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EFFECT OF FOLIAR SPRAY OF POTASH ON ECONOMIC SEED PRODUCTION OF BERSEEM

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ABSTRACT

Fodder is fuel of livestock contributing 53.21% for agriculture and 11.4 % to GDP of the country. Availability of fodder to milk animals is very low resulting very poor milk production per animal. Low fodder availabilities due to non-availability of quality seed in country in berseem because seed yield of berseem is very low. Present study reveals that foliar application of potash has increased per acre seed production. The concentration of potash solutions were used that were 0, 0.5, 1.0, 1.5, 2.0, 2.5 and 3 $glit^{-1}$ along with basal dose 23-80-50 (NPK kg ha^{-1}). Two foliar applications were applied, 1st application before the flowering and the 2nd at the flowering initiation stage. The concentration of potash solutions as foliar produces seed yield of 631.7, 639.4, 644.3, 657.1, 653.9, 641.2 and 637.6 kg ha^{-1} in year 2009-10 while next year in 2010-11 produces 651.5, 653.6, 660.5, 686.4, 677.6, 659.9 and 652.4 kg ha^{-1} respectively which were slightly higher than year 2009-10. No of seeds per capsule in potash dose of 0, 0.5, 1.0, 1.5, 2.0, 2.5 and 3 $glit^{-1}$ remained 55.32, 57.10, 58.82, 62.6, 62.2, 57.8 and 55.5 in year 2009-10 while in next year 57.3, 58.8, 60.1. 64.3, 60.7, 58.1 and 57.7 respectively. Overall 1.5 $glit^{-1}$ solution of potash applied as foliar, produces 4.02 % higher seed yield, 13.20 % higher no of seeds per pod compared to control in year 2009-10 while produces 5.36 % higher seed yield and 5.93 % higher no of seeds per pod as compared to control in year 2010-11. The results confirmed that the practice of foliar potash nutrition when used as supplement is beneficial and economical for berseem seed production.

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INTRODUCTION

Berseem provides about 75% of total fodder available during Rabi. High quality of berseem seed is imported although its imports has reduced from 9929 t ha^{-1} 2002-03 to 4106 tha^{-1} 2007-08. Imported seed is cheaper than local seed due to its low yield. Potash plays significant role in berseem seed production. Foliar fertilization is a supplemental nutrition with macro and micro nutrients. Foliar nutrition is ideally designed to provide many elements in conditions that may be limiting production at a time when nutrient uptake from the soil is inefficient or nonexistent (Hiller, 1995).Balance supply of potassium fertilizer is necessarily for suitable crop production. Potassium is monovalent cation and is readily adsorbed by the soil cation exchange sites.

It is generally considered not to mobile in soil. In terms of nutrient absorption, foliar fertilization can be from 8 to 20 times as efficient as ground application (Kuepper,

2003). Fodder crops are cheapest source of feed for livestock and shortage of fodder production is main limiting factor for its development in the country. Major fodder crops grown during winter including berseem, vetch, oats, lucerne and barley. These crops cover 16-19% of the total cropped area in the country. However, availability of improved seed of fodder crops is one of the major limiting factors in fodder crops production in the country.

It is estimated that 5-10 percent area of fodder crops is grown with improved seed. Considering the subject of improved seed production, it involves a number of linked systems. Unfortunately, there is neither private nor government sector involve in seed business of fodder crops as it is in case of wheat, cotton vegetable etc. Only 10 percent fodder crops seed produced locally. So there is great potential at domestic fodder crop seed production. The present study was carried out to enhance seed production of berseem crop through foliar spray of potash.

MATERIAL AND METHODS

A field experiment was conducted during 2009-11 at fodder research institute, Sargodha. The trial was laid out in randomized complete block design with three repeats having a plot size of 18m^2. The soil characteristics were given in the table 1. The basal dose of fertilizer was applied as 23-80-50 (NPK kg ha^{-1}) at the time of sowing to all the treatments later on the foliar treatments were applied as 0, 0.5, 1.0, 1.5, 2.0, 2.5 and 3 glit^{-1} potash solutions.

Berseem variety "Anmol" was sown and seed was applied @ 4kg per acre. Seed was sown by broad cast method. After taken second cut of berseem for green fodder yield the trial was left in the field for seed production. The foliar spray doses were applied at two stages, one at before flowering and second at flowering stage. Dilute solutions of potash salt as per treatment were applied at 80 litter of water per acre as foliar spray at each stage. The data was significantly analyzed using analysis of variance LSD at 5% level of significance was worked out.

Table 1. Pre-sowing physico-chemical analysis of experimental soil.

Soil characteristics	2015-16	2016-17	Mean
Soil texture	loam	loam	loam
pH	7.9	8.07	7.99
EC(mScm^{-1})	0.62	0.64	0.63
O.M. %	0.67	0.69	0.68
Available K mg kg^{-1}	125	129	127

RESULTS AND DISCUSSION

The seed producing ability of berseem variety Anmol at various rates of potash foliar spray application differed significantly Table 2. Foliar treatments were applied in accordance to the plane in each plot. The concentration of potash solutions used were 0, 0.5, 1.0, 1.5, 2, 2.5 and 3 glit^{-1} which produces seed yield of 631.7, 639.4, 644.3, 657.1, 653.9, 641.2 and 637.6 kg ha^{-1} in year 2009-10 while next year in 2010-11 produces 651.5, 653.6, 660.5, 686.4, 677.6, 659.9 and 652.4 kg ha^{-1} respectively which were slightly higher than year 2009-10. The treatment T_4 overall gave significantly higher seed yield in both years followed by T_6 and T_3 as compared to control. The significant response of the potassium to seed yield in berseem (*Trifolium alexandrinum* L.) was observed by Attia (1996) and moreover, it is pronounced that the higher N rates because of a significant N × K interaction. His views was supported by Misra et al. (2012) that the seed yield and the test weight of the seeds increased with each successive increase in the K level in berseem.

The maximum number of sterile grains was recorded in T_7 followed by T_6, T_5, T_4, T_3, T_2 and T_1 which were 7.47, 6.20, 5.73, 4.30, 4.27, 4.23, and 3.20 in year 2009-10. Data in Table 2 also showed that in year 2010-11 T_1 (3.63) shows 52.3% less sterile grains as compared to T_7 (5.53). T_7 (3g lit^{-1} potash solution) showing its toxicity followed by T_6, T_5, T_4, T_3, T_2 and T_1. Similarly Nigam et al. (2010) also reported that dose 2.5 kg ha^{-1} gave higher grain yield as compared to control in second year. The higher concentration of potassium spray (T_6, T_7) decreases seed yield indicating no response, which might be due to toxicity.

In year 2009-10 the higher 1000 seed weight obtained was in T_4 which was 3.63g followed by T_5 and T_3 having 3.46 g and 3.36g respectively, which were 10.7%, 5.5% and 2.43% respectively higher as compared to control. Treatments T_7 with maximum concentration of potash showed decrease in thousands seed weight (3.29g). Similar results were also obtained in 2010-11, T_4 with 3.91g thousands seed weight which was 14.3% higher as compared to control. Similarly, at higher potash concentration in T_7 (10.7%) and T_6 (5.9%) decrease in weight was observed compared to T_4. Kumar et al. (2013) was also reported that foliar application of salicylic acid at 50 mg l^{-1} and KNO_3 (2%) produced the maximum heads m^{-2}, seeds head^{-1}, 1000 seed weight, seed yield and seed quality (germination percentage and seedling vigor index) in Egyptian clover.

Table 2. Yield components and seed yield of berseem.

TREATMENTS	No of seeds per capsule		No of sterile seeds per capsule		1000 seed weight (g)		Seed yield (kg ha^{-1})	
	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11	2009-10	2010-11
T1 23-80-50 (NPK kg ha^{-1}basal dose)	55.3E	57.3E	3.20D	3.63C	3.28E	3.42F	631.7F	651.5E
T2 0.5g lit^{-1} potash foliar spray+NPK basal dose	57.1CD	58.8C	4.23C	3.67C	3.31DE	3.49E	639.4DE	653.6D
T3 1 g lit $^{-1}$ potash foliar spray+ NPK basal dose	58.8B	60.1B	4.27C	4.70B	3.36C	3.69C	644.3C	660.5C
T4 1.5 g lit^{-1} potash foliar spray+ NPK basal dose	62.6A	64.3A	4.30C	4.73B	3.63A	3.91A	657.1A	686.4A
T5 2 g lit $^{-1}$ potash foliar spray+ NPK basal dose	62.2A	60.7B	5.73B	5.13B	3.46B	3.87B	653.9B	677.6B
T6 2.5 g lit $^{-1}$potash foliar spray+ NPK basal dose	57.8BC	58.1CD	6.20B	5.20A	3.33CD	3.67C	641.2D	659.9C
T7 3.0 g lit^{-1} potash foliar spray + NPK basal dose	55.5DE	57.7D	7.47A	5.53A	3.29DE	3.53D	637.6E	652.4DE
	1.62	0.95	0.96	0.99	0.05	0.03	1.91	1.46

Data in Table 2 also showed that No of seed per capsule was also 13.2% and 12.2% were higher in T_4 as compared to control followed by T_5 and T_3 in both years. Least number of seeds per capsule was recorded in control where no potash was applied as foliar. It might be the role of potash which may improves grain filling and phytomass production due to photosynthetic activity and effective translocation of assimilates to reproductive parts resulting in higher grain yield (Nigam et al., 2010). Overall results showed that 1.5 glit^{-1} potash solution application produces 23.38% higher grain yield, 8.55 % higher grain weight and 13.82% higher no of grains per capsule. Sarkar and Malik (2001) that foliar spray of potash at moderate rate of 0.5% proved more effective than lower (0.25%)and higher rate (1.0%) for grass pea in rice fellow land.

Economic analysis: Economic analysis as shown in Table 3 was performed for each treatment combination. Treatment T_4 1.5 g lit-1 potash foliar spray with NPK basal dose exhibited maximum benefit-cost ratio (12.7) with net benefit of Rs. 9030, followed by treatment T_5 2 g lit $^{-1}$ potash foliar spray with NPK basal dose (10.1) with net benefit of Rs. 7230. While minimum benefit-cost ratio of 2.1 was computed in treatment T_2 0.5g lit^{-1} potash foliar spray with NPK basal dose with net benefit of Rs.1470.

Table 3. Economic analysis on per hectare basis for each treatment for berseem seed yield as effected by potash foliar spray.

Treatments	Ave. Seed yield (kg ha^{-1})	Increase yield over control (kg ha^{-1})	value of the increased yield (Rs.)	Additional cost (Rs./ha)	Benefit cost ratio
T_1 23-80-60 (NPK kg ha^{-1}basal dose)	641.6	-	-	-	-
T_2 0.5g lit^{-1} potash foliar spray+NPK basal dose	646.5	4.9	1470	694.33	2.1
T_3 1 g lit $^{-1}$ potash foliar spray+NPK basal dose	652.4	10.8	3240	701.65	4.6
T_4 1.5 g lit^{-1} potash foliar spray+NPK basal dose	671.7	30.1	9030	708.97	12.7
T_5 2 g lit $^{-1}$ potash foliar spray+NPK basal dose	665.7	24.1	7230	716.3	10.1
T_6 2.5 g lit $^{-1}$potash foliar spray+NPK basal dose	650.5	8.9	2670	723.63	3.7
T_7 3.0 g lit^{-1} potash foliar spray+NPK basal dose	645	3.4	1020	730.95	1.4

CONCLUSIONS

Potash as foliar spray had the most prominent influence on the yield and the seed yield components of berseem. 1.5 g lit^{-1} potash foliar application influenced the formation of higher number of seeds in a pod that's why also showed higher seed yield in both years as compared to control. Higher concentration 3 g lit^{-1} of potash solution as foliar spray has negative effect on seed yield because its cause toxicity and seed sterility in berseem.

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