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Effect of potassium and sulphur on yield and quality of berseem (*Trifolium alexandrinum*)

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ABSTRACT

This research was conducted with the aim to quantify the effect of potassium and sulphur on yield and composition of berseem (*Trifolium alexandrinm L.*) during winter season of 2014-15, at Agriculture experimental field, Nehru P.G. College Lalitpur, (U.P.). The treatments consisted of four potassium levels (0, 30, 60 and 90 Kg K_2 ha^{-1}) and four sulphur levels (0, 10, 20 and 40 Kg S ha^{-1}). The experiment was laid out in randomized block design with three replications. Application of 90 kg K_2O ha^{-1} and 20 kg S ha^{-1} significantly increased the green foliage and dry matter yield of berseem. The greem foliage and dry matter production at 20 kg S ha^{-1} was significantly enhanced by 9.9 and 10.9% over control, respectively. The maximum N, P, K and S contents in berseem plants were recorded with 90 kg K_2O and 40 kg S ha^{-1}, respectively. The interaction between K and S had significant effect on yield and mineral composition of berseem and maximum yields were recorded under 60 kg K_2O and 20 kg S ha^{-1} which was statistically at par with 90 kg K_2O and 40 kg S ha^{-1}.

Keywords: Interaction effect K and S yield, nutrient content, berseem

INTRODUCTION

Berseem (*Trifolium alexandrinum*L.) belongs to leguminaceae family. It is rich in protein and the other total digestible nutrients, as well as carotenes and minerals; it is very nutritious, succulent, palatable and high yielding valuable leguminous crop. The nutrient element of major significance for yield and quantity of berseem are nitrogen, phosphorus and sulphur. Fodder and nutritional security for livestock population plays a vital and catalytic role in Indian farming system. Optimum nutrition is required for getting maximum production of fodder of good quality. Several abiotic and biotic factors have been found to affect the yield of berseem. Apart from major plant nutrients (N and P), potassium and sulphur play an important role in the production phenology of legume crops and these crops respond well to applied K and S (Singh 2018, Singh 2017). Potassium is one of the essential primary nutrients for fostering crop production, while the importance of balanced fertilizer use is widely and forced fully recognized its actual practice over much of the agriculture area Potassium (K) is extremely important for the growth of the plant root system. Potassium improves the root development especially in legumes and pulses. Sulphur plays an important role in chlorophyll formation because it has been observed that sulphur deficient plants contain as 40 to 60% in comparison with those receiving normal amounts of this elements. However, studies investigating the impact of potassium and sulphur application on yield of berseem remain scarce. Therefore, the present investigation was planned to study the effect of K and S on yield and mineral composition of berseem.

MATERIAL AND METHODS

The field experiment was carried out at Agriculture experimental field, Nehru P.G. College, Lalitpur (U. P.) during rabi season of 2014-15. Lalitpur district is a part of Bundelkhand plateau. Betwa River is the boundary between Jhansi and Lalitpur in the north. Most of the area is under the average elevation of 300m–450m from the sea level. Its latitudinal extension is from $24^0$10’ to $25^0$15’ N and longitudinal extension is from 78.10’ E to 79^0 00’ E. Geographically, Lalitpur district falls in the zone of sub-tropical climate and may be characterized by a very hot dry summer and cold winter. The soil of the experimental field was loam in texture having pH 7.9, organic carbon 4.6 g kg^{-1} and available N, P and K 170, 10 and 190 kg ha^{-1}, respectively. The experiment was laid out in randomized block design with three replications. The treatments were four levels each of K (0, 30, 60 and 90 kg K_2O ha^{-1}) and S

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(0, 10, 20 and 40 kg S ha^{-1}). Diammonium phosphate as source of P and K were used. Sulphur was applied as elemental sulphur at the time of sowing. Berseem was sown in the last week of November, 2014. The crop was grown by adopting all agronomic practices except fertilizer rate. The crop was harvested at various stages of growth. The plant samples were analysed for their N content by modified Kjeldahl method (Jackson 1973). The P and K in di-acid extract (HNO_3 and $HClO_4$) was determined by vanadomolybdate yellow colour method and flame photometer, respectively.

RESULTS AND DISCUSSION

Yield Studies

A study of Table 1 reveals that the green foliage and dry matter yield of berseem significantly increased with potassium application. The increases in the yield at each level of potassium addition were found to be significant as compared to control. The maximum yields of green forage dry matter were recorded under 90 kg K_2O ha-^{1}. All the levels of k differed significantly among themselves in respect of green forage production of berseem. These findings are similar to those of Singh (2018). Application of sulphur enhanced the green forage and dry matter yield of berseem significantly over control. All the levels of S proved significantly superior over control in respect of green forage and dry matter production. The maximum green forage and dry matter production was noted under 40 kg S ha^{-1}. The green forage yield of berseem increased by 7.1, 9.9 and 10.0 % with 0, 10, 20 and 40 kg S/ha levels over control respectively. The corresponding increases in dry matter production were 9.0, 10.9 and 8.6 %. The higher level of sulphur 40 kg S ha^{-4} tended to decrease the green forage yield and dry matter in berseem over 20 kg S ha^{-1}. These findings are similar to those of Singh and Singh (2017). The interaction effect of potassium and sulphur on green forage yields and dry matter production was significant. The maximum green forage and dry forage yields were recorded at 60 kg K_2O and 40 kg S ha^{-1} treatment.

Table 1: Effect of K and S level on green foliage and dry matter yield (in five cuttings) of berseem crop (q ha^{-1})

Potassium (Kg ha^{-1})	Sulphur Levels (Kg ha^{-1})				
	0	10	20	40	Mean
			Green foliage yield (q ha^{-1})		
0	350.42	394.29	421.71	412.37	394.69
30	425.65	461.90	548.74	473.35	477.41
60	469.28	493.91	521.28	502.74	496.80
90	487.28	506.97	519.97	516.62	507.61
Mean	433.15	464.26	502.82	476.27	
	K		S	K×S	
SEM ±	17.22		17.22	34.44	
CD at %	35.16		35.16	70.33	
			Dry Matter yield (q ha^{-1})		
0	40.17	45.5	47.72	33.72	41.77
30	48.37	53.56	54.79	62.95	54.91
60	53.68	56.87	56.97	59.11	56.65
90	55.39	59.65	59.76	58.89	58.42
Mean	49.40	53.65	54.81	53.66	
	K		S	K×S	
SEM ±	1.95		1.95	3.90	
CD at %	3.98		3.98	7.92	

Chemical composition of berseem plants

Nitrogen: A gradual increase in N content was recorded up to 90 kg K_2O ha^{-1} treatment (Table 2). Nitrogen content in berseem plants ranged from 2.35% at control to 2045% with 90 kg K_2O ha^{-1}. Similar results were reported by Gadi *et al.* (2018). Application of sulphur increased the N content in berseem significantly over control. All the levels of S were found to have significant

beneficial effect on N content over control. The maximum concentrations of N in berseem plant were recorded at 40 kg S ha^{-1}.. These findings are similar to those of Singh and Singh (2017) and Singh et al (2017).The Interaction (KxS) effect on nitrogen content was found to be significant.

Phosphorus: The impact of potassium application on the P content in berseem plant was statistically significant (Table 2). The content of P in berseem plants increased with increasing levels of K and maximum value was recorded with the application of 60 kg K_2O ha^{-1}. These findings are similar to those of Singh (2018). A further study of table 2 reveals that the application of sulphur to the soil increased the P content in berseem plants significantly, over control. The increasing levels of sulphur increased the P content in berseem and. maximum P content was recorded under 40 kg S ha^{-1} application. Results obtained are in close agreement with the findings of Saket *et al.* (2017). The K x S interaction had a significant effect on P concentration in berseem and maximum value of P content was recorded with 60 kg K_2O + 40 kg S ha^{-1} treatment.

Table 2: Effect of K and S levels on nitrogen and phosphorus content in berseem

Potassium (Kg ha^{-1})	Nitrogen content (%)					Phosphorus Content(%)				
	Sulphur (Kg ha^{-1})					Sulphur (Kg ha^{-1})				
	0	10	20	40	Mean	0	10	20	40	Mean
0	2.01	2.20	2.36	2.44	2.35	0.24	0.29	0.34	0.35	0.31
30	2.04	2.22	2.45	2.49	2.30	0.28	0.32	0.36	038	0.34
60	2.10	2.32	2.44	2.56	2.35	0.30	0.33	0.37	0.40	0.35
90	2.16	2.41	2.56	2.68	2.45	0.33	0.35	0.38	0.39	0.36
Mean	2.07	2.38	2.45	2.54		0.29	0.32	0.36	0.39	
	K		S	K×S		K		S		K×S
SEM ±	0.03		0.03	0.06		0.008		0.008		0.01
CD at %	0.06		0.06	0.13		0.016		0.016		0.03

Potassium: A perusal of the data (table 3) reveals that the K content in berseem plants increased with K application over control. All the levels of K proved significantly superior over control and differed significantly among themselves in respect of k content in berseem. The maximum concentration of K in berseem was recorded under 90 kg K_2O ha^{-1} application. These findings are similar to those of Singh (2017) and Singh (2018). A reference to table 3 indicates that the application of S increased the K content in berseem. The K content ranged from 1.26% at control to 1.39 with 40 kg S ha^{-1}. These findings are similar to those of Singh and Sharma (2016). The interaction effect of K and S levels on K content was significant. However, application of potassium with the combination of sulphur significantly enhanced the K content in berseem.

Table 3: Effect of K and S levels on potassium and sulphur content (%) in berseem crop

Potassium (Kg ha^{-1})	Potassium content (%)					Sulphur Content (%)				
	Sulphur Levels (Kg ha^{-1})					Sulphur Levels (Kg ha^{-1})				
	0	10	20	40	Mean	0	10	20	40	Mean
0	1.06	1.11	1.15	1.17	1.12	0.18	0.23	0.25	0.26	0.23
30	1.20	1.26	1.31	1.32	1.27	0.21	0.24	0.26	0.28	0.24
60	1.35	1.42	1.48	1.50	1.44	0.23	0.26	0.27	0.29	0.26
90	1.42	1.49	1.55	1.57	1.51	0.24	0.25	0.27	0.29	0.36
Mean	1.26	1.32	1.37	1.39		0.21	0.24	0.26	0.28	
	K		S	K×S		K		S		K×S
SEM ±	0.01		0.01	0.02		0.003		0.003		0.007
CD (P=0.05)	0.02		0.02	0.04		0.007		0.007		0.015

Sulphur: From the data (table 3), it is clear that the sulphur content in berseem plants increased significantly with the application of potassium. The concentration of S in berseem plants increased from 0.23% at control to 0.36% with 90 kg K_2O ha^{-1}. These findings are similar to those of Singh (2018) and Singh (2017).The S content in berseem plants also increased significantly with S application. Sulphur content in berseem crop increased gradually and significantly with increasing levels of S and the maximum value of sulphur content was recorded with 40 kg S ha^{-1} This increase in S content in berseem plants may be ascribed to increased availability of S in soil due to its application. Similar results were also obtained by Singh and Sharma (2016) and Singh *et al.* (2017). The interaction effect of K and S on sulphur content was found to be significant and maximum values of K and S were found with 90 kg K_2O + 40 kg S ha^{-1}. Similar results were reported by Singh (2017).

It may be concluded from the results that in light textured soil, deficient in K and S, application of K and S are required to harvest optimum crop yield and nutrient content in produce. Application of 60 kg K_2O and 20 kg S ha^{-1} was found optimum for maintaining higher berseem yield in soils of Lalitpur district of Uttar Pradesh.

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