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Full Length Research Paper

Effect of phosphorus and potassium on seed production of berseem

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A research study was conducted to find out the effect of phosphorus and potassium on seed production performance of berseem Egyptian clover (*Trifolium alexandrinum* L) which belongs to the family Papilionaceae. The experiment was conducted at Research Farm of Khyber Paktunkhwa, Agricultural University Peshawar, Pakistan during 2004 to 2005. The experiment was carried out in randomized complete block design (RCBD) with four replications. Treatments including phosphorus (30, 60 and 90 kg P ha^{-1}) and potassium (0, 30 and 60 kg K ha^{-1}) were applied to berseem. These treatments produced significant effect on the number of heads (m^{-2}), number of seeds head $^{-1}$, biological yield (kg ha^{-1}), seed yield (kg ha^{-1}) and thousand seed weight (g). Maximum number of heads (2430 m^{-2}), number of seeds head^{-1} (41.50), biological yield (1310 kg ha^{-1}), seed yield (240 kg ha^{-1}) and thousand seed weight (2.18 g) were recorded in plots having 60 kg P ha^{-1} x 30 kg K ha^{-1}, while minimum number of seeds (1680 m^{-2}), number of seeds head^{-1} (30.06), biological yield (1072 kg ha^{-1}), seed yield (120kg ha^{-1}) and thousand seed weight (1.90g) were obtained from plots having no fertilizers (control or 0 kg ha^{-1}). The findings of this study shows that berseem had better performance in terms of seed production when fertilized with of 60 kg P ha^{-1} and 30 kg K ha^{-1} in irrigated areas of Peshawar valley.

Key words: Berseem, seed production, phosphorus, potassium.

INTRODUCTION

The berseem (*Tifolium alaxandrium* L) is one of the most important forage legumes in Pakistan and India which belongs to the family Papilionaceae and order Leguminale. It was first introduced in Sindh in 1904. Later, its cultivation was started in Peshawar (Khyber Pakhtunkhwa) region in 1924, from where its cultivation was extended to the irrigated tracts of Punjab. Now it is a major winter fodder crop and is successfully grown under irrigated conditions and in some areas in the entire country.

In Pakistan, major fodder crops grown in winter (*Rabi*) include berseem, shaftal, lucerne, oats, barley and mustard; while during summer (*Kharif*) the ones grown include maize, sorghum and millets. These crops cover 16 to 19% of the total cropped area in the country. Over time, the area remained more or less stagnant.

In many parts of Pakistan, there is a serious shortage of fodder of livestock and the available fodder is often of poor quality. These two situations (shortage and poor quality fodder), particularly need attention. In the higher altitude, that is, hilly areas of northern Pakistan, is where conserved fodder in the form of maize stalks (stovers) and wheat straws are traditionally fed to livestock during winter and spring seasons. In the irrigated areas of Pakistan, green fodder is a traditional crop but only a few

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local fodder species and varieties are in widespread use.

Improved fodder varieties are available at research level and this need to be made available to the farmers through extension department in order to exploit their full genetic potentials so as to meet the requirements of our live stock. These varieties have the potential to increase fodder yields 2 to 3 times when compared to local varieties currently in use (Singh, 2000).

The ability of given forage species to produce sufficient quantity of seed plays a very important role in the species desirability, perpetuation, palatability and availability. The difficulty in producing high seed yields in forages is due to the failure of seed setting in flowers. Disease and insect can be incriminated in some cases, whereas in others, lack of pollination, soil fertility or a caustic shortage may be involved. Numerous problems exist in harvesting and conditioning forage seeds. A seed's viability starts to deteriorate immediately after the seeds have reached maturity and all one can do is to retard the change by regulating the time and method of harvest and post harvest treatment. Importation of fodder seed is increasing each year. The farmers generally use the locally available cultivars due to their low purchasing power and unawareness of new cultivars of fodder. Local production of clovers seed seems to be neglected by farmers, government organizations and private companies (Dost, 1997).

The present study was therefore designed to determine the effect of different levels of phosphorus and potassium in order to maximize seed production from berseem in the irrigated areas of Peshawar valley.

MATERIALS AND METHODS

This study was conducted at the Research Farm of Khyber Pakhtunkhwa, Agricultural University, Peshawar, during 2004-2005. 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 in a reaction with a pH of 8.0 to 9.2. The experiment was designed using randomized complete block design (RCBD) with four replications. Treatments including phosphorus (30, 60 and 90 kg P ha^{-1}) and potassium (0, 30 and 60 kg K ha^{-1}) were applied to berseem. The size of each plot was 2.1 x 8 m. After making water channels and thorough preparation of field, the seeds were broadcasted uniformly in standing water in their respective plots. The calculated quantities of fertilizers doses were broadcasted in the respective plots according to the design and mixed with the soil at the time of sowing.

Sowing was done on 15th of October, 2004. First irrigation was applied at the time of sowing, while second irrigation was applied about 12 days after sowing for the best establishment of seedlings. Data were recorded on number of heads (m^{-2}), number of seeds $head^{-1}$, biological yield (kg ha^{-1}), seed yield (kg ha^{-1}) and thousand seed weight (g). Number of heads (m^{-2}) was recorded by counting the number of heads in one square meter randomly selected area in each plot. Number of seeds $head^{-1}$ was counted in three selected heads in each plot at the time of cutting and averaged. Biological yield was recorded by harvesting the whole plot and then converted into kg ha^{-1}. Seed yield was obtained after threshing of the dried material collected for biological yield. Thousand seed weight was recorded by separating thousand seeds manually from each treatment and weighed by electrical balance. Least significant difference test was used to test the significance of differences among means of the different treatments.

RESULTS AND DISCUSSION

Number of heads (m^{-2})

Number of heads (m^{-2}) of berseem was significantly affected by different levels of phosphorus and potassium (Table 1). Maximum number of heads (2430 m^{-2}) was recorded in berseem plots having 60 kg P ha^{-1} x 30 kg K ha^{-1} treatments, while minimum number of heads (1680) m^{-2} was obtained from control plots. The possible reason could be due to the fact that, there was more vegetative growth in berseem which leads to production of more heads. These results are in conformity with Vaez and Zadeh (1995). They also reported that phosphorus had significant effect on seed production of berseem clover.

Number of seeds $head^{-1}$

Seeds $head^{-1}$ of berseem was significantly affected by phosphorus and potassium fertilizers (Table 1). Highest number of seed $head^{-1}$ (41.50) were produced by 60 kg P ha^{-1} x 30 kg K ha^{-1}, while minimum numbers of seeds $head^{-1}$ (36.06) were produced by control plots. The possible reason could be due to more branching capacity of berseem with more well filled heads which resulted in greater number of seeds $head^{-1}$. The same results were founded by Mukharje and Mandal (2000), who reported that the phosphorus levels had significant effect on the number of seed $head^{-1}$.

Biological yield (kg ha^{-1})

Biological yield (Kg ha^{-1}) of berseem was significantly affected by the different levels of phosphorus and potassium (Table 1). Maximum biological yield (1310 kg ha^{-1}) was obtained from plots having 60 kg P ha^{-1} x 30 kg K ha^{-1} treatments, while minimum biological yield (1072 kg ha^{-1}) was recorded in control plots. The possible reasons could be suitable temperature, proper light and lesser weed competition. Our results are in line with Naveen and Sood (1995) who also reported that phosphorus had significant effect on the yield and quality of berseem.

Seed yield (kg ha^{-1})

Phosphorus and potassium had significant effect on seed yield (kg ha^{-1}) (Table 1). Higher seed yield (240 kg ha^{-1}) was obtained from berseem having 60 kg P ha^{-1} x 30 kg K ha^{-1}, while lower seed yield (120 kg ha^{-1}) was gotten from plots having no fertilizer. This might be due to the fact that higher number of plants emerged with more branches, better filled heads and sound and plump seeds which in

Table 1. Effect of Phosphorus and Potassium fertilizers on various Plant characters

Treatment	Number of head (m^{-2})	Number of seed $head^{-1}$	Biological yield (kg ha^{-1})	Seed yield (kg ha^{-1})	Thousand seed weight (g)
30 kg P ha^{-1}	1775^{e}	38.50^{b}	1130^{b}	145^{d}	2.09^{b}
60 kg P ha^{-1}	1825^{d}	38.17^{c}	1219^{a}	160^{c}	2.00^{d}
90 kg P ha^{-1}	1860^{d}	38.92^{b}	1218^{a}	162^{c}	2.06^{c}
0 kg K ha^{-1}	1680^{f}	36.06^{c}	1072^{c}	120^{e}	1.90^{e}
30 kg K ha^{-1}	1900^{d}	38.83^{b}	1213^{a}	140^{d}	2.06^{c}
60 kg K ha^{-1}	1985^{d}	38.67^{b}	1183^{b}	170^{c}	2.06^{c}
30 kg P ha^{-1} x 30 kg K ha^{-1}	2085^{c}	38.50^{b}	1141^{b}	187^{b}	2.08^{b}
30 kg P ha^{-1} x 60 kg K ha^{-1}	2100^{c}	39.00^{b}	1117^{c}	196^{b}	2.13^{b}
60 kg P ha^{-1} x 30 kg K ha^{-1}	2430^{a}	41.50^{a}	1310^{a}	240^{a}	2.18^{a}
60 kg P ha^{-1} x 60 kg K ha^{-1}	2135^{b}	37.75^{c}	1263^{a}	205^{a}	1.99^{d}
90 kg P ha^{-1} x 30 kg K ha^{-1}	2046^{c}	39.50^{b}	1196^{b}	190^{b}	2.10^{b}
90 kg P ha^{-1} x 60 kg K ha^{-1}	2125^{b}	39.25^{b}	1169^{b}	185^{b}	2.08^{b}
LSD	102.0	1.919	196.3	0.7362	0.09409

Means of the same category followed by different letters are significantly different at 5% level of probability. LSD: least significant difference.

turn yielded more seed in berseem. These results are in close proximity to Singh and Virendra (1999) who also reported that phosphorus and potassium has significant effect on seed production of berseem.

Thousand seed weight (g)

Significant differences were found among different levels of phosphorus and potassium for thousand seed weight of berseem (Table 1). Maximum thousand seed weight (2.18 g) was obtained from 60 kg P ha^{-1} x 30 kg K ha^{-1} levels followed by minimum thousand seed weight (1.90 g) from plots having no application of phosphorus and potassium. The probable reason for this might be due to more healthy plants in berseem which in turn resulted in healthier and plump seed formation. Our findings are in close agreement with Jamriska (2000), who also reported that phosphorus and potassium had significant effect on the yield and quality of berseem.

Conclusion and recommendation

On the basis of the experimental results, it can be concluded that berseem showed better performance in terms of seed production under 60 kg P ha^{-1} x 30 kg K ha^{-1} dose of P and K fertilizer. Therefore, a dose of 60 kg P ha^{-1} x 30 kg K ha^{-1} fertilizer is recommended during sowing of berseem to get maximum seed production in irrigated areas of Peshawar valley.

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