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EFFECT OF PHOSPHORUS LEVELS ON FORAGE YIELD OF PROMISING MULTICUT GENOTYPES OF BERSEEM (*TRIFOLIUM ALEXANDRINUM* L.)

S. M. KUMAWAT AND VIMAL KHINCHI

Agricultural Research Station
S. K. Rajasthan Agricultural University,
Bikaner-334 006 (Rajasthan), India
**(e-mail : sagarskrau@gmail.com)*

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SUMMARY

A field experiment was conducted at Agricultural Research Station, SKRAU, Bikaner on sandy loam soil during **rabi** season of 2016-17 to study the effect of P levels on forage yield of promising multicut genotype of berseem. The experiment consisted of five treatment combination of berseem genotype (AVTB2-1, AVTB 2-2, AVTB 2-3, AVTB 2-4, AVTB 2-5) in main plot and 3 phosphorus levels (60,80 &100 kg/ha) in sub plot. The experiment was laid out in randomized complete block design and replicated thrice. The result show that Berseem genotype namely AVTB 2-3 performed better and recorded higher plant height, GFY, DMY and CPY along with net return and B:C ratio in compared to rest all genotypes. While application of phosphorus @80 kg/ha gave the maximum GFY (143.7q/ha) and L:S ratio (1.27) being at par to 60 kg/ha and gradually decreased at higher dose of phosphorus application. Though, growth, quality and economic values were recorded higher at 60 kg/ha phosphorus application. further, plant stand /m^2 recorded at 30 DAS was showed non significant variation due to different phosphorus levels and genotype.

Key words : Berseem genotype, crude protein, green fodder yield, dry fodder yield, net returns, B : C ratio

Shortage of green fodder is common problem throughout the country. Among major fodder crops, Berseem (*Trifolium alexandrinum* L.) is one of the most important legumineous fodder crop of subtropical countries. This fodder crop is grown in the northern part of India in **rabi** season mainly. It is most productive and nutritious fodder crop. It appears to behave as the most potent milk multiplier in lactating cattle as compared to other forages, alone or in combination. The varietals improvement in this crop however, could get a slow momentum (Shukla and Patil, 1985). Therefore, recently efforts are being made to test and release multicut berseem genotype to bridge to increasing gap for green fodder demand and supply. Berseem is a nutritious legumineous fodder crop containing moisture 84.9 per cent, crude protein 20.8 per cent, crude fiber 2.9 per cent, ash 2.2 per cent, nitrogen free extract 6.6 per cent, Ca 0.40 per cent, phosphorus 0.07 per cent and potassium 0.72 per cent (Chatterjee and Das, 1989). Among nutrition factors, Phosphorus is an essential plant nutrient and as it stands next to nitrogen which is required for the root growth and thus it helps in absorption of different plant nutrient. Berseem, being a leguminous crop, requires sufficient quantity of phosphorus in free form for better nodulation which might have resulted in more nitrogen fixation in plant roots. It plays a major role in energy transfer system (ADP, ATP). Obviously, phosphorus is essential for numerous metabolic processes. Though the sufficient research work has been conducted on phosphate fertilization of berseem in different part of country, which has proved that application of phosphate was produced tremendous effect on the yield of berseem and its quality. Many researcher reported that phosphorus fertilization increases forage yield of clover (Miles *et al.*, 1984; Macedo *et al.*, 1985; Hume and August, 1988; Hern *et al.*, 1988; Ortega *et al.*,1994; caradus *et al.*, 1996; Castilhos and Jacques, 2000). However in light textured sandy loam soils where berseem growing was questionable, study on different multicut genotype and phosphorus levels to maximize fodder production was carried out from berseem in the arid region of Rajasthan.

MATERIALS AND METHODS

This study was conducted at Agricultural Research Station, S. K. Rajasthan Agricultural

University, Bikaner situated at 28.01^0N latitude and 73.22^0E longitude at an altitude of 234.70 metres above mean sea level in arid western hyper arid zone of Rajasthan. Weather parameters data recorded during rabi 2016-17 present in (Fig. 1). The soil quality having alkaline reaction pH (1 : 2) 8.4, electrical conductivity (1 : 2) 0.20 dS/m, organic carbon 0.11 per cent and available N, P and K were 91.85, 18.91 and 231.0 Kg/ ha, respectively.

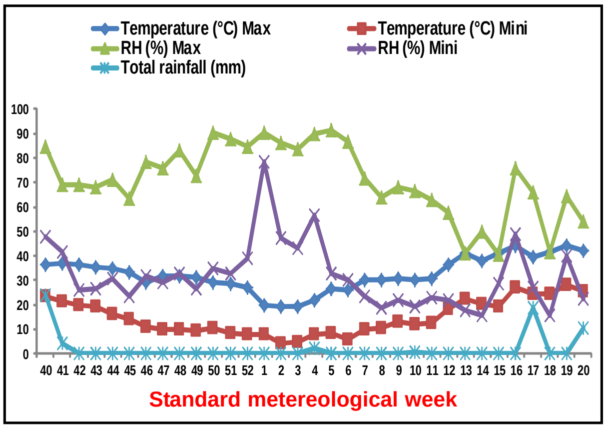

Fig. 1. Weather parameters data recorded during rabi 2016-17.

The treatment were five multicut genotype of berseem viz., (AVTB2-1, AVTB 2-2, AVTB 2-3, AVTB 2-4 and AVTB 2-5) and three phosphorus levels (60,80 and 100 kg/ha). These treatment combination were laid out in randomized complete block design (RCBD) allocating berseem genotype in main plot and phosphorus levels in sub plot and replicated twice. The size of each plot was 4 x 3 m^2. The seeds were sown at 25 cm row apart to using seed rate of 25 kg /ha respective plots. The calculated quantities of fertilizers doses as per treatment drilled in the respective plots according to the design and mixed with the soil at the time of sowing. First irrigation was applied at the time of sowing, while next irrigations were applied as and when irrigation need to rises after establishment of seedling. $ZnSO_4$ at the rate of 12.5 kg/ha and one-third dose of nitrogen was applied as basal and remaining two-third dose of nitrogen was top dressed in two splits equally *i.e*, first at 25 DAS and rest dose after first cutting about 20 kg N/ha was top dressed after each cutting. Plant population was recorded by counting number of plants per meter square putting quardet from three randomly in all spots at 25 DAS and at harvesting. These were averaged to work out number of plant per meter square. For green fodder, crop was harvested first at 60 DAS and there after 35-40 days interval. Then crops were harvested from each net plot area individually, tagged and weighed. Weight was recorded and expressed in q/ha. Then converted into green fodder yield (q ha^{-1}). Dry matter yield (q ha^{-1}) was taken from samples of fresh weight after complete drying or on the basis of the moisture content in biomass at cutting, putting sample in oven at 72^0C for 24 hours. for L:S ratio, 100g sample was taken from each plot and separated leaves & stem. then oven dry weight was recorded.

RESULTS AND DISCUSSION

Effect of Genotypes

The plant height, leaf : stem ratio, green fodder and dry matter yield of berseem genotype significantly differed under different phosphorus levels (Table 1). The data on various parameters studied indicated that AVTB 2-3 genotype recorded significantly higher plant height (49.33 cm), crude protein (17.63%) and crude protein yield (4.95 q/ha), green fodder yield (153.2 q/ha) and dry matter yield (28 q/ha) than AVTB 2-5. This may be due to the interactive effect of genotype environment, This might contribute for more plant height and resulted in higher yield. The maximum plant height (49.33 cm) was recorded in AVTB 2-3 at par with AVTB 2-4, which was significantly higher over AVTB 2-1 AVTB 2-2 and AVTB 2-5.

Leaf : stem ratio did not influenced significantly among different genotypes of berseem. The crude protein yield were obtained significantly higher with AVTB 2-3 and AVTB 2-4 than AVTB 2-1. The green fodder yield of AVTB 2-3 (153.2 q/ha) was significantly higher over AVTB 2-1, AVTB 2-2 and AVTB 2-5. However, the differences between AVTB 2-3 and AVTB 2-4 were non significant. The dry matter yields of AVTB 2-3 (28 q/ha) were significantly recorded higher over AVTB 2-1, AVTB 2-2, AVTB 2-4 and AVTB 2-5. The higher herbage yield of AVTB 2-3 could be attributed because comparatively higher plant height these genotype. The differences in growth characters varieties may be attributed to their inherent characteristics. The net return of AVTB 2-3 (7644 Rs./ ha) was at par AVTB 2-4 (6756 Rs./ha) though significantly higher over AVTB 2-1, AVTB 2-2 and AVTB 2-5 while B:C ratio was higher on AVTB 2-2, AVTB 2-3 and AVTB 2-4 over AVTB 2-1 and AVTB 2-5. Several workers have also noticed the variation among the genotypes of berseem for forage yield and growth characteristics Sestrienka (1980), Tongel and Albayrak (2006) and Nargesh (2012).

TABLE 1
Effect of phosphorus levels and berseem genotypes on forage productivity

Treatment	Plant Stand/m^2	Plant height (m)	L : S ratio	Crude protein (%)	Crude protein yield (q/ha)	Net returns (Rs./ha)	B : C ratio
Genotypes							
$AVTB_{2-1}$	35.9	45.07	1.21	17.66	4.21	244	0.01
$AVTB_{2-2}$	37.6	45.56	1.23	17.74	4.67	5978	0.26
$AVTB_{2-3}$	38.6	49.33	1.21	17.63	4.95	7644	0.33
$AVTB_{2-4}$	38.0	48.85	1.20	16.42	4.14	6756	0.30
$AVTB_{2-5}$	38.0	45.44	1.17	15.70	3.47	4822	0.21
S. Em±	0.8	0.84	0.04	0.21	0.13	341	0.02
C. D. (P=0.05)	2.5	2.74	0.12	0.68	0.42	1112	0.05
P level (kg/ha)							
P 60	37.7	46.20	1.17	17.00	4.37	6200	0.28
P80	37.6	47.40	1.27	16.76	4.24	5733	0.25
P100	37.5	46.96	1.18	17.33	4.25	3333	0.14
S. Em±	0.4	0.42	0.04	0.26	0.11	515	0.02
C. D. (P=0.05)	NS	1.25	0.11	0.78	0.34	1521	0.07
C. V. (%)	4.1	3.50	12.00	6.03	10.38	-	-

Effect of Phosphorus

The result (Table 2) indicated that dry matter yield and economics of fodder berseem significantly influenced by different phophorus levels, however, plant population, plant height, leaf : stem ratio, green fodder yield, crude protein %, crude protein yield was not affected by different phosphorus levels. Maximum dry matter (28 q ha^{-1}), yield of berseem recorded with 60 kg P ha^{-1}; while maximum GFY (143 q/ha) was found at 80 kg P_2O_5/ha dose and economics *viz*. net return (Rs. 6200 ha^{-1}) and B:C ratio (0.25) were recorded with 60 kg P ha^{-1}. However, 80 kg P/ha gave at par values dry matter yield and net returns of berseem (Table 1). further data reveal that GFY did not influenced both genotype and P levels in early growth stage i.e., at first cutting, Also P levels could not influenced growth and yield parameter at 2nd

TABLE 2
Effect of phosphorus levels on forage yield of promising genotypes of berseem

Treatment	Green fodder yield (q/ha)				Dry fodder Yield (q/ha)			
	I cut	II cut	III cut	Total	I cut	II cut	III cut	Total
Genotypes								
$AVTB_{2-1}$	26.22	40.89	49.11	116.22	3.17	11.02	9.64	23.83
$AVTB_{2-2}$	28.22	53.22	63.44	144.89	3.81	10.93	11.53	26.28
$AVTB_{2-3}$	30.78	53.56	68.89	153.22	4.26	11.09	12.70	28.04
$AVTB_{2-4}$	28.78	51.67	68.33	148.78	3.87	10.58	10.76	25.20
$AVTB_{2-5}$	27.11	47.89	64.11	139.11	2.51	8.94	10.60	22.06
S. Em±	1.57	1.73	1.43	1.7	0.18	0.40	0.39	0.7
C. D. (P=0.05)	NS	5.63	4.65	5.6	0.58	1.31	1.26	2.2
P levels (kg/ha)								
P 60	29.00	51.47	60.53	141.00	3.73	11.25	10.68	25.66
P80	29.33	49.93	64.40	143.67	3.62	10.41	11.14	25.17
P100	26.33	46.93	63.40	136.67	3.21	9.88	11.32	24.41
S. Em±	1.06	1.29	1.24	7.6	0.14	0.28	0.24	1.2
C. D. (P=0.05)	NS	NS	NS	7.1	0.43	NS	0.69	6.2

NS–Not Significant.

cutting and 3rd cutting as well. However berseem genotype differ in their potentials of growth and yield (Table-3) The probable reason may be that the increasing P levels resulted in greater accumulation of carbohydrates, protein and thir translocation to the productive organs, which in turn, improved all growth and yield attributing characters. Increase in these parameters due to P could be ascribed to more branch formation resulting in the overall improvement in plant growth, vigour and production of sufficient photosynthates. The results corroborate the work of Taneja *et al.* (1987) and Mahmud *et al.* (2003).

Interaction (Genotype x Phosphorus)

The result (Table 3) clearly indicated that berseem genotype AVTB 2-3 performed better and gave higher GFY at 80 kg P_2O_5 /ha, while AVTB 2-4 gave at 60 kg P_2O_5/ha dose, However AVTB 2-1, AVTB 2-2 and AVTB 2-5 did not differ in growth and yield due to varying P application. Whereas with increasing P dose from 60 to 100 kg/ha, but maximum at 80 kg/ha of AVTB 2-3(13.6 q/ha). The higher DFY 38.2 q/ha was noted in AVTB 2-1 genotype at 60 kg/ha which was significantly higher over rest treatment combination. The less response of increasing levels on growth & yield might be the result of poor organic carbon content of soil and coarse texture nature representing poor water retension capacity. Hence poor mineralization take place resulting poorly solubility and availability of P to plant roots , therefore less absorption by roots. The result are close conformity with the findings of Nargesh (2012).

TABLE 3
Interaction (genotype x phosphorus) of GFY and DFY

Treatment	$AVTB_2$	$AVTB_{2-2}$	$AVTB_{2-3}$	$AVTB_{2-4}$	$AVTB_{2-5}$
			Dry fodder yield (q/ha)		
P_{60}	9.9	11.7	11.9	15.7	6.8
P_{80}	9.4	12	13.6	11.3	8
P_{100}	9.2	10.6	12.8	7.8	7.8
S. Em±	0.32	-	-	-	-
C. D. (P=0.05)	0.95	-	-	-	-
			Green fodder yield (q/ha)		
P_{60}	30.4	38.2	35.9	35.3	29
P_{80}	34.7	33.9	29.7	31.6	26.2
P_{100}	34.1	26.3	34.2	28.3	25.3
S. Em±	0.63	-	-	-	-
C. D. (P=0.05)	1.86	-	-	-	-

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