Genetic Variability, Correlation and Path Coefficient Analysis for Seed Yield and its Component Traits in Berseem (*Trifolium alexandrinum* L.)

RN Arora

Forage Section, Department of Plant Breeding, CCS Haryana Agricultural University, Hisar-125 004, Haryana

Twenty seven promising genotypes of berseem were evaluated for seed yield and its component traits. The range of variation was from 3.60 to 5.97 for tillers/plant; 13.60 to 24.7 for number of heads/plant and 0.85 to 2.49 g for seed yield/plant. The estimates of GCV and PCV was maximum for seed yield and primary branches/plant, whereas, low estimates were observed for head length and head breadth. High estimates of heritability coupled with high genetic gain were observed for seed yield/plant and primary branches/plant. Tillers/plant, primary branches/plant, number of heads/plant and seeds/head showed significant and positive association with seed yield/plant. However, based on path coefficient analysis, number of seeds/head and tillers/plant were found to be the best characters for bringing desired improvement in seed yield/plant in berseem.

Key Words: Berseem, Correlation and Path Analysis, Seed Yield, *Trifolium alexandrinum*, Variability

Berseem or Egyptian clover (*Trifolium alexandrinum* L.) is very important fodder crop in India during winter season. It is entirely grown through seeds. Hence seed production in berseem is as important as the green fodder production. Substantial amount of research work on genetic variability, heritability, correlation and path coefficient analysis have been carried out for fodder yield and its components (Yadav *et al.*, 1974; Sidhu *et al.*, 1976; Jatasra *et al.*, 1980 and Jatasra, 1981) but studies on seed yield and its component traits are very meagre (Bakheit, 1988). Realizing this, present study was undertaken to estimate genetic variability, correlation and path coefficients for seed yield and its components in berseem.

Materials and Methods

Twenty seven promising strains of berseem grown for evaluation for fodder yield were also evaluated for seed yield and its contributing traits. The experimental material was sown by broadcast method in complete randomized block design with three replications. After the last harvest for green fodder taken during the last week of March, the crop was left for seed production. At maturity, the data on various traits such as number of tillers, number of primary branches, head length (cm), head breadth (cm), number of heads, number of seeds/head, 1000-seed weight (g) and seed yield/plant (g) were recorded on 5 randomly chosen competitive plants in each genotype replicated thrice. The mean value of each character for each genotype was subjected to analysis of variance as described by Panse and Sukhatme (1989). Genotypic and phenotypic coefficient of variation was estimated by the formula suggested by Burton (1952). Heritability in broad sense was calculated according to formula suggested by Hanson et al. (1956) and genetic gain as suggested by Johnson et al. (1955). Phenotypic and genotypic correlation coefficients were worked out by the method described by Al-Jibouri et al. (1958) and the direct and indirect effects of independent traits on seed yield/plant were estimated by the method of Dewey and Lu (1959).

Results and Discussion

The estimates of range in variation, average performance, genotypic and phenotypic coefficient of variation, heritability and genetic advance are presented in Table 1. The range in variation was from 3.60-5.97 for number of tillers/plant; 5.47-13.20 for number of primary branches/plant; 1.53-1.88 cm for head length; 2.87-3.80 cm for head breadth; 13.60-24.87 for number of heads/plant; 22.00-42.47 for number of seed/head; 1.78-3.07 g for 1000-seed weight and 0.85-2.49 g for seed yield/plant. An overall mean value averaged over 27 genotypes was 4.41 for tillers/plant; 8.17 for primary branches/plant; 1.68 cm for head length; 3.29 cm for head breadth; 17.29 for heads/plant; 31.70 for seeds/head; 2.51 g for 1000-seed weight and 1.36 g for seed yield/plant. Bakheit (1988) from Egypt reported that 1000-seed weight in berseem varied from 3.37-3.93 g with an average of 3.71g.

The maximum coefficient of variation was observed for seed yield/plant and primary branches/plant. Moderate coefficient of variability was observed for

Email: forages@hau.nic. in Arora15@rediffmail.com

Table 1. Range, mean, coefficient of variability, heritability and genetic advance for eight characters in berseem

Components	No. of tillers/ plant	No. of primary branches/ plant	Head length (cm)	Head breadth (cm)	No. of heads/ plant	No. of seeds/ head	1000-seed weight (g)	Seed yield/ plant (g)
Range	3.60-5.97	5.47-13.20	1.53-1.88	2.87-3.80	13.60-24.87	22.00-42.47	1.78-3.07	0.85-2.49
Mean + S.E.	4.41+0.32	8.17+0.56	1.68+0.04	3.29+0.04	17.29+0.89	31.70+0.94	2.51+0.03	1.36+0.08
C.D. at (5%)	0.92	1.58	0.11	0.10	2.54	2.67	0.10	0.24
GCV (%)	14.49	23.69	5.90	7.17	14.43	16.89	14.80	24.27
PCV (%)	19.28	26.46	7.04	4.41	16.98	17.65	14.98	26.52
H2% (BS)	56.52	80.90	70.34	93.62	72.18	91.55	97.60	83.75
GA (% of mean)	22.45	43.70	10.20	14.28	25.25	33.28	30.11	45.36

seeds/head, 1000-seed weight, heads/plant and tillers/ plant. However, head length and head breadth showed low estimates of variation. Low amount of GCV and PCV has been reported for seed yield and 1000-seed weight by Bakheit (1988). The high estimates of heritability coupled with high genetic advance were observed for seed yield/plant, primary branches/plant, number of seeds/head and 1000-seed weight. So, these characters are amendable to improvement through simple selection. Moderate estimates of heritability and genetic advance for seed yield and moderate estimates of heritability and low genetic advance for 1000-seed weight has been reported by Bakheit (1988) in berseem.

Genotypic and phenotypic correlation coefficients among eight characters are presented in Table 2. Number of tillers/plant, number of primary branches/plant, number of heads/plant, number of seeds/head showed significant and positive association with seed yield per plant. Test weight however showed non-significant but positive association with primary branches/plant and number of heads/plant. Number of primary branches also showed positive and significant association with number of heads/ plant. Head length showed positive and significant association with head breadth, whereas head breadth showed negative and significant association with 1000-seed weight. Number of heads revealed negative and significant association with 1000-seed weight. Bakheit (1988) reported significant positive association between seed yield and 1000-seed weight in berseem.

Path coefficient studies revealed that 1000-seed weight had the maximum direct effect on seed yield/ plant followed by number of seeds/head, number of heads/ plant and tillers/plant. Of these all but 1000-seed weight had significant and positive association with seed yield/ plant. Primary branches/plant showed negative direct effects on seed yield/plant though it has significant positive association with seed yield/plant. Number of seeds/head though had high direct effect as well as positive significant association with the seed yield/plant but had maximum negative indirect effect through 1000-seed weight on seed yield/plant, likewise 1000-seed weight which had maximum direct effect but no positive significant association with seed yield/plant and also it showed high negative indirect effect through number

Table 2. Genotypic (in parentheses) and phenotypic correlation coefficients among eight characters in berseem

Characters	No. of primary branches/ plant	Head length	Head breadth	No. of heads/ plant	No. of seeds/ head	1000-seed weight	Seed yield/ plant
No. of tillers/plant	(0.668)	(0.238)	(0.027)	(0.776)	(0.087)	(-0.047)	(0.553)
	0.489**	0.103	0.029	0.504**	0.063	-0.009	0.412*
No. of primary branches/plant		(0.305)	(0.328)	(0.677)	(-0.056)	(0.155)	(0.486)
		0.184	0.273	0.614**	-0.064	0.146	0.456*
Head length			(0.532)	(0.055)	(0.354)	(-0.018)	(0.229)
			0.441*	0.014	0.257	-0.028	0.117
Head breadth				(0.212)	(0.364)	(-0.553)	(0.000)
				0.159	0.348	-0.519**	0.001
No. of heads/plant					(0.173)	(-0.014)	(0.771)
					0.153	-0.036	0.772**
No. of seeds/head						(-0.532)	0.443)
						-0.501**	0.455*
1000-seed weight							(0.276)
							0.250

*Significant at P = 0.05
**Significant at P = 0.01

Table 3. Path coefficient analysis of seed yield and its components in berseem

Characters	No. of tillers/plant	No. of primary branches/ plant	Head length	Head breadth	No. of heads/ plant	No. of seeds/ head	1000-seed weight	Genotypic correlation coefficient with seed yield/plant
No. of tillers/plant	**0.300**	-0.092	-0.052	0.007	0.364	0.067	-0.041	0.553
No. of primary branches/plant	0.200	**-0.137**	-0.067	0.082	0.317	-0.044	0.134	0.46
Head length	0.0713	-0.042	**-0.219**	0.134	0.026	0.274	-0.015	0.229
Head breadth	0.008	-0.045	-0.116	**0.251**	0.099	0.282	-0.479	0.000
No. of heads/plants	0.233	-0.093	-0.012	0.053	**0.169**	0.134	-0.012	0.771
No. of seeds/head	0.026	0.008	-0.077	0.091	0.081	**0.775**	-0.461	0.443
1000-seed weight	-0.014	-0.021	0.004	-0.139	-0.007	-0.413	**0.866**	0.276

Residual effect = 0.008

of seeds/head, hence neither number of seeds/head nor the 1000-seed weight fit into good selection criteria for increasing the seed yield/plant in berseem. Instead, number of heads/plant might be a good selection criteria for improving the seed yield/plant since it had highest positive significant association with seed yield/plant, high positive direct effect on seed yield/plant and also has high indirect effect on seed yield/plant through tillers/plant. In turn, tillers/plant showed high positive direct effect on yield as well as the strong positive association with seed yield/plant and also had high indirect effect through number of heads/ plant on seed yield/plant. So, selection for more number of heads/plant and more number of tillers/ plant might result in significant improvement in seed yield/plant in berseem.

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