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MUTATION INDUCED GENETIC VARIABILITY FOR TWO IMPORTANT COMPONENTS OF FODDER YIELD IN BERSEEM (*TRIFOLIUM ALEXANDRINUM* L.)

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SUMMARY

Seeds of berseem variety Mescavi were treated with three doses (50, 70 and 100 kR) of gamma rays and three doses (0.1, 0.3 and 0.6%) each of methyl methane sulphonate (MMS), diethyl sulphonate (DES) and sodium azide (SA) to study the induced genetic variability, heritability and genetic advance for plant height and tillers per plant, the main components of fodder yield. The estimates of genotypic and phenotypic coefficients of variation were higher for tillers per plant in comparison to plant height which were indicative of induction of wider genetic variability for this trait due to mutagenesis. The estimates of high heritability (broad sense) coupled with high genetic advance (% of mean) were observed for plant height in treatments of 70 kR gamma rays and 0.6 % MMS, whereas for tillers/plant medium heritability with high genetic advance was recorded for all the three treatments of MMS.

Key words : Mutation, genetic variability, fodder yield

Berseem (*Trifolium alexandrinum* L.) is the most important winter fodder crop of India. It is accepted due to its higher fodder yield, multicut nature, faster regeneration and better nutritional value. The extent of natural genetic variability in this crop is very limited. Moreover, whatever variation is available has not been thoroughly exploited due to certain bottlenecks like complex floral biology, very tiny and delicate flowers and self sterility, etc. Due to these reasons, slow genetic improvement has been realized in this crop. Under such circumstances, mutation breeding seems to be the most viable technique for improvement in this crop. Genetic variations induced by mutation represent a more efficient source of genetic variability than gene pool conserved by nature (Brock, 1977). A wide range of physical and chemical mutagens has been used for inducing mutations in different crop plants. However, high random variations can be induced in short time in a chosen genetic background and comparatively with little natural selection interference (Mackey, 1981). Therefore, the present investigation was carried out to study the effects of physical and chemical mutagens on plant height and tillers/plant which are the major components of fodder yield.

MATERIALS AND METHODS

Two hundred dry seeds in triplicate of berseem var. Mescavi were used for mutagenic treatments with one physical mutagen (gamma-rays) having three different doses i. e. 50, 70 and 100 kR and three chemical mutagens viz., MMS, DES and SA with three different doses (0.1, 0.3 and 0.6%). The seeds were sown in the field immediately after treatment. Seeds soaked in distilled water for 6 h were used as control. The M_1 generation was planted in the field during **rabi** 2004-05. The control as well as treated seeds was sown in single rows of 3 m length. Individually threshed seeds of M_1 plants of each treatment were grown as separate progenies in M_2 generation in single rows of 5 m length each with three replications in randomized block design during **rabi** 2005-06. A distance of 30 cm was kept between each row. Observations were recorded on 30 randomly selected plants in each treatment for plant height (cm) and number of tillers/plant and different parameters of variability were calculated.

RESULTS AND DISCUSSION

The parameters of genetic variability, heritability and genetic advance for both plant height and tillers/plant are presented in Table 1. Different parameters revealed a wide range of variability for both the traits in M_2 generation. Wide range (35.0-67.2 cm) for plant

TABLE 1
Estimates of parameters of genetic variability, heritability and genetic advance for plant height and tillers/plant in M_2 generation of berseem var. Mescavi

	Plant Height (cm)								Tillers/plant						
Treatment	No. of plant	Range	Mean ± SE	Variance	GCV (%)	PCV (%)	h^2 (%) (broad sense)	GA (% of mean	Range	Mean ± SE	Variance	GCV (%)	PCV (%)	h^2 (%) (broad sense)	GA (% of mean
Control	30	42.6-61.9	50.67±1.18	12.28	-	-	-	-	3.9-8.7	5.74±0.04	0.73	-	-	-	-
			Gamma rays (kR)									**Gamma rays (kR)**			
50	30	39.4-58.8	51.03±1.11	18.12	8.32	11.33	54.15	12.63	3.8-10.7	6.15±0.09	1.12	17.23	26.83	40.87	22.59
70	30	35.0- 67.2	54.82*±1.40	60.68	14.19	16.27	76.21	25.54	5.1-13.1	7.19*±0.22	1.13	14.74	25.59	33.33	17.57
100	30	38.8-55.6	47.93*±0.68	12.49	6.76	8.51	63.00	11.05	4.1-11.3	5.61±0.26	1.38	20.86	27.63	57.50	24.28
			MMS (%)									**MMS (%)**			
0.1	30	34.6-58.5	48.29±0.40	23.64	10.06	13.25	57.68	15.74	4.1-10.3	6.05±0.16	1.81	22.14	27.77	64.41	36.84
0.3	30	34.3-53.0	45.42*±0.15	16.50	8.93	11.58	59.57	14.21	3.5-10.4	5.54±0.15	1.99	25.45	31.23	66.78	42.95
0.6	30	30.8-53.3	43.23**±017	27.61	12.14	14.78	67.52	20.56	4.0-9.2	5.13±0.22	0.82	17.74	20.66	72.56	30.89
			DES (%)									**DES (%)**			
0.1	30	38.4-58.8	51.05±1.06	21.55	9.08	11.22	65.68	15.18	3.5-11.4	6.47*±0.36	2.83	25.96	32.45	64.17	42.91
0.3	30	34.9-56.5	48.59±0.53	23.11	9.87	12.65	60.91	15.88	3.2-10.5	5.83±0.06	1.73	22.47	30.19	55.63	34.59
0.6	30	36.3-55.2	46.56*±0.39	12.37	7.56	10.56	51.09	11.12	2.7-7.6	5.10*±0.11	0.92	18.82	25.49	54.12	28.42
			SA (%)									**SA (%)**			
0.1	30	35.7-63.8	52.55±1.02	36.08	11.43	13.89	67.66	19.36	5.1-12.8	7.14*±0.34	1.54	17.36	26.61	42.42	23.26
0.3	30	35.0-62.4	48.68±0.73	40.17	13.00	15.89	66.92	21.92	4.0-11.7	6.39*±0.36	2.13	22.85	33.80	45.61	31.76
0.6	30	32.3-55.6	45.05**±1.18	32.90	12.74	14.67	75.18	22.72	3.1-10.4	5.77±0.23	1.84	23.57	32.76	51.25	34.58

*,**Significant at P=0.05 and P=0.01 levels, respectively.

height was observed in case of seeds treated with 70 kR gamma rays. The population raised from 70 kR gamma rays also showed a significant positive shift in mean values of plant height, whereas for remaining treatments shift was either negative or non-significant. The magnitude of induced variability was more in all the treated populations as compared with the control. Highest genotypic and phenotypic coefficients of variation (14.19 and 16.27%, respectively) were exhibited in the treatment 70 kR of gamma rays. The heritability in broad sense (76.21%) coupled with genetic advance as per cent of mean (25.54%) was also observed to be highest in the same dose of gamma rays i. e. 70 kR which revealed that simple selection would be quite effective for improvement of this trait and simultaneously green fodder yield would also be improved. Similar results in berseem were reported earlier for plant height by Sidhu and Mehndiratta (1976), Jatasra *et al*. (1980), Jatasra (1981) and Beri (1983). No trend of increase or decrease in the estimates of heritability and genetic advance was observed with the increasing doses of mutagens.

The range for tillers/plant increased in all the treated populations in comparison to the control. The maximum range (5.1-13.1) was recorded in 70 kR gamma rays. The mean values for this trait showed a positive and significant shift from the control in the treatments 70 kR gamma rays, 0.1 per cent DES, 0.1 per cent SA and 0.3 per cent SA, while shift of the mean was significantly negative from the mean values of control in case of 0.6 per cent DES. The magnitude of induced variability was more in treated population as compared to that of the control. The highest genotypic coefficient of variation was recorded in 0.1 per cent dose of DES (25.96%), while phenotypic coefficient of variation was observed to be the highest in 0.3 per cent dose of SA (33.80%). The broad sense heritability was maximum in case of 0.6 per cent MMS (72.56%), whereas maximum genetic advance was observed in population raised with 0.3 per cent dose of MMS (42.95%). Arora *et al*. (1994) observed the doses 25 kR followed by 10 kR of gamma-rays to be the most effective to create positive shift for plant height and tillers/ plant in berseem. Moreover, another study in berseem (Anonymous, 2006) indicated that plant height increased with increasing doses of SA and gamma rays, whereas a decrease was noticed in tillers/plant with increasing doses of gamma rays.

REFERENCES

Anonymous, 2006 : Annual Progress Report of Forage Crops. Forage Section, CCS Haryana Agricultural University, Hisar. pp. 13.

Arora, R. N., R. S. Khatri, D. S. Jatasra, G. P. Lodhi, N. K. Thakral, and S. K. Pahuja, 1994 : *Forage Res.*, **20** : 190-195.

Beri, S. M. 1983 : Ph. D. thesis, Punjab Agricultural University, Ludhiana, India.

Brock, R. O. 1977 : In : *Genetic Diversity in Plant*, Muhammed, A., R. Aksel, and R. Von-Borstel (eds.). Plenum Press, New York. pp. 177-232.

Jatasra, D. S. 1981 : *Forage Res.*, **7** : 163-168.

Jatasra, D. S., G. P. Lodhi, and K. C. Goyal, 1980 : *Forage Res.* **6** : 56-62.

Mackey, J. 1981 : Proc. Symp. FAO/IAEA, Vienna, IAEA, Vienna. pp. 3.

Sidhu, B. S., and P. D. Mehndiratta, 1976 : *Indian J. agric. Sci*., **46** : 168-170.