

Short Communication

Forage yield of berseem (*Trifolium alexandrinum*) as affected by phosphorus and potassium fertilization

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Accepted 21 March, 2011

This research was conducted with the aim to quantify the effect of phosphorus and potassium fertilization on forage yield of berseem (*Trifolium alexandrinum*). The experiment was carried out at the Research Farm of Khyber Pakhtunkhwa, Agricultural University Peshawar, Pakistan during the cropping season of 2004 to 2005. Randomized complete block design (RCBD) having four replications was used for the experiment. Significant differences were found among the treatments for number of branches per plant, fresh forage yield and dry forage yield. The highest number of branches per plant (9.15), fresh forage yield (6077 kg ha⁻¹) and dry forage yield (156.83 kg ha⁻¹) were recorded in plots with 60 kg P ha⁻¹ x 30 kg K ha⁻¹ treatments, while the lowest values of 6.93, 5430 kg ha⁻¹ and 153.80 kg ha⁻¹ for branches per plant, fresh forage yield and dry forage yield, respectively were recorded in the plots with no fertilizer (control). Emergence (m⁻²) and plant height of berseem were non-significantly affected by phosphorus and potassium fertilization. So, it was concluded that berseem showed better performance in terms of higher forage yield under 60 kg P ha⁻¹ x 30 kg K ha⁻¹ levels in Peshawar valley.

Key words: Phosphorus, potassium, forage yield, berseem.

INTRODUCTION

In Pakistan, the major fodder crops during winter (*Rabi*) include berseem (*Trifolium alexandrinum*), shaftal (*Trifolium resipunatum*), lucerne (*Medicago sativa*), oats (*Avena sativa*), barley (*Hordium vulgare*) and mustard (*Brassica campestris*); while during summer (*Kharif*), these comprise maize (*Zea mays*), sorghum (*Sorghum bicolor*) and millets. These crops cover 16 to 19% of the total cropped area in Pakistan. Over time, the area remained more or less stagnant.

In many parts of Pakistan, there is a serious shortage of fodder for livestock, and the available fodder is often of poor quality. These situations need particular attention. In the higher altitude, that is, hilly areas of northern Pakistan where conserved fodder is in the form of maize stalk, wheat straw is traditionally fed during winter and spring.

In irrigated areas of Pakistan where although green, fodder is a traditional crop, only a few local fodder species and varieties are in widespread use

The ability of the given forage species to produce sufficient quantity of seed plays a very crucial role in the species desirability and availability. The farmers are facing a lot of problems in getting maximum forage yield from berseem for their livestock. Improved fodder varieties are available at research level and they need to be made available to farmers. These varieties have the potential to increase fodder yields 2 to 3 times when compared to local varieties which are currently under cultivation (Singh, 2000). Phosphorus is essential for the formation of adenosine triphosphate (ATP) which is currency the energy for living things and also for nicotinamide adenine dinucleotide phosphate (NADP) which is very important for the process of photosynthesis. Potassium (K) is extremely important for the growth of the plant root system.

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Moreover, phosphorus is also an integral part of myo-inositol phosphate which may be tri, tetra or hex-inositol (1,2, 3,4,5,6 myo-inositol hexakisphosphate also called Phytic acid (Brune et al., 1992).

The project was therefore designed to find out the effect of different levels of phosphorus and potassium on the forage yield performance of berseem in the irrigated areas of Peshawar.

MATERIALS AND METHODS

The research on the "forage yield of berseem as affected by phosphorus and potassium fertilization" was conducted at the Research Farm of Khyber Pakhtunkhwa Agricultural University, Peshawar, during 2004 to 2005 cropping season. The soil of the experimental site was silty clay loam with a clay type montmorillonite, low in nitrogen (0.03 to 0.04%), low in organic matter (0.8 to 0.9%) and alkaline with a pH of 8.0 to 9.2. Generally, Pakistani soils are deficient in P and K which creates so many nutritional disorders in crop plants and thus tremendously decreased crop plant, and so, fertilizers in the form of NPK are applied to the crop plants. The experiment was carried out in RCBD having four replications. Treatments including phosphorus (30, 60 and 90 kg ha⁻¹) and potassium (0, 30 and 60 kg ha⁻¹) were applied to berseem. The size of each plot was 2.1 x 8 m. After making the water channels and preparation of field, the seeds were broadcasted uniformly in standing water in their respective plots. The calculated quantities of fertilizer doses were broadcasted in the respective plots according to the design and were mixed with soil at the time of sowing. Sowing was done on the 15th of October 2004. The first irrigation was applied at the time of sowing, while the second irrigation was applied about 12 days after sowing for the best establishment of seedlings. Data were recorded on emergence (m²), plant height (cm), number of branches per plant, fresh forage yield (kg ha⁻¹) and dry forage yield (kg ha⁻¹). Data relating to emergence (m²) was recorded by selecting an area of 1 m² in each plot. Plant height was recorded on three randomly selected plants at each cutting by measuring the length of the plant from the soil surface to the upper most tip of the plant and then averaged. The number of branches per plant was counted on randomly selected three plants in each plot at the time of each cutting and then the average value was calculated. The fresh forage yield of a plot was taken just after each cutting in the representative area of 1 m² and then converted into kg ha⁻¹. The harvested material was placed in the open air for drying and the dry weight of a plot was converted into kg ha⁻¹. The data were statistically analyzed using analysis of variance for RCB design. LSD test was used to test the significance of differences among the means of different treatments.

RESULTS AND DISCUSSION

Emergence (m²)

Both phosphorus and potassium had non-significant effect on emergence (m²) (Table 1). The possible reason may be due to improper utilization of phosphorus and potassium. Secondly, more losses of fertilizers occurred during the application at the sowing time. Contrary results were given by Sinha and Rai (1999) who reported that emergence (m²) of berseem fodder was significantly affected by different levels of phosphorus and potassium. The differences may be due to heterogeneity of the soil or difference in irrigation water or it may be due to more

percolation of fertilizers in the deeper zones of the soil which may be away from the root system of berseem.

Plant height (cm)

Non-significant differences were found for phosphorus and potassium for the plant height of berseem (Table 1). The possible argument may be that plant height is a function of genotype as well as environmental condition. Secondly, it may be due to less competition of the plant for nutrients, particularly P and K. The results are in close agreement with that of Lannucci et al. (2000) who reported that plant height was not affected by P and K.

Number of branches per plant

Significant differences were found among the different levels of phosphorus and potassium for number of branches per plant (Table 1). Maximum number of branches (9.15) per plant was recorded in plots with 60 kg P ha⁻¹ x 30 kg K ha⁻¹, while minimum value was recorded (6.93) in the control plots. The possible reason for this may be due to good emergence, proper light and temperature. Similar results were given by Jadhav and Keskar (1998). They reported that 0 to 120 kg K ha⁻¹ increased the number of branches. But since emergence was non significant, thus there were no differences. The number of branches per plant is actually a vegetative trait and can be easily influenced by environment and in this work, it was fertilizer.

Fresh forage yield (kg ha⁻¹)

Fresh forage yield was significantly affected by phosphorus and potassium (Table 1). The highest fresh forage yield (6077 kg ha⁻¹) was recorded in the plots with 60 kg P ha⁻¹ x 30 kg K ha⁻¹, while the lowest value (5430 kg ha⁻¹) was observed in the control plots. It may be due to the good emergence and more number of branches which resulted to higher fresh forage yield. Opposite results were reported by Ali and Yousif (1996) and Zafer et al. (2006).

Dry forage yield (kg ha⁻¹)

Dry forage yield was significantly affected by phosphorus and potassium fertilizer (Table 1). The highest dry forage yield (156.83 kg ha⁻¹) was observed in the plots with 60 kg P ha⁻¹ x 30 kg K ha⁻¹, while the lowest value (153.80 kg ha⁻¹) was recorded in plots with no fertilizer. This may be due to the suitable date of sowing and timing of the application of phosphorus at the vegetative stage. The findings are supported by Sood and Kumar (1998), who concluded that the application of P₂O₅ at 30 to 90 kg ha⁻¹ increased the fresh forage yield which in turn increased the dry forage yield.

Table 1. Forage yield of berseem as affected by phosphorus and potassium fertilization.

Treatment	Emergence (m ⁻²)	Plant height (cm)	Number of branch per plant	Fresh forage yield (kg ha ⁻¹)	Dry forage yield (kg ha ⁻¹)
30 kg P ha ⁻¹	53.00	65.25	8.57 ^b	5873 ^c	155.14 ^b
60 kg P ha ⁻¹	53.08	65.10	8.58 ^b	5873 ^c	155.22 ^b
90 kg P ha ⁻¹	54.00	64.22	8.50 ^b	5912 ^b	156.16 ^a
∅ kg K ha ⁻¹	53.50	64.75	6.93 ^d	5430 ^e	153.80 ^d
30 kg K ha ⁻¹	52.82	65.10	8.53 ^b	5899 ^c	155.37 ^b
60 kg K ha ⁻¹	53.25	64.68	7.93 ^c	5690 ^d	155.58 ^b
30 kg P x 30 kg K ha ⁻¹	52.25	66.25	8.65 ^b	5938 ^b	154.55 ^c
30 kg P x 60 kg K ha ⁻¹	53.50	64.85	7.85 ^c	5899 ^c	156.36 ^a
60 kg P x 30 kg K ha ⁻¹	53.75	65.10	9.15 ^a	6077 ^a	156.83 ^a
60 kg P x 60 kg K ha ⁻¹	53.25	65.30	8.10 ^b	5821 ^c	154.76 ^c
90 kg P x 30 kg Kha ⁻¹	5.50	63.95	8.45 ^b	5860 ^c	156.63 ^a
90 kg P x 60 kg K ha ⁻¹	54.50	63.90	7.95 ^c	5821 ^c	155.62 ^b
LSD	ns	ns	0.3414	197.0	1.568

Means of the same category followed by different letters were significantly different at 5% level of probability; ns = non-significant; LSD = least significant difference.

Conclusion

From the results, it can be concluded that berseem showed better performance in terms of the maximum forage yield under 60 kg P ha⁻¹ x 30 kg K ha⁻¹ levels. Therefore, 60 kg P ha⁻¹ x 30 kg K ha⁻¹ levels is recommended for higher forage yield from berseem in the irrigated areas of Peshawar valley.

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