INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
1560–8530/2006/08–4–450–451
http://www. fspublishers.org

Association and Effect of Yield Related Traits on Achene Yield in Sunflower

MUHAMMAD ILYAS KHOKHAR[1], HAFEEZ AHMAD SADAQAT AND MUHAMMAD HAMMAD NADEEM TAHIR
Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad-38040, Pakistan
[1]Corresponding author's e-mail: ilyaslovely@yahoo.com; drhafeezsadaqat@yahoo.com

ABSTRACT

Ten genotypes of sunflower viz. A- 43, A- 75, A- 88, A- 132, G- 68, G- 33, HBRS- 1, FH- 243, Bemisal- 4710 and Bemisal-205 were evaluated for various parameters. Stem diameter, internodal length, head size, number of whorls per head and 100-achene weight had positive and significant correlations with achene weight per head at genotypic level. Head size and number of floral whorls per head also had positive and significant correlations with achene weight per head. 100-achene weight had positive significant correlations with stem diameter, head size and number of floral whorls per head. Correlations of head size with stem diameter and internodal length were also positive and significant. Stem diameter followed by 100-achene weight had the highest positive direct effects on achene weight per head. Head size, number of floral whorls per head and 100-achene weight had high positive indirect effects on achene weight per head via stem diameter. It was concluded that improvement in achene yield in sunflower can be accomplished by improving stem diameter, head size, number of floral whorls per head and 100-achene weight.

Key Words: Sunflower; Correlation coefficient; Path coefficient; Achene yield

INTRODUCTION

Sunflower, because of its high oil content (32 - 40%) with some types yielding up to 50% (Skoric & Marinkovic, 1986) has greater potential for bridging up the gap between the supply and demand of edible oil. Achene yield of sunflower in Pakistan is very low (1810 kg ha^{-1}) compared with other sunflower growing countries with average yield of 3015 kg ha^{-1} (Bilal, 2004). Amongst the reasons of low yield in Pakistan, non-availability of seed adapted to local environmental conditions is the most important. Almost all the seed of hybrid sunflower is imported and due to different agro-ecological conditions of their development, evolution and production, the full potential of yield is not achieved in our climatic conditions. Furthermore, there is always potential danger and threat of new insect pests and diseases. This necessitates developing locally well adapted, high yielding sunflower genotypes under local agro-ecological conditions. Keeping in view these facts the present work was carried out to develop selection criteria for genotypes of sunflower with high achene yield.

MATERIALS AND METHODS

The experimental material comprised of 10 entries of sunflower including 6 genotypes viz. A- 43, A- 75, A-88, A- 132, G- 68 and G- 33, developed and maintained in the department and 4 hybrids HBRS- 1, FH- 243, Bemisal- 4710 and Bemisal- 205. The experiment was laid out in a randomized complete block design with three replications. Seeds of these genotypes were sown in the field at the depth of 3 cm, keeping within rows and between rows distances of 30 cm and 75 cm, respectively. At maturity, ten plants of each entry were taken at random in each replication and data were recorded on pre- and post-harvest plant characters including plant height (cm), stem diameter (cm), internodal length (cm), head size (cm), number of floral whorls per head, achene weight per head (g) and 100-achene weight (g). Correlations among the traits under study were estimated at phenotypic and genotypic levels following statistical techniques developed by Kown and Torrie (1964). Direct and indirect effects of various plant traits on achene yield per head were estimated according to the method given by Dewey and Lu (1959).

RESULTS AND DISCUSSION

Achene weight per head (Table I) had positive and significant ($P = 0.01 - 0.5$) correlations with head size and number of whorls per head at both genotypic and phenotypic level. Association of achene weight per head with stem diameter, internodal length and 100-achene weight was positive and highly significant at genotypic level but non-significant at phenotypic level. 100-achene weight had positive and significant correlation at genotypic level with stem diameter, head size and number of whorls per head. Number of whorls per head exhibited positive and highly significant correlations with head size at both genotypic and phenotypic level, while positive and significant with stem diameter and internodal length at genotypic level. Correlations of head size with stem diameter and internodal length and that of internodal length with stem diameter were positive and significant at genotypic level.

Correlations of achene weight were positive and significant with most of the characters studied. These results indicate that achene yield per head can be increased by increasing stem diameter, head size, number of whorl per head and 100-achene weight. Rao (1987); Tanimu and Ado

(1989); Lal *et al*. (1997) and Tahir *et al*. (2002) reported positive and highly significant correlations of achene weight per head with head size. Gill *et al*. (1997); Doddamani *et al*. (1997); Naryana and Patel (1998); Nirmala *et al*. (1999) and Teklewold *et al*. (2000) found significant correlation of achene weight per head with stem diameter, internodal length and 100-achene weight. Singh *et al*. (1985) reported that selection of large head size increased the 100-seed weight of plant. Highly significant correlation between number of whorls per head and head size has also been reported by Lal *et al*. (1997); Nirmala *et al*. (1999); Ashok *et al*. (2000) and Teklewold *et al*. (2000).

The results of path analysis (Table II) showed that stem diameter had the highest positive direct effect on achene weight per head, followed by 100-achene weight per head. Plant height and head size had negative direct effects on achene weight per head. The highest positive indirect effect was observed by internodal length via stem diameter followed by number of whorl per head via stem diameter and head size via stem diameter. 100-achene weight also had high positive indirect effect via stem diameter.

Ashok *et al*. (2000) observed positive direct effect of stem diameter on achene yield. Pathak *et al*. (1983); Patil *et al*. (1996) and Lal *et al*. (1997) reported that 100-achene weight had positive direct effect on achene yield. Stem diameter and 100- achene weight had significant positive correlations with achene weight per head and also had high positive direct effects on achene weight per head. Head size, number of whorls per head and 100-achene weight had high positive indirect effects on achene weight per head via stem diameter and also had significant positive correlations with achene weight per head. These results suggest that thick and stout stem shows less lodging and bear larger heads with more floral whorls per head and heavier, large sized achenes; that ultimately results in higher yields of achene per head.

Positive and significant correlations of various characters under study with each other and with achene weight per head and their direct and indirect effects on achene weight per head suggest that achene yield in sunflower can be improved by improving plant traits including stem diameter, head size, number of floral whorls per head and 100- achene weight. Furthermore, these characters can be used as selection criteria for improvement of sunflower genotypes.

Table I. Genotypic (upper value) and phenotypic (lower value) correlation coefficients among various plant traits in sunflower

Variable	P.H	S.D	I.L	H.S	NFWH	100-A.Wt
P.H						
S.D	0.583					
	0.565					
I.L	0.549	0.739*				
	0.499	0.560				
H.S	-0.153	0.666*	0.47*			
	-0.112	0.444	0.343			
NFWH	0.036	0.690*	0.462*	0.812**		
	0.022	0.434	0.309	0.885**		
100-A.Wt	l.192	0.630*	-0.197*	0.462*	0.254*	
	0.129	0.382	-0.155	0.273	0.149	
A.Wt/H	0.213	0.928**	0.421**	0.936**	0.783**	0.776**
	0.154	0.611	0.295	0.767**	0.680*	0.564

* = Significant (P≤ 0.05), ** = Highly significant (P≤ 0.01); P.H= Plant height, S.D= Stem diameter, I.L= Internodal length, H.S= Head size, NFWH= Number of whorls per head, 100-A.Wt= 100-Achene weight, A.Wt/H= Achene weight per head.

Table II. Direct (bold font) and indirect (normal font) effects of various traits on achene weight per plant in sunflower

Variables	P. H	S. D	I. L	H. S	NFWH	100-A. Wt	A. Wt/H (r_g)
P. H	**-0.676**	1.264	0.303	0.480	0.022	0.249	0.213
S. D	-0.394	**2.168**	0.407	-2.087	0.414	0.820	0.923
I. L	-0.372	1.603	**0.551**	-1.469	0.277	-0.256	0.443
H. S	0.104	1.444	0.259	**-3.127**	0.487	0.601	0.935
NFWH	-0.024	1.497	0.255	-2.541	**0.600**	0.331	0.784
100-A. Wt	-0.13	1.367	-0.108	-1.447	0.153	**1.300**	0.776

P.H= Plant height, S.D= Stem diameter, I.L= Internodal length, H.S=Head size, NFWH= Number of whorls per head, 100-A.Wt= 100-Achene weight, A.Wt/H= Achene weight per head, r_g= Genotypic correlation coefficient.

REFERENCES

Ashok, N., M. Sheriff and L.S. Narayana, 2000. Character association and path coefficient analysis in sunflower (*Helianthus annuus*). *Crop Res*., 20: 453–6

Bilal, H., 2004. *Enhancing Edible Oil Production*. Daily Dawn. October, 18, 2004

Doddamani, I.K., S.A. Patil and R.L. Ravikumar, 1997. Relationship of autogamy and self fertility with seed yield and yield components in sunflower (*Helianthus annuus*). *Helia,* 20: 95–102

Dewey, D.R. and K.H. Lu, 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron. J.,* 51: 515–8

Gill, H.S., R.K. Sheoran, C. Naveen, K. Lokendra, N. Chandra and L. Kumar, 1997. Intercharacter association and path coefficient analysis in sunflower. *Ann. Bio. Ludhiana,* 13: 275–7

Kown, S. and J. Torrie, 1964. Heritability and interrelationship among traits of two soyabean populations. *Crop Sci*., 4: 196–8

Lal, G.S., V.S. Bhadoriya and A.K. Singh, 1997. Genetic association and path analysis in elite lines of sunflower. *Crop Res. Hisar,* 13: 631–4

Naryana, E. and J.C. Patel, 1998. Correlation studies in sunflower. *J. Res. Gujrat,* 23: 100–2

Nirmala, V.S., A. Gopalan and D. Sassikumar, 1999. Corelation and path coefficient analysis in sunflower. *Agric. J. Madras,* 86: 269–72

Pathak, A.R., M.U. Kukadia and B.A. Kunadia, 1983. Path coefficient analysis in sunflower. *Indian J. Agric. Sci*., 53: 607–8

Patil, B.R., M. Rudraradhya, C.H.M. Vijayakumar, H. Basppa and R.S. Kulkarni, 1996. Correlation and path analysis in sunflower. *J. Oilseed Res*., 13: 162–6

Rao, N.G.L., 1987. Studies on correlation and path coefficient analysis in sunflower (*Hellianthus annuus* L.). *Mysore J. Agric. Sci*., 21: 94–5

Singh, J.V., T.P. Yadava and R.P.S. Kharb, 1985. Correlation and path-coefficient analysis in sunflower. *Indian J. Agric. Sci*., 55: 243–6

Skoric, D. and R. Marinkovic, 1986. *Most recent results in sunflower breeding*. Pp: 118–9. International Symposium on sunflower, Budapest, Hungary

Tahir, M.H.N., H.A. Sadaqat and S. Bashir, 2002. Correlation and path coefficient analysis of morphological traits in sunflower. *Int. J. Agri. Biol.,* 4: 341–3

Tanimu, B. and S.C. Ado, 1989. Relationship between yield and yield components in forty populations of sunflower. *Helia,* 11: 17–20

Teklewold, A., H. Jayaramaith and B.N. Jagadeesh, 2000. Correlation and path analysis of physiomorphological characters of sunflower. *Helia,* 23: 105–14

(Received 27 February 2006; Accepted 20 April 2006)