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

Association Analysis in Linseed (*Linum Usitatissimum* L.)

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Abstract
Fifteen advanced lines of linseed (*Linum usitatissimum* L.) were evaluated to identify the relationship of grain yield and its related attributes during 2010-11 at Barani Agricultural Research Institute, Chakwal, Pakistan. Grain yield (kg/ha) had significant and positive association with plant height, number of primary branches plant^{-1}, number of capsule plant^{-1}, number of grains capsule^{-1} and 1000 grain weight both at genotypic and phenotypic levels. Therefore focusing on these traits would improve breeding efficiency of linseed in the future breeding programs. Path analysis demonstrated that plant height, number of primary branches plant^{-1}, number of capsule plant^{-1}, number of grains capsule^{-1} and 1000 grain weight had the positive direct effect in determining the grain yield (kg/ha) in linseed. According to these results, breeding for high grain yielding cultivars of linseed, number of capsule plant^{-1} should be kept in mind firstly followed by 1000 grain weight, number of grains capsule^{-1}, number of primary branches plant^{-1}and plant height.
Key Words: genotypic correlation, phenotypic correlation, path analysis, Linseed

Introduction

Linseed (*Linum usitatissimum* L.) also identified as flaxseed is belong to Linaceae family. It is the only economically significant specie of the family, its semi dehiscent and non-dehiscent capsules types of make it suitable for cultivation (Savita et al., 2011)). The origin of cultivated linseed is not exactly known, but it is assumed that the crop have been originated from the Indian sub-continent as the greatest genetic diversity of this crop present in this area (Genesar and Morris, 2003). It is a self pollinated crop but cross pollination can take place up to 2% (Tadesse *et al.*, 2009).

Grain yield is a complex character and its appearance mainly depends upon the interaction of numerous traits. A clear picture of contribution of each component in final expression of complex character would emerge through the study of correlations and path coefficient analysis revealing different ways in which component attributes influence the complex trait (Savita et al., 2011). In order to achieve the goal of increased production by increasing the yield potential of the crop, knowledge of direction and magnitude of association between various traits is essential for plant breeders (Iqbal et al., 2013). Accordingly, the current research was carried out to evaluate the relationship of grain yield and its related attributes and to recognize the direct and indirect effects of important characters on grain yield which can be used by plant breeder in future for development of superior genotypes with ideal combination of characters.

Material and Methods

To identify the relationship of grain yield and yield related attributes, 15 advanced line of linseed including one check variety “Chandani” were evaluated in randomized complete block design (RCBD) with three replications during 2010-11 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 agronomic cultural practices were adopted to manage the crop. The data were collected by using ten randomly selected plants in each advanced line in each replication on days to 50% flowering, days to maturity, plant height (cm), number of primary branches per plant, number of capsule per plant, number of grains per capsule 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 calculate the genotypic and phenotypic correlation coefficient. Correlation estimates at both genotypic and phenotypic level were calculated by using the formula given by (Snedecor and Cochran, 1989)

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

Direct and indirect effects of traits on grain yield were calculated using genotypic correlation coefficient of various traits as suggested by Wright (1921) and elaborated by Dewey and Lu (1959). Therefore the genotypic correlation coefficient of any attribute with grain yield was dividing into direct and indirect effects adopting the standard formula:

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

Where
rij = Mutual association 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

Characters Association analysis:

The results of present research showed that the number of capsule per plant, number of grains per capsule and 1000 grain weight had highly significant and positive while number of primary branches per plant and plant height had significant and positive relationship with grain yield (kg/ha) at both genotypic and phenotypic levels (Table-1). Both the genotypic and phenotypic correlations were in the similar direction, although the levels of genotypic correlation coefficients were superior in extent than the corresponding phenotypic correlation coefficient. This low degree of phenotypic correlation may be due to effect of the environment on the phenotype of the plants. The current investigation presented that selection strategy based on plant height, primary branches per plant, number of capsules plant^{-1}, number of grains capsule^{-1} and 1000 grain weight could give a superior solution for the enhancement of grain yield (kg/ha) in linseed. The similar results are also demonstrated earlier by Gauraha and Rao (2011), Sohan *et al*., (2004), Pal et al., (2000), Tadesse *et al*. (2009) and Nagaraja *et al*. (2009).

Path Coefficient Analysis:

The grain yield is reliant on numerous yield related traits. Minor alteration in any one yield character will eventually disquiet the complex. Therefore traits has to be study for its action namely direct effect of yield related attributes on grain yield and also the indirect effects through other yield related traits on grain yield. Hence characters associations were separated into direct and indirect effects and given in (Table 2). The role of various characters towards grain yield exposed that the number of capsules plant^{-1} prejudiced grain yield (kg/ha) directly and principally followed by 1000 grain weight and number of grains capsule^{-1}. The relationship of these traits with grain yield was also positive and significant, demonstrating the significance of these characters for enhancement of grain yield (kg/ha) in linseed. Number of capsules per plant also effects grain yield indirectly in a considerable degree through 1000 grain weight, plant height and grains capsule^{-1}. This specifies that capsules plant^{-1} is the most imperative attribute for the improvement of grain yield (kg/ha). The results of present research are in corroborated with the investigations of Akbar *et al.* (2003), Gauraha and Rao (2011), Iqbal et al., (2013), Pal *et al*., (2000), Savita et al., (2011) and Yadav (2001).

Conclusion

From the inference of current investigation it can be concluded that number of capsule plant^{-1}, number of grains capsule^{-1} and 100 grain weight are the most imperative selection parameters for the enhancement of grain yield in linseed as all these above traits correlate with seed yield significantly and positively at both genotypic as well as phenotypic level. Whereas path analysis also suggests that these traits had the positive and direct effect on the grain yield

Table 1: Genotypic (upper diagonal) and phenotypic (lower diagonal) correlation between grain yield and its related traits in linseed advanced lines

Traits	DFF	DM	PH	PBP	CPP	GPC	TGW	Grain Yield (kg/ha)
Days to 50% Flowering (DFF)		0.05	0.42	0.06	-0.08	-0.44*	-0.04	-0.04
Days to Maturity (DM)	**0.04**		0.45*	0.20	0.01	0.30	0.13	-0.14
Palnt height (PH)	**0.53**	**-0.15**		-0.42*	0.01	0.36*	0.18	0.41*
Primary Branches/plant (PBP)	**0.08**	**0.21**	**-0.01**		0.48*	0.19	-0.31	0.38*
Capsule/plant (CPP)	**-0.07**	**0.01**	**-0.41***	**0.43***		0.59**	0.51**	0.82**
Grain/capsule (GPC)	**-0.39**	**0.23**	**-0.08**	**0.17**	**0.56****		-0.07	0.55**
1000 grain weight (TGW)	**-0.05**	**0.11**	**-0.11**	**-0.53****	**0.49***	**-0.04**		0.68**
Grain Yield (kg/ha)	**-0.02**	**-0.12**	**-0.21**	**0.55****	**0.61****	**0.57****	**0.71****	

*and** Significant at 5% and 1% level respectively

Table 2: Path analysis for grain yield based on genotypic correlation coefficients in linseed advanced lines

Traits	Direct effect	Indirect Effect					
		PBP	CPP	GPC	TGW	PH	Total effect
Primary Branches/plant (PBP)	0.17	-	0.13	0.11	-0.11	0.08	0.38
Capsule/plant (CPP)	0.45	-0.09	-	0.03	0.27	0.16	0.82
Grain/capsule (GPC)	0.25	0.06	0.18	-	-0.05	0.11	0.55
1000 grain weight (TGW)	0.31	0.11	0.08	0.11	-	0.07	0.68
Plant height (PH)	0.14	0.02	0.11	0.08	0.06	-	0.41

References

Akbar, M., T. Mahmood, M. Anwar, M. Ali, M. Shafiq and J. Salim. 2003. Linseed Improvement Through Genetic Variability, Correlation and Path Coefficient Analysis. International J. Agri. Biol., 5(3): 303-305.

Dewey, D. H. and K. H. Lu. 1959. A correlation and path co-efficient analysis of components of crested wheat grass seed production. Agronomy J., 51: 515-518.

Gauraha, D. and S. S. Rao. 2011. Associationanalysis for yield and its characters in linseed (*Linum usitatissimum* L.). Research J. Agri. Sci., 2(2):258-260.

Genser, A. D. and N. D. Morris. 2003. History of cultivation and uses of flaxseed. In A. D. Muir and N. D. Westcott (eds). Flax- The genus *Linum.* Taylor and Francis, London.

Iqbal, J., F. Hussain, M. Ali, M. S. Iqbal and K. Hussain. 2013. Trait association of yield and yield components of linseed (*Linum usitatissimum* L.). Int. J. Modern. Agric. 2(3): 114-117.

Nagaraja, T. E., K. R. Agit and B. S. Golasangi. 2009. Genetic variability, correlation and path analysis in linseed. J. Maharashtar Agriculture Uni., 34(3): 282-285.

Pal, S. S., T. R. Gupta, I. Singh and I. Singh. 2000. Genetic determination of yield in linseed (*Linum usitatissimum* L.). Crop Improvement, 27(1): 109-110.

Savita, S. G., P. V. Kenchanagoudar, K. G. Parameshwarappa and V. Rudranaik. 2011. Correlation and path coefficient analysis for yield and yield related components in linseed (Linum Usitatissimum L.) germplasm. Karnataka J. Agric. Sci. 24(3): 382-386.

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

Sohan, R., S. K. Singh and V. Kerketta. 2004. Correlation studies in linseed (*Linum usitatissimum* L.). J. Res. Birsa Agriculture Uni., 16(1): 123-126.

Tadesse, T., H. Singh and B. Weyessa. 2009. Correlation and path coefficient analysis among seed yield traits and oil content in ethiopian linseed germplasm. Int. J. Sustain. Crop Prod., 4(4): 08-16.

Wright, S., 1921, Correlation and causation. J. Agric. Res. 20: 557-585.

Yadav R. K. 2001. Association studies over locations in linseed. Prog. Agri., 1(1): 11-15.