). The regression coefficient of cotton bolls weight (b=-167.495) indicated that for a unit decrease in CBW, there would be a proportional decreased of -167.495 in seed cotton yield. However, the results are fully supported by Hosny & Shahine (1995) who conducted experiment on cotton to find out the correlation of yield with various plant characters and found that significant association between boll weight and seed cotton yield. This correlation can be helpful in selection program for

improvement of cotton varieties towards the yield.

Seed Index and Seed Cotton Yield

Seed index had high significant negative correlation with seed volume (r= -0.490**). It displayed positive correlation with cotton seed weight per plant (r=0.057), seed oil contents (r=0.206) and boll weight (r=0.094). It has negative correlation with seed cotton yield (r= -0.005). The regression coefficient of seed index (b=71.357) indicate that for a unit increase in CSI, there would be a proportional increase of 71.357 in seed cotton yield. However, the results are fully supported by Simic et al., (2006) who conducted experiment on cotton to find out the correlation of yield with various plant characters and found that significantly association between seed index and seed cotton yield.

Seed Volume and Seed Cotton Yield

Cotton seed volume had high significant negative correlation with seed index (r= -0.490**). It displayed positive correlation with boll weight (r=0.115), cotton seed weight per plant (r=0.039), seed cotton yield (r=0.138) and seed oil content (r=0.069). The regression coefficient of seed volume (b=120.328) showed for every increased of one unit on the cotton seed volume, predicted that would be proportional increases of 120.328 in seed cotton yield. However, the results are fully supported to cotton seed volume by Yar et al., (2003) who's reported that early cotton cultivation yielded higher yields because this type of crop gave the maximum number of bolls with an average larger boll volume.

Cotton Seed Weight Per Plant and Seed Cotton Yield

Cotton seed weight per plant show the high significant positively correlation with cotton boll weight (r=0.811**). The seed cotton weight per plant show the significant positively correlation with seed index (r=0.057) and seed volume (r=0.039). The regression coefficient of cotton seed weight per plant (b=-74.088) indicated that for a unit decreased in SCW/P, there would be a proportional decreased of -74.088 in seed cotton yield. However, the results are fully supported by Pettigrew (2002) who has reported that early sowing of low plant population increase yield. Our research finding also supported the previous study of Kakani et al., (2005) who has suggested that early cotton production system has the ability to improve yield and quality due to the best environmental condition.

Seed Oil Contents and Seed Cotton Yield

Seed oil contents had positive correlation with seed index (r=0.206), seed volume (r=0.069) and seed cotton yield (r=0.020). It has negative correlation with boll weight (r= -0.264). The regression coefficient of seed oil content (b=4.954) showed for every increased of one unit in SOC, there would be a proportional increase of 4.954 in seed cotton yield. The discussion of the results showed that the data regarding seed oil content (%) showed significant among the treatment. Cotton seed oil contains high concentration of vitamin E, fatty acid and antioxidant. Our finding supported to the last study of Lamlom, (2018) who has reported that cotton seed oil increase by the application of different factors. Cotton seed oil content depends upon the seed index.

CONCLUSION

The conclusion of the study revealed that correlation for quantitative characters was significantly positive correlation of boll weight, seed volume, seed oil content, while negative correlation of seed index was observed with seed cotton yield. Thus, seed cotton yield was greatly influenced by all characters. In future, this study will help in selecting a program for improvement of cotton varieties towards the yield.

Table 1: ***Mean squares values for morphological in cotton (Gossypium hirsutum).***

Components Traits	Traits	Replication	Genotypes	Genotypes Location	Error
	D.f	8	3	9	24
Morphological Traits	BW	0.3067	0.1224*	0.1342	0.4585
	SI	1.2162	2.0215*	0.4362**	1.5468
	SV	0.4601	0.6318**	0.5893**	0.7336
	CSW/P	0.9912	0.6258**	0.8869**	1.7029
	SCY	563,490.96	240,320.28	275,301.29	204,350.53
	SOC	1.3692	7.2354	1.0598	5.4825

* = Significant at 5% probability level * = significant at P < 0.05
** = Significant at 1% probability level ** = significant at P < 0.01
BW, boll weight; SI, seed index; SOC, seed oil contents; SV, seed volume; CSW/P, cotton seed weight per plant; SCY, seed cotton yield; SOC, Seed oil contents.

Table 2: Phenotypic correlation coefficients of morphological traits in cotton ***(Gossypium hirsutum).***

Traits	SI	SV	CSW/P	SCY	SOC
BW	.094	0.115	0.811**	0.211	-0.264
SI		-0.490**	0.057	-0.005	0.206
SV			0.039	0.138	0.069
SCY					0.020

* = Significant at 5% probability level * = significant at P < 0.05
** = Significant at 1% probability level ** = significant at P < 0.01
BW, boll weight; SI, seed index; SOC, seed oil contents; SV, seed volume; CSW/P, cotton seed weight per plant; SCY, seed cotton yield; SOC, Seed oil contents.

Table 3: Coefficients of regression analysis.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	**Std. Error**	**Beta**			**Lower Bound**	**Upper Bound**
(Constant)	2141.715	2793.698		.767	.448	-3518.854	7802.284
BW	-167.495	292.579	-.186	-.572	.570	-760.316	425.326
SI	71.357	69.530	.218	1.026	.311	-69.523	212.237
SV	120.326	105.264	.245	1.143	.260	-92.960	333.612
CSW/P	-74.088	141.176	-.159	-.525	.603	-360.136	211.961
SOC	4.954	52.524	.018	.094	.925	-101.470	111.378

BW, boll weight; SI, seed index; SOC, seed oil contents; SV, seed volume; CSW/P, cotton seed weight per plant; SOC, Seed oil contents.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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