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RESEARCH PAPER

Response of different sources and levels of potash on growth, yield attributes and yields of isabgul (*Plantago ovata* Forsk)

C.J. PATEL*, J.J. PATEL, S.B. PATEL, R.A. PATEL, N.M. KUMBHAR AND B.V. HIRPARA
Department of Agronomy, B.A. College of Agriculture, Anand Agricultural University,
ANAND (GUJARAT) INDIA

Abstract : A field experiment was conducted during *Rabi* seasons of the year 2009-10 at College Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat to evaluate the productivity of isabgul crop under varying levels of potash. Application of 60 kg K_2O ha^{-1} from potassium sulphate (K_2SO_4) was most effective for securing higher seed yield and yield attributes, which resulted in to increased seed yield to the tune of 27.04 % over control. Higher net return (91266 Rs. ha^{-1}), cost benefit ratio (1:11.52) and net CBR (1:10.52) were obtained under the treatment combination (application of 60 kg K_2O ha^{-1} from K_2SO_4). The interaction effect of different sources and levels of potash was non-significant.

Key Words : Isabgul, *Plantago ovata*, *Blonde psyllium*, Potash

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INTRODUCTION

Blonde psyllium is an important medicinal crop of Gujarat. Due to low cost of production and higher return from the crop, Gujarat commands near monopoly in the production and export of isabgul seed and seed husk to the world market. It is cultivated in India about 1.3 lakh ha with production of 77000 MT seed. (Desai and Devra, 2008). Earning about 130 crores rupees from the isabgul seed and 150 crores rupees from husk were exported valued together Rs.280 crores. Isabgul is raised as a *Rabi* season crop and grown in all type of soil under irrigated conditions but does best on loamy soils. Water is scare commodity, which if used judiciously along with suitable agrotechniques would substantially increase the plant growth, yield attributes and yield. Application of fertilizers in proper amount and in proper time will go for higher crop production. Potassium application increases the plant's growth and yield because it participates in the mechanisam of stomatal movement, photosynthesis and helps in osmoregulatory adaption of plant due to water stress (Weimberg *et al*., 1982). With these dual purpose agronomic aspects in mind, an attempt has been made to conduct an experiment on response of different sources and levels of potash on growth, yield attributes and yields of isabgul (*Plantago ovata* Forsk).

MATERIALS AND METHODS

A field experiment was conducted during *Rabi* seasons of the year 2009-10 at College Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat. The soil was loamy sand in texture. The soil was low in available nitrogen, medium in phosphorus and low in potash. The experiment was laid out in Factorial Randomized Block Design (FRBD) with four replications. The treatments consisted of two sources of potash and five different levels of potash *viz.*, S_1: (Potassium chloride, KCl), S_2: (Potassium sulphate, K_2SO_4) and levels of potash *viz*., K_0: Control; K_1: 20 kg K_2O ha^{-1} ; K_2: 40 kg K_2O ha^{-1} ; K_3: 60 kg K_2O ha^{-1} and K_4: 80 kg K_2O ha^{-1}. In all, there were ten treatment combinations. Isabgul variety GI-2 was sown in line sowing at 30 cm distance on November 20th during the year 2009-10 and fertilized with

* Author for correspondence

30+15 kg NP ha^{-1}.

RESULTS AND DISCUSSION

The experimental findings obtained from the present study have been discussed in following heads:

Effect of sources and levels of potash :

The effect of sources of potash had significant influenced the yield attributes *viz.*, number of tillers per plant, number of effective spike per plant and total number of spike per plant, but non significant effect was observed on length of spike and test weight. Seed yield had an increasing trend with the source of sulphate of potash (K_2SO_4). Significantly the highest seed yield (2000 kg/ha) was registered under the treatment S_2 (K_2SO_4), (Table 1). The magnitude of increased in the seed yield was at the extent of 11.42 per cent over the treatment S_1 (KCl), it might be due to higher photosynthesis, protein synthesis, increased the root growth, drought resistance and reduced the lodging of the plant due to weak stalks, water loss and wilting consequently the dry matter production and ultimately increased the seed yield.

The seed yield displayed on increasing trend with the different levels of potash. Significantly higher seed yield (2116 kg/ha) was registered under the treatment K_4 (80 kg K_2O/ha), which remained at par with treatments K_3 (60 kg K_2O/ha) and treatment K_2 (40 kg K_2O/ha), (Table 1). The increased in seed yield of isabgul under the treatments K_4 (80 kg K_2O/ha), K_3 (60 kg K_2O/ha), K_2 (40 kg K_2O/ha), and K_1 (20 kg K_2O/ha), were to the tune of 28.61, 27.04, 27.36 and 11.74 per cent, respectively as compared to control. The increased seed yield due to levels of K_2O might be due to favourable influence of K on growth and yield attributes contributed towards the higher seed and straw yield over control. The second reason might be that the greater response to sulphate of potash (SOP) might be ascribed to increase availability of S in soil which was deficient in it. These results are in agreement with the results of Bose *et al*. (2006), Das and Choudhury (1996) and Singh and Verma (2001).

Interaction effect (S × K) (Table 2 and 3) with respect to seed yield of isabgul was influenced significantly due to different sources and levels of potash. The non-significant results were observed for the plant stand, plant height, av. number of tillers per plant, total number of tillers per plant, length of spike, lodging (%) and diseased index (%).

Economics :

The economical aspect of crop production is the major consideration for the farmers while making a decision on the adoption of a new technology. Among the different treatment combinations the treatment combination S_2K_3 (Potassium sulphate with application of 60 kg K_2O/ha) had given higher net realization, CBR and net CBR (91266, 1:11.52, 1:10.52), respectively, followed by treatment combination S_2K_2 (K_2SO_4 with 40 kg K_2O/ha) with net realization (87031), CBR (1:11.48) and Net CBR (1:10.48) (Table 4). The treatment combination S_2K_3 (K_2SO_4 with 60 kg K_2O/ha) yielded (114 kg/ha) higher seed yield over treatment combination S_2K_2 (K_2SO_4 with 40 kg K_2O/ha). If we consider the economics that treatment combination gave higher returns (Rs. 4235/ha) than treatment combination S_2K_2, though higher 20 kg K_2O/ha application from potassium sulphate (K_2SO_4) increased the cost. These might have been due to the cumulative effect of the superiority of K_2 (40 kg K_2O/ha) and K_1 (20 kg K_2O/ha) treatments. These results

Table1: Influence of different sources and levels of potash on growth, yield attributes and yield of isabgul

Treatments	Plant stand (cm)		Plant height (cm)		Av. no. of tillers per plant	Total no. of spikes per plant	Av. no. of effective spikes per plant	Average Length of spike	Seed yield (kg/ha)	Straw yield (kg/ha)
	At 25 DAS	At havest	At tillering stage	At havest						
Sources of potash (S)										
S_1 = KCl	31.05	42.65	31.06	40.48	21.75	109.08	106.81	6.22	1795	12716
S_2 = K_2SO_4	29.98	42.61	31.06	39.88	23.81	118.22	116.80	6.55	2000	13241
S.E.±	0.46	0.63	0.36	0.47	0.60	1.81	1.64	0.24	45.30	288.88
C.D. at 5%	NS	NS	NS	NS	1.75	5.25	4.75	NS	131.45	NS
Levels of potash (K)										
K_0 = control	29.64	44.72	31.40	38.33	20.18	106.60	105.68	5.47	1511	12653
K_1 = 20Kg K_2O/ha	29.92	41.39	31.50	40.65	22.05	109.60	108.80	5.58	1712	12742
K_2 = 40Kg K_2O/ha	29.88	41.88	30.80	41.10	23.85	116.90	111.05	7.00	2080	12933
K_3 = 60Kg K_2O/ha	31.29	42.50	30.86	40.23	23.90	118.10	117.63	7.02	2071	13034
K_4 = 80Kg K_2O/ha	31.86	42.64	30.73	40.59	23.93	117.05	115.88	6.85	2116	13532
S.E±	0.73	1.00	0.56	0.74	0.95	2.86	2.59	0.38	71.63	456.75
C.D. at 5%	NS	NS	NS	NS	2.77	8.31	7.52	1.10	207.84	NS
Interaction (S × K)	NS	NS	NS	NS	NS	NS	Sig.	NS	Sig.	Sig.
C.V. (%)	6.75	6.64	5.13	5.21	11.83	7.13	6.55	16.77	10.68	9.95

Table 2 : Seed yield (kg ha^{-1}) as influenced by interaction of different sources and levels of potash

Treatments	Levels of potash (K)				
Sources of potash (S)	K_0 (control)	K_1 (20 Kg K_2O/ha)	K_2 (40 Kg K_2O/ha)	K_3 (60 Kg K_2O/ha)	K_4 (80 Kg K_2O/ha)
S_1 (K_2SO_4)	1577	1587	1940	1807	2066
S_2 (KCl)	1444	1837	2220	2334	2165
S.E..±		101.30			
C.D. at 5 %		293.94			
C.V.%		10.68			

Table 3: Straw yields (kg ha^{-1}) as influenced by interaction of different sources and levels of potash

Treatments	Levels of potash (K)				
Sources of potash (S)	K_0 (control)	K_1 (20 Kg K_2O/ha)	K_2 (40 Kg K_2O/ha)	K_3 (60 Kg K_2O/ha)	K_4 (80 Kg K_2O/ha)
S_1 (K_2SO_4)	13246	12679	12790	12909	11957
S_2 (KCl)	12060	12805	13075	13159	15107
S.E..±		645.95			
C.D. at 5 %		1874.36			
C.V.%		9.95			

Table 4 : Gross realization, net realization and cost benefit ratio (CBR) and net cost benefit ratio for treatment combination

Treatment combinations	Seed yield (kg.ha^{-1})	Straw yield (kg.ha^{-1})	Gross realization (Rs.ha^{-1})	Total cost of production (Rs.ha^{-1})	Net realization (Rs.ha^{-1})	CBR	NET CBR
S_1K_0	1577	13246	69703	7473	62230	1:9.33	1:8.33
S_1K_1	1587	12679	69819	7758	62061	1:8.99	1:7.99
S_1K_2	1940	12790	78675	7943	70732	1:9.90	1:8.90
S_1K_3	1807	12909	78734	8127	70607	1:9.67	1:8.67
S_1K_4	2066	11957	88618	8312	80306	1:10.66	1:11.66
S_2K_0	1444	12060	63790	7473	56317	1:8.54	1:7.57
S_2K_1	1837	12805	79882	7940	71942	1:10.06	1:9.06
S_2K_2	2220	13075	95337	8306	87031	1:11.48	1:10.48
S_2K_3	2334	13159	99939	8673	91266	1:11.52	1:10.52
S_2K_4	2165	15107	94153	9040	85113	1:10.41	1:9.41

Selling Price : Seeds @ Rs. 40.00 kg^{-1} **:** Straw @ Rs. 0.5 kg^{-1}

were supported by Bose *et al*. (2006) and Anna *et al*. (2008).

Conclusion :

In the light of the results obtained from present investigation, it is concluded that for securing higher seed yield and net realization of isabgul, crop should be fertilized with common basal application of 30 kg N + 15 kg P_2O_5 and 60 kg K_2O ha^{-1} from potassium sulphate on loamy sand soil under middle Gujarat conditions.

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