Pak. J. Agri. Sci., Vol. 28, No. 2, 1991

HARVEST INDEX IN BREAD WHEAT

M. Aslam Chowdhry, Khurshid Alam and Ihsan Khaliq
Department of Plant Breeding & Genetics,
University of Agriculture, Faisalabad

Genotypic and phenotypic correlation coefficients were worked out for grain weight per spike, harvest index, economic yield and biological yield in six strains/varieties of wheat to select the genotypes efficient in apportioning their biomass into grain yield and vegetative part in proper proportion. The variety LU26S was found to be the most efficient and possessed the highest harvest index of 33.59%, followed by strain 1697-1 (32.28%). Positive and significant associations existed among almost all the characters studied except between grain weight per spike and harvest index where relationship was positive though non-significant. Path-coefficient analysis indicated that the direct effect of harvest index on economic yield was remarkable.

INTRODUCTION

The biological yield of a cereal crop is the total of plant material and harvest index is the ratio of the yield of grain to the biological yield (Donald, 1962). Selection based on high harvest index may have value for improving grain yield of cereal crops (Rostelle and Frey, 1975). This improvement in grain yield of high yielding semi-dwarf wheat varieties is due to increased harvest index with a change in biological yield (Bhatt, 1976). Donald and Hamblin (1976) reported the harvest index as breeding criterion in cereals.

The objective of the present study was to select physiologically the most efficient genotypes having the highest harvest index for further breeding programme.

MATERIALS AND METHODS

The studies were conducted in the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad during 1989-90. The experimental material comprised six wheat strains/variety *viz.*, LU26S, 1697-1, K-1595, 4362, 4072 and 4125 planted in triplicated randomized complete block design. Plot size used was 1.5 m^2. Inter-row and inter-plant distance was kept at 15 cm. Regularity of spacing and uniformity of sowing depth were achieved by sowing with the help of a template. To avoid edge effects, the central 1 x 1 m area from each plot was harvested at maturity to record data on biological yield, economic yield and harvest index. The randomly selected plants from this marked area were used to measure the grain weight per spike.

Phenotypic correlation coefficients were worked out by method described by Steel and Torrie (1960) while genotypic correlations were calculated according to the formula given by Fischer (1963). Path-coefficient analysis was performed according to the procedure delineated by Dewey and Lu (1959) using genotypic correlation coefficients to estimate the direct and indirect effects of different variables on economic yield.

RESULTS AND DISCUSSION

The mean values of six wheat strains/variety for different characters indicated that the genotypes differed significantly for different traits (Table 1). Considerable variation was obtained in harvest index values which ranged from 27.80 to 33.59%. Variety LU26S gave the highest harvest index (33.59%), followed by the strain 1697-1 which has a harvest index value of 32.28%. Strain 4362 produced maximum dry matter (1831.25 g/plot) but due to low economic yield it gave harvest index value of 27.80%.

The technique of path-coefficient analysis was applied for determining the true nature of character association. The economic yield was taken as the dependent variable and grain weight per spike, biological yield and harvest index as the casual variable (Table 3). This technique partitioned the correlation coefficient into direct and indirect effects through alternate pathways (Bhatt, 1973).

Grain weight per spike vs economic yield: Association between grain weight per spike and economic yield was positive and significant. Direct effect of grain weight per spike on yield was small (0.273) while indirect effects through harvest index and biological yield were large and similar (0.348 and 0.292, respectively). Correlation analysis indicated that grain weight per spike was an important factor influencing grain yield. However, path-coefficient analysis reflected that this character had no direct effect on economic yield but had indirect influence via harvest index and biological yield.

Harvest index vs economic yield: Direct effect of harvest index on economic yield was positive and quite high. Indirect effect

Table 1. Mean values of physiological parameters of bread wheat

Variety/ strain	Grain weight per spike (g)	Harvest index (%)	Biological yield (g/plot)	Economic yield (g/plot)
LU26S	1.41	33.59	1679.25	564.17
1697-1	1.56	32.28	1644.25	531.05
K-1595	1.24	29.17	1592.50	464.52
4362	1.39	27.80	1831.25	509.39
4072	1.23	31.44	1169.75	368.28
4125	1.26	28.69	1053.00	302.19
LSD at 5%	0.21	2.05	77.48	43.47
LSD at 1%	0.29	2.83	107.15	60.12

Biological yield was positively and significantly correlated with grain weight per spike, harvest index and economic yield (Table 2). Similar findings had been reported by Jain and Kulshrestha (1976), Sadiq *et al.* (1985) and Masood *et al.* (1986). Positive and significant association of grain weight per spike was also observed with other variables except the harvest index where it was positive though non-significant. The genotypic and phenotypic values agreed closely in each case.

Table 2. Genotypic (G) and phenotypic (P) correlation coefficients among four characters in bread wheat

		Harvest index	Biological yield	Economic yield
Grain weight	G	0.787	0.893*	0.913*
per spike	P	0.724	0.847*	0.853*
.Harvest index	G	-	0.819*	0.925**
	P	-	0.783	0.913*
Biological	G	-	-	0.933**
yield	P	-	-	0.926**

* = Significant at 5% level of probability.
** = Significant at 1% level of probability.

Table 3. Path-coefficient analysis of economic yield versus grain weight per spike, harvest index and biological yield

Pathway of association	Direct effect path-coefficient (p)	Indirect effect path-coefficient (pxr)	Correlation coefficient (r)
Grain weight per spike vs economic yield			
Direct effect	0.273		
Indirect effect via harvest index	-	0.348	
Indirect effect via biological yield	-	0.292	
Total	-	-	0.913
Harvest index vs economic yield:			
Direct effect	0.443		
Indirect effect via grain weight per spike	-	0.214	
Indirect effect via biological yield	-	0.268	
Total	-	-	0.925
Biological yield vs economic yield			
Direct effect	0.327		
Indirect effect via grain weight per spike	-	0.243	
Indirect effect via harvest index	-	0.363	
Total	-	-	0.933

through grain weight per spike was positive but low (0.214). Whereas via biological yield, it was comparatively higher (0.268). The total correlation coefficient (0.925) between harvest index and economic yield was positive and highly significant. This indicated a significant contribution of biomass production for increasing economic yield.

Biological yield vs economic yield: The relationship between biological yield and economic yield was positive and highly significant (0.933). Indirect effect via harvest index was positive and large (0.363). Whereas indirect effect through grain weight per spike was relatively low (0.243). Direct effect of biological yield on economic yield was positive and quite high. This reflected that biological yield played an important role in increasing the grain yield directly as well as indirectly through harvest index.

In the present studies dry matter production had shown positive and significant association with economic yield and harvest index suggesting that both the harvest index and biological yield could be effectively exploited for increasing the grain yield as reported previously by Donald and Hamblin (1976).

REFERENCES

Bhatt, G.M. 1973. Significance of path-coefficient analysis in determining the nature of character association. Euphytica 22: 338-343.

Bhatt, G.M. 1976. Variation of harvest index in several wheat crosses. Euphytica 25: 41-50.

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: 515-518.

Donald, C.M. 1962. In search of yield. J. Aust. Inst. Agri. Sci. 28: 171-178.

Donald, C.M. and J. Hamblin. 1976. The biological yield and harvest index of cereals as agronomic and plant breeding criteria. Adv. Agron. 28: 361-405.

Fischer, R.A. 1963. Statistical methods for research workers. 13th Ed., Oliver and Boyd, London.

Jain, H.K. and V.P. Kulshrestha. 1976. Dwarfing genes and breeding for yield in bread wheat. *Z. Pflanzenzuchtg* 76: 102-112.

Masood, M.S., M.Y. Mujahid, N.S. Kisana and M. Tahir. 1986. Identification of physiologically efficient genotypes in bread wheat. Pak. J. Agri. Res. 7 (3): 165-167.

Rostelle, A.A. and K.J. Frey. 1975. Estimates of selection parameters associated with harvest index in oat lines derived from bulk population. Euphytica 24: 121-131.

Sadiq, M.S., M. Saleem and M.A. Haq. 1985. Harvest index in hexaploid triticale. Pak. J. Agri. Res. 6: 153-156.

Steel, R.G.D. and J.H. Torrie. 1980. Principles and Procedures of Statistics. McGraw Hill Book Co., Inc., New York.