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Original Article

Effect of Macro and Micro Nutrients on Herbage Yield and Quality of Berseem (*Trifolium Alexandrinum* L) *Tarai* Region of Indo-Gnagetic Plains

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Abstract

Field experiment was conducted during 2009-10 to 2011-12 (3 years) at Instructional Dairy Farm, G B Pant University of Agriculture & Technology, Pantnagar to study the effect of integrated nutrient management on growth, forage yield and forage quality of berseem. The experiment consisted of 11 treatments i.e. T_1 – Absolute Control, T_2 – Recommended dose of fertilers (RDF), 30:60:40 kg N:P;K kg / ha, T_3 – FYM @ 5t / ha, T_4 – FYM @ 10t / ha, $T_5 – T_2 + T_3$, $T_6 – T_2 + T_4$, $T_7 – T_2 + S + Mo + B$, $T_8 – T_3 + S + Mo + B$, $T_9 – T_4 + S + Mo + B$, $T_{10} – T_2 + T_3 + S + Mo + B$ and $T_{11} – T_2 + T_4 + S + Mo + B$ was planted during Rabi season 2009-10 to 2011-12 under Randomized Block Design with three replications. The experimental results indicated that application of 10t / ha FYM along with sulphur, boron and molybdenum had higher plant height, leaf:shoot ratio, green and dry forage yield and also crude protein production of berseem than application of both treatment either 100% RDF (inorganic source) or RDF+FYM @ 5t / ha +S+Mo+B. Therefore, it is recommended that the berseem should be fertilized with 10t / ha FYM+30 kg sulphur+4 kg boron+1kg molybdenum / ha in place of chemical fertilizer for higher productivity and quality of berseem herbage.

Keywords

Berseem; Crude Protein; Green Forage Yield; RDF; FYM; Boron and Molybdenum.

Introduction

India is leading in livestock population with nearly 56.7% buffaloes, 12.5% cattle, 20.4% ruminants, 2.4% camel, 1.4% equines, 1.5% pigs, and 3.1% poultry of the world population and contributes only 4% to our GDP mainly because of low productivity i.e. 20-60% of the world average due to improper nutrition, inadequate health care and management and also due to lack of scientific breeding of animals. Half of the total losses in livestock productivity are contributed to by the inadequacy in supply of feed and fodder. At present, the country faces a net deficit of 35.6% of green fodder, 26% of dry fodder and 41% of concentrate feed ingredients. India has nearly 4.9% of total cropped area under cultivated forages but it required nearly 10% of the cropped area to cater the need of the green fodder to our increasing livestock population.

Berseem (*Trifolium alexandrinum* L) is one of the most important leguminous forages grown in winter season comprising 1.9 m ha area in India. It grows well in mild winter and recovers strongly after cutting. It is cultivated from 35°N to the Tropics from sea level up to 750 m (1500 m in North West Himalaya. It is a frost tolerance down to -6°C and as low as -15°C for certain cultivars. Berseem can grow in areas where annual rainfall ranges between 550 mm and 750 mm. It can withstand some drought and short periods of water logging. It does better than alfalfa in high moisture soils and is very productive under irrigation. It is moderately tolerant of salinity and can grow on a wide range of soils, though it prefers fertile, loamy to clay soils with mildly acidic to slightly alkaline pH (6.5-8). These requirements make berseem very versatile forage crop in *Tarai* region to mid hills of Uttarakhand. The green forage of berseem is highly nutritious with high 20-24% crude protein, succulent and palatable and available for longer period from

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Proper nutrient management in crop production not only improve and stabilize the yield, but also will improve the environmental health. There are two things very common in forage production in our country, 1. Forage production is considered a non remunerative enterprise and so high yielding crop varieties are non available, and 2. Forage crops are grown under resource scarce conditions. This is the main constraints of low fodder productivity. Therefore, the integrated nutrient management approach is required to be adopted in fodder production. Among the nutrient sources, chemical fertilizers, organic manures, biofertilizers, green manure, crop residue management, sewage and sludge and also industrial effluents are well known. In general, the major nutrients are applied neglecting the role of micro nutrients, so the interaction effect of nutrients impair the availability of other nutrients and leading to low crop productivity. The multicut fodder like berseem requires special nutrient management with supplementation of macro as well as micro nutrients to crop [6]. The integrated nutrient increased the growth and productivity of berseem [3]. The proper blend of organic and inorganic fertilizer is important not only for increasing yield but also for sustaining soil health [8,10]. The present study was undertaken to study the effect of macro and micro nutrients on quality and productivity of berseem in *Tarai* region of Indo-Gnagetic plains of India.

Materials and Methods

Field experiment was conducted during 2009-10 to 2011-12 (3 years) at Instructional Dairy Farm, G B Pant University of Agriculture & Technology, Pantnagar to study the effect of integrated nutrient management (macro & micro) on growth, forage yield and forage quality of Berseem. The experimental site was clay loam with soil pH 7.2 and available N, P, K, S, B and Mo were 363, 15.84, 145 kg/ha, 34.2ppm, 1.23 and 15.80ppm, respectively. The experiment consisted of 11 treatments i.e. T_1 – Absolute Control, T_2 – RDF, T_3 – FYM @ 5t/ha, T_4 – FYM @ 10t/ha, T_5 – $T_2 + T_3$, $T_6 – T_2 + T_4$, $T_7 – T_2 + S + Mo + B$, $T_8 – T_3 + S + Mo + B$, $T_9 – T_4 + S + Mo + B$, $T_{10} – T_2 + T_3 + S + Mo + B$ and $T_{11} – T_2 + T_4 + S + Mo + B$ was planted during Rabi season 2009-10 to 2011-12 under Randomized Block Design with three replications. The sulphur, boron and molybdenum were applied @ 30 kg/ha (Elemental Sulphur), 4 kg/ha (Borax) and 1 kg/ha (Sodium Molybdenum), respectively. The FYM was applied before 15 days of planting and mixed properly in soil. The micronutrients were applied at the time of sowing. The recommend dose of fertilizers (RDF) was 30 kg N, 60 kg $P_2 0_5$ and 30 kg $K_2 0$ /ha and applied as basal and 25 kg N was applied after each cut. Three cut of berseem were taken and then left for seed production. All other management practices were followed as per crop recommendation.

Results and Disscussion

Poole data revealed that the green forage yield, dry matter yield, crude protein production and also number of shoots/m affected significantly by integrated nutrient management practices (Table 1). The plant height and L:S ratio did not differ with integrated nutrient management practices (Table 1). However, the application of RDF+FYM@5t/ha+S+Mo+B' and Control had the highest and the lowest plant height values, while a treatments with RDF+FYM @ 10t/ha and control gave the highest and the lowest L:S ratio. The combined application of FYM @ 5 t/ha with S + Mo + B gave the highest number of shoots/m but remained significantly at par with treatments T_6 i.e. RDF+FYM @ 10t/ha T_{10} i.e. RDF+FYM @ 5t/ha+ S+Mo+B and T_{11} i.e. RDF+FYM @ 10 t/ha+S+Mo+B.

Similarly, treatment T_9 i.e., FYM@10t/ha+S+Mo+B' gave significantly higher green and dry forage yield than control, FYM @ 5 t/ha and also RDF+FYM @ 10t/ha treatments. The crude protein production was recorded significantly higher under treatment T_9 i.e. FYM @10 t/ha+S+Mo+B' and also had significantly higher values than control and alone application of FYM@5t/ha treatments. The results revealed that combined application of FYM@10 t/ha along with S+B+Mo produced higher plant height, L:S ratio, green and dry forage as well as crude protein and seed yield than both treatment i.e., alone application of chemical fertilizers and also RDF combined with S+B+Mo. Higher plant growth, plant height, number of branches/plant and green forage yield at all cuts in berseem were found at application of 50% NPK+2t poultry manure followed by 100% recommended dose of NPK [7]. The FYM application might have helped in improving the bio-physio-chemical properties of soil resulting in to better plant growth and development [4]. while under combined application of FYM and chemical fertilizers had higher fertility status and did not utilized properly by crop due to genetic capability of berseem crop. Hence, it had a greater chance to loss of nutrients in absence of proper utilization and these results were supported [2]. The micronutrients had improved the yield and quality of berseem fodder and also supported [3]. The economic optimum level of S was found at 59.19 or 60 kg/ha [7,9] for higher green forage yield and also crude protein. The

micronutrients also play great role for enhancing the growth and yield of berseem and it was reported that application of 2 or 4 kg boron / ha enhanced the green and dry forage yield of berseem [1].

The gross returns, net returns and B:C ratio were also affected significantly by integrated nutrient management practices (Table 2). The highest gross return was recorded at application of FYM @10 t / ha with S, B and Mo followed by RDF treatment and remained significantly at par with all other treatments except control and alone application of FYM@5 t / ha treatments. However the net return was found significantly highest under RDF treatment followed by application of RDF + FYM@5 t / ha. The similar trend was noticed for B:C ratio. Application of high dose of FYM and micro nutrients in treatments like T_6, T_8, T_9, T_{10} and T_{11} increased the cost of cultivation resulting in to low net returns as well as B:C ratio. The higher dose of FYM is practically not suitable because of its unavailability as well as it increases the cost of cultivation. It was also reported that application of 50% N through FYM and 50% through chemical fertilizers proved economically viable than 100% NPK application at Jhansi [6].

Table 1: Effect of macro and micro nutrients on growth, forage yield and forage quality of Berseem during 2009-10 to 2011-12 (Pooled data)

Treatments	Plant height (cm)	No. of shoots/ m row length	L : S Ratio	Green forage yield (q/ha)	Dry matter yield (q/ha)	Crude protein yield (q/ha)
T_1 – Absolute Control	46.9	95	1.27	393	63.1	9.86
T_2 – RDF	47.2	94	1.40	497	79.8	11.82
T_3 – FYM @ 5t / ha	47.5	95	1.39	433	68.8	10.33
T_4 – FYM @ 10t / ha	48.1	95	1.43	473	74.4	11.51
T_5 – T_2 + T_3	47.9	87	1.43	474	74.6	11.44
T_6 – T_2 + T_4	48.1	101	1.48	449	71.5	11.55
T_7 – T_2 + S + Mo + B	47.7	96	1.42	457	73.0	11.50
T_8 – T_3 + S + Mo + B	49.1	103	1.29	463	73.8	11.79
T_9 – T_4 + S + Mo + B	47.6	90	1.41	501	78.8	12.27
T_{10} – T_2 + T_3 + S + Mo + B	50.1	100	1.38	471	74.8	11.85
T_{11} – T_2 + T_4 + S + Mo + B	49.9	97	1.32	486	76.9	12.26
SEm±	**0.7**	**2**	**0.05**	**15**	**2.2**	**0.32**
CD at 5%	**ns**	**6**	**ns**	**44**	**6.3**	**0.93**

Table 2: Effect of macro and micro nutrients on gross returns, net returns and B:C ratio of Berseem during 2009-10 to 2011-12 (Pooled data)

Treatments	Cost of cultivation (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B: C ratio
T_1–Absolute Control	14500	39333	24833	1.71
T_2 – RDF	15000	49733	34733	2.31
T_3 – FYM @ 5t / ha	17000	43333	26333	1.55
T_4 – FYM @ 10t / ha	19500	47267	27767	1.42
T_5 – T_2 + T_3	17500	47367	29868	1.70
T_6 – T_2 + T_4	20000	44900	24900	1.25
T_7 – T_2 + S + Mo + B	17000	45667	28667	1.69
T_8 – T_3 + S + Mo + B	19000	46333	27333	1.44
T_9 – T_4 + S + Mo + B	21500	50066	28567	1.33
T_{10} – T_2 + T_3 + S + Mo + B	19500	47133	27633	1.42
T_{11} – T_2 + T_4 + S + Mo + B	22000	48633	26633	1.21
–	-	1483	1483	0.08
CD at 5%	-	4376	4376	0.22

Note: The herbage forage sale rate was Rs. 100 / - per q.

Conclusion

The experimental results indicated that application of 10 t / ha FYM along with sulphur, boron and molybdenum had higher green and dry forage yield of berseem than 100% RDF (inorganic source) but the net returns and B:C ratio were observed significantly highest under alone application of recommended dose of fertilizer followed by combined application of RDF+FYM@5 t / ha. Besides, it will improve the soil status and sustained the system. Therefore, it is recommended that the berseem should be fertilized

with FYM@10 t / ha +30 kg sulphur+4 kg boron+1kg molybdenum / ha for higher productivity and quality of berseem herbage followed by RDF+FYM@5 t / ha in Tari region of Indo-Gangetic plains of India.

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