Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.4, No.6, 2014

Characters Association Analysis in Safflower (Carthamus tinctorius L.)

Tamoor Hussain[1], Muhammad Azeem Tariq[1], Ishfaq Ahmad[1], Muhammad Saghir[1], Maria Batool[1], Misbah Safdar[1], Ahmad Sher[2] and Muhammad Tariq[1]
[1]Barani Agricultural Research Institute, Chakwal, Pakistan
[2]Department of Agronomy, B. Z. University, Multan
* *E-mail of the corresponding author: tamoorhussain792@gmail.com*

Abstract
Twenty genotypes of safflower was evaluated to study the genotypic and phenotypic correlation coefficients and path effects of yield related traits on grain yield during rabi cropping season 2011-12 at Barani Agricultural Research Institute, Chakwal, Pakistan. Grain yield (kg/ha) correlated significantly and positively with plant height, boll diameter, number of grains per boll, 1000 grain weight and days to maturity. Thus these characters are the key yield contributing attributes to be given selection pressure for improving yield. The result of path analysis showed highest and positive direct effect of number of grains per boll followed by 1000 grain weight and plant height on grain yield (kg/ha).
Key words: Genotypic correlations, phenotypic correlation, path analysis, safflower

Introduction

Identification of the characters that influence grain yield in safflower (*Carthamus tinctorius* L.) is very imperative in genetic advancement of these characters. Principally, grain yield is a polygenic character that direct selection isn't successful for this particularly in early generation. Consequently, indirect selection via characters having higher heritability and interrelated sturdily with grain yield has more genetic effectiveness than direct selection in genetic enhancement of these characters (Golparvar, 2011). Correlation coefficient analysis helps researchers to differentiate considerable association between characters (Akbar and Kamran, 2006). Path analysis has been expansively used in field crops. Path analysis is used to find out the quantity of direct and indirect effects of the variables on the dependent variable (Ahmadzadeh et al., 2012). Cassato *et al., (1997)* observed positive and significant association of capitulum number plant^{-1} with seed yield in safflower. Rao and Ramachandram (1997) found high significance of capitulum number plant^{-1} and capitulum weight in breeding of grain yield in safflower cultivars. Arslan (2007) emphasized on indirect selection via higher capitulum number plant^{-1} and 1000-seed weight for enhancement of grain yield in safflower genotypes. The core objective of current research was to find out the dependence association of grain yield with yield related characters in safflower genotypes and to recognize the most important indirect selection criteria for genetic improvement of these characters.

Materials and Methods

To identify the relationship of yield and yield related traits, 20 genotypes of safflower including one check variety "Thori-78" were evaluated in randomized complete block design (RCBD) with three replications during 2011-12 at Barani Agricultural Research Institute, Chakwal, Pakistan. Each genotype was sown in 5m length with row to row and plant to plant spacing of 30cm and 10 cm respectively. All the cultural practices were carried out to manage the crop. The data were collected by using ten randomly selected plants in each genotype in each replication on days to 50% flowering, days to maturity, plant height(cm), boll diameter(cm), number of grains per boll and 1000 grains weight(g) while grain yield was recorded on plot basis then converted to grain yield (kg/ha). The data collected were used to estimate the genotypic and phenotypic correlation coefficient. Correlation estimates at both genotypic and phenotypic level were computed by using the formula given by (Snedecor and Cochran, 1989)

$r_g = COVg_{xy} / (\sigma^2 g_x \times \sigma^2 g_y)^{½}$
$r_p = COVp_{xy} / (\sigma^2 p_x \times \sigma^2 p_y)^{½}$

The path analysis was performed to find out the direct and indirect effects of all the characters under study by the formula suggested by Dewey and Lu (1958).

$$Path\ Analysis = rij = pij + \sum rikpk$$

Where
rij = mutual relationship of independent variable (i) and dependent variable (j)
pij = components of direct effects of independent variable (i) on the dependent variable (j) as measured by the path coefficients
Σ rik pk = summation of components of indirect effects of a given independent character (i) on a given dependent character (j) through all other independent characters (k).

Results and Discussions

Grain yield is a complex attribute controlled by a number of contributing characters. Therefore, it is imperative to identify the interrelationship of different traits with grain yield for improvement in genetic development in safflower. The result of current research revealed that phenotypic and genotypic characters associations are on par with each other signifying the less influence of environment (Table 1). Consistently grain yield had positive association with plant height, boll diameter, number of grains per boll, 1000 grains weight and days to maturity. However, non significant but positive correlation of grain yield noticed with days to 50 % flowering. Comparable conclusions were also reported earlier by Omidi-Tabrizi (2002) and Casatto *et al.* (1997). The Interrelationship among yield attributes showed that days to 50% flowering has significant positive association with plant height, boll diameter and days to maturity while days to maturity has significant and positive correlation with plant height, boll diameter and 1000 grain weight. Plant height has significant positive relationship with boll diameter, 1000 grain weight and number of grains per boll. Boll diameter has significant and positive correlation with number of grains per boll, and 1000 grain weight. These findings are in corroborated with the investigations of Arslan (2007); El-Lattief (2012); Golkar et al., (2011); Golparvar (2011); Mozaffari and Asadi (2006) and Naserirad et al., (2013).

The values of correlation coefficient indicate simply the nature and extent of relationship present among the pairs of traits. A dependent character like grain yield is governed by numerous communally related traits. If association arises due to direct effect of trait among dependent and independent attributes then it reflects a factual relationship among them. In the breeding programme selection can be accomplished for such traits to improve the dependent trait. The direct and indirect effects of various grain yield characters on grain yield both at genotypic and phenotypic levels are presented in Table-2. Among the entire yield contributing attributes the utmost direct positive effect of number grains per boll was followed by 1000 grains weight and plant height and was observed on grain yield. Hence, for the improvement of grain yield these characters must be considered in a direct selection criterion. Our results are in consonance with earlier reports Behnam (2010); Topal (2010); Arslan (2007) and Mozaffari and Asadi (2006). Days to maturity showed direct positive effect on grain yield and also contributed indirectly through plant height, number of grains per boll and 1000 grain weight while days to 50% flowering exhibit direct negative effect on grain yield. These results are contrary to the findings of Ahmadzadeh et al., (2012) who found negative direct effect of days to maturity and positive direct effect of days to 50% flowering on grain yield in safflower.

Conclusion

From the result of present investigation it can be concluded that plant height, number of grains per boll, 1000 grain weight and boll diameter were the key yield contributing characters through which high yielding genotypes of safflower may be selected for future hybridization programme.

References

Ahmadzadeh, A. R., B. Alizadeh, H. A. Shahryar and M. Narimani. 2012. Path analysis of the relationships between grain yield and some morphological characters in spring safflower (Carthamustinctorius) under normal irrigation and drought stress condition. J. Medi. Plants Res. 6(7): 1268-1271

Akbar, A. A. and M. Kamran. 2006. Relationship among components and selection criteria for improvement in Safflower (Carthamus tinctorius L.). J. Appl. Sci., 6(13): 2853-255.

Arslan, B. 2007. Assessing of heritability and variance components of yield and some agronomic traits of different safflower cultivars. Asian. J. Plant. Sci. 6 (3): 554-557.

Behnam, T., A. Said, S. Mohamadreza, B. B. Alireza and G. Gafari. 2010. Path analysis of seed and oil yield in safflower (Carthamus tinctorius L.). Int. J. Agric. Crop. Sci. 3(4): 114-122.

Cassato, E., P. Ventricelli and A. Corleto. 1997. Response of hybrid and open pollinated safflower to increasing doses of nitrogen fertility. IV International safflower conf. Italy.98-103.

Dewey DR, Lu KH (1959). A correlation and path co-efficient analysis of components of crested wheat grass and seed production. Agron. J., 51: 515-518.

El- Lattief, E. A., 2012. Evaluation of 25 Safflower Genotypes for Seed and Oil Yields Under Arid Envirnmen in Upper Eygypt. Asian J. Crop Sci., 4 (2): 72-79.

Golkar, P., A. Arzani and A. M. Rezaei. 2011. Determining relationships among seed yield, yield components and morpho-phenological traits using multivariate analyses in safflower (Carthamus tinctorious L.) Annals Biol. Res. 2 (3):162-169

Golparvar, A. R., 2011. Assessment of Relationship between Seed and Oil Yield with Agronomic Traits in Spring Safflower Cultivars under Drought Stress Condition. J. Res. Agric. Sci. 7 (2): 109-113.

Mozaffari, K. and A.A. Asadi. 2006. Relationships among traits using correlation, principal components and path analysis in safflower mutants sown in irrigated and drought stress condition. Asian J. Plant Sci. 5(6): 977-983.

Naserirad, H., A. Soleymanifard, R. Naseri and S.Nasiri. 2013. Study of correlation between important agronomic traits and path analysis for grain and oil yield in safflower. Int. J. Agro. P. Prod. 4 (4): 670-673.

Omidi Tabrizi, A.H. 2002.Correlation between traits and path analysis for seed and oil yield in spring safflower. J. Plant Seed. 18(2): 229-240.

Rao V. and M. Ramachandram. 1997. An analysis of association of yield and oil in safflower. Fourth International Safflower Conference. Italy, Bari, 2-7 June, pp: 185-191.

Snedecor W. and Cochran WG (1989). Statistical methods. Oxford and IBM Calcutta. Pp: 593.

Topal, M., E. Oztruk and T. Polat. 2010. Path analysis of seed yield components using different correlations coefficients in safflower (Carthamus tinctorius L.). J. Plant Animal Sci. 20(4): 220-224.

Table 1: Phenotypic correlation (PC) and genotypic correlations (GC) between grain yield and yield related attributes in safflower genotypes

Traits		Days to 50% flowering	Days to maturity	Plant height	Boll diameter	Number of grains per boll	1000 grain weight	Grain Yield
Days to 50% flowering	PC	1.000	0.9392**	0.6621**	0.2533**	0.0591	0.2024	0.1753
	GC	1.000	0.9613**	0.6882**	0.2661**	0.0653	0.2101*	0.1880
Days to maturity	PC		1.000	0.6624**	0.2624**	0.0434	0.2471*	0.2168*
	GC		1.000	0.6820**	0.2781**	0.048	0.2540*	0.2134*
Plant height	PC			1.000	0.5014**	0.3632**	0.4083**	0.5799**
	GC			1.000	0.5184**	0.3681**	0.4142**	0.5877**
Boll diameter	PC				1.000	0.4491**	0.5542**	0.7473**
	GC				1.000	0.4732**	0.6010**	0.7891**
Number of grains per boll	PC					1.000	-0.126	0.6492**
	GC					1.000	-0.124	0.6549**
1000 grain weight	PC						1.000	0.6124**
	GC						1.000	0.6174**

* and ** Significant at 0.05 and 0.01 level respectively

Table 2: Path analysis direct (diagonal) and indirect effects of yield related attributes on grain yield in safflower genotypes

Traits		Days to 50% flowering	Days to maturity	Plant height	Boll diameter	Number of grains per boll	1000 grain weight	Grain Yield
Days to 50% flowering	PC	-0.0302	0.0107	0.0240	0.0030	0.0328	0.1350	0.1753
	GC	-0.0187	0.0133	0.0219	-0.0078	0.0341	0.1452	0.1880
Days to maturity	PC	-0.0297	0.0103	0.0239	0.0031	0.0312	0.1780	0.2168
	GC	-0.0179	0.0120	0.0232	-0.0091	0.0302	0.1750	0.2134
Plant height	PC	-0.0203	0.0066	0.0409	0.0047	0.2608	0.2872	0.5799
	GC	-0.0131	0.0094	0.0349	-0.0149	0.2808	0.2906	0.5877
Boll diameter	PC	-0.0070	0.0021	0.0206	0.0114	0.3278	0.3924	0.7473
	GC	-0.0042	0.0043	0.0175	-0.0271	0.3657	0.4329	0.7891
Number of grains per boll	PC	-0.0021	0.0007	0.0140	0.0042	0.7333	-0.1009	0.6492
	GC	-0.0018	0.0009	0.0132	-0.0115	0.7584	-0.1043	0.6549
1000 grain weight	PC	-0.0052	0.0039	0.0170	0.0084	-0.1024	0.6907	0.6124
	GC	-0.0044	0.0028	0.0156	-0.0174	-0.1052	0.7260	0.6174

Residual effect of Phenotypic Correlation (PC) = 0.2043, Residual effect of Genotypic Correlation (GC) = 0.1412