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Effect of potassium application on productivity of barley (*Hordeum vulgare* L.) in arid conditions of western Rajasthan

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ABSTRACT : A field experiment entitled effect of potassium application on productivity of barley (*Hordeum vulgare* L.) in arid condition of Western Rajasthan was conducted on loamy sand soil of the Agronomy farm, College of Agriculture, Bikaner during *Rabi* season of 2009-2010. The experiment was comprised of three potassium application methods (as full basal at sowing, ½ basal+ ½ top dressing at 30 DAS and ½ basal + ½ top dressing in two splits at 30 and 60 DAS) along with control. Results of the experiment indicated that application of potassium through different methods significantly increased growth characters *viz*., plant height, dry matter accumulation and yield attributes namely effective tillers per metre row length, spike length, grains per spike and test weight of barley as compared to control. Similarly, grain yield, straw yield and biological yield enhanced significantly application through different methods in comparison to control. The maximum grain yield (2787 kg/ha), straw yield (3143 kg/ha) and biological (5930 kg/ha) were obtained when K as ½ basal + ½ top dressing at 30 DAS which were statistically found at par with same K rate as fully basal application. Also, the maximum harvest index was recorded with basal application no potassium, being at par with same K rate as ½ basal + ½ top dressed at 30 DAS and showed statistically superiority over control treatment.

Key Words : Potassium application, Productivity, Barley

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Barley (*Hordeum vulgare* L.) is an important cereal crop of India, which play a major role in the barley producing countries. Ranking of barley is next to the maize, wheat and rice both in acreage and in production of grain. In India, the major states growing barley are Uttar Pradesh, Rajasthan, Punjab, Haryana, Madhya Pradesh, Himachal Pradesh, Bihar, Jharkhand and Jammu and Kashmir. It is also grown in small pockets in the other states like Chhattisgarh, West Bengal, Nagaland, Maharashtra, Sikkim and Delhi. However, barley cultivation is concentrated mostly in Uttar Pradesh, Rajasthan and Madhya Pradesh which, put together, account for 80.34 per cent of total barley acreage (Dogra, 2008). According to the ministry of agriculture, the total domestic food grain production is estimated at 219 million tonnes for 2007-08. Out of this, barley production accounts for a meagre 1.33 million tonnes. According to karvy comtrade's 'barley outlook report' in India, during 2007–2008, the area brought under barley cultivation was around 0.77 million ha and production was estimated at 1.31 million tonnes. The total consumption estimated to be 1.31 million tonnes is equal to the production. This indicated the great scope for about its cultivation. Rajasthan ranks second after Uttar Pradesh both in area and production. During the year 2008-09, it was grown in nearly 2.87 lakh hectares with production and productivity levels of 8.78 lakh tonnes and 3061 kg/ha, respectively (Anonymous, 2009). In the state of Rajasthan, important barley growing regions are Jaipur, Bharatpur, Sriganganagar, Bhilwara and Jodhpur. Presently, with the advent of irrigation facilities through canals and tube-wells, area under barley cultivation is increasing in arid western region comprising districts of Bikaner, Jaisalmer, Barmer, Jodhpur and

Churu. But productivity level is too low fluctuating between 10-18 q/ha because of course textured sandy soils with poor fertility status, low water retention capacity and stressful environmental conditions. Though barley is well suited to the condition of water scarcity, poor fertility, salinity and sodicity of soils. Thus, it is grown well where other crops cannot be grown successfully. Therefore, its ability to grow under adverse conditions has attracted farmers' even of such non-traditional area in the state.

RESEARCH PROCEDURE

The experiment was conducted at Agronomy Farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner. Geographically, Bikaner is situated at 28.01^0N latitude and 73.22^0 E longitude at an altitude of 234.70 meters above mean sea level under agro climatic zone 1c (Hyper arid partially irrigated north western plain) of Rajasthan. The experiment was laid out in Randomized Block Design (RBD) with three replications. The treatments were randomized with the help of random number table (Fisher, 1950). Sowing was done at R x R spacing of 25 cm apart towards width dimension of 3.0 m, thus 12 rows in each plots. Each plot consisted of gross dimension of 4.0 m x 3.0 m and net area 3.0 m x 2.0 m.

RESEARCH ANALYSIS AND REASONING

Potassium @ 30 kg ha^{-1} was applied through murate of potash (MOP) as per treatments (full basal at sowing, ½ basal + ½ top dressed at 30 DAS and ½ basal + remaining ½ top dressed in two splits at 30 and 60 DAS).

Plant height :

Data presented in Table1,clearly indicated that application of potassium @ 30 kg ha^{-1} as full basal and ½ basal + ½ top dressed at 30 DAS significantly increased plant height of barley at maturity stage as compared to control. Though the maximum plant height (80.40 cm) was recorded with K application as ½ basal + ½ top dressed at 30 DAS treatment being at par with the same rate as full basal which were higher by 3.05 and 2.35 per cent over control, respectively. Further data revealed that there was non significant variation among different methods of K application.

Dry matter accumulation :

Data given in Table 2, reveal that potassium application @ 30 kg ha^{-1} as basal treatment significantly increased dry matter accumulation in barley at initial growth stage (30 DAS) over control. Further, application of 30 kg K ha^{-1} as ½ basal + ½ top dressed and as ½ basal + ½ top dressed in two splits though improved dry matter accumulation per plant but failed to record statistical superiority over control. Further data indicated that potassium application @ 30 kg ha^{-1} through different methods significantly improved dry matter accumulation per plant at later growth stages (60, 90 and 120 DAS) as compared to no potassium control treatment. The maximum dry matter per plant at 60 DAS and 120 DAS were noted with split application as ½ basal + ½ top dressed at 30

Table 1 : Effect of potassium on plant stand and plant height of barley

Treatments	Plant stand per m row length at 20 DAS	Plant height at harvest
Potassium application		
Control	24.44	78.0
30 kg K_2O basal application	25.12	79.8
30 kg K_2O ½ basal and ½ top dressing at 30 DAS	25.74	80.4
30 kg K_2O ½ basal and ½ top dressing in two split at 30 DAS and 60 DAS	25.45	79.1
S.E. ±	0.328	0.55
C.D. (P=0.05)	NS	1.6

NS = Non–significant

Table 2 : Effect of potassium on dry matter accumulation of barley

Treatments	Dry matter accumulation (g/plant)			
	30 DAS	60 DAS	90 DAS	120 DAS
Potassium application				
Control	0.15	1.57	9.24	14.20
30 kg K_2O basal application	0.19	1.65	9.77	14.80
30 kg K_2O ½ basal and ½ top dressing at 30 DAS	0.17	1.72	9.95	15.21
30 kg K_2O ½ basal and ½ top dressing in two split at 30 DAS and 60 DAS	0.17	1.71	10.04	15.08
S.E. ±	0.006	0.032	0.089	0.093
C.D. (P=0.05)	0.02	0.09	0.26	0.27

DAS. Whereas at 90 DAS, the maximum dry matter per plant was recorded with three split treatment as ½ basal + ½ top dressed in two splits at 30 and 60 DAS. The later treatment proved statistically superior in comparison to the same rate of K applied as fully basal and no potash (control) treatment at 90 DAS and at maturity stage. Also application 30kg k ha^{-1} as basal dose significantly increased dry matter accumulation per plant by 5.74 and 4.23 per cent over control at 90 and 120 DAS, respectively.

Effect of potassium application on yield attributes and yield :

Effective tillers :

Data given in Table 3 reveal that application of potassium @ 30 kg ha^{-1} through different methods significantly increased effective tillers per meter row length recorded at maturity stage in barley over control. Application of potassium as ½ basal + ½ top dressing at 30 DAS registered the maximum number of effective tillers per meter row length which also showed significant edge over the same K rate applied as fully basal and ½ basal + remaining ½ dose top dressing in two splits. The corresponding increases in effective tillers per meter row length was of the order of 3.63, 2.22 and 6.69 per cent over K application as fully basal, ½ basal + ½ top dressing in two splits and no potassium control treatments, respectively.

Spike length :

Data presented in Table 3, showed that potassium application @ 30 kg ha^{-1} through different methods significantly increased spike length as compared to control. The maximum spike length (17.95 cm) was recorded with K application as ½ basal + ½ top dressing at 30 as DAS against the minimum spike length (17.52 cm) recorded under no potassium (control) plots.

Grains per spike :

It is clearly indicated in the data of Table 3, that application of potassium @ 30 kg ha-1irrespective of the methods significantly increased grains per spike over control. Though the maximum grain per spike (33.50) was noted with K application as ½ basal + ½ top dressing at 30 DAS which was higher by 3.75 per cent over fully basal but was found statistically at par with K application in three splits treatment.

Test weight :

A critical examination of data Table 3 showed that application of 30 kg K ha^{-1} irrespective of methods significantly improved the test weight of barley grain over control. The maximum test weight (41.24 g) was recorded with 30 kg K ha^{-1} as ½ basal + ½ top dressing at 30 DAS which was found statistically at par with other K treatments.

Grain yield :

Data given in Table 4 showed that potassium application @ 30 kg ha^{-1} as fully basal and ½ basal + ½ top dressing at 30

Table 3 : Effect of potassium on yield attributes of barley at harvest

Treatments	Effective tillers/ meter row length	Spike length (cm)	Grains per spike (Nos.)	Test weight (g)
Potassium application				
Control	64.83	17.52	30.88	39.67
30 kg K_2O basal application	66.75	17.78	32.29	40.58
30 kg K_2O ½ basal and ½ top dressing at 30 DAS	69.17	17.95	33.50	41.24
30 kg K_2O ½ basal and ½ top dressing in two split at 30 DAS and 60 DAS	67.67	17.80	32.58	40.55
S.E. ±	0.42	0.09	0.32	0.28
C.D. (P=0.05)	1.22	0.25	0.93	0.81

Table 4 : Effect of potassium on grain, straw and biological yields and harvest index of barley

Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)
Potassium levels				
Control	2523	2954	5478	46.03
30 kg K_2O basal application	2747	3092	5839	47.02
30 kg K_2O ½ basal and ½ top dressing at 30 DAS	2787	3143	5930	46.96
30 kg K_2O ½ basal and ½ top dressing in two split at 30 DAS and 60 DAS	2603	2989	5530	46.53
S.E. ±	44.6	43.8	85.7	0.20
C.D. (P=0.05)	129	126	247	0.59

DAS significantly increased grain yield of barley over control. However, the same rate of K applied as ½ basal + ½ top dressing in two splits at 30 and 60 DAS did not gain statistical significance over control. The maximum grain yield (2787 kg ha^{-1}) was recorded with 30 kg K ha^{-1} as ½ basal + ½ top dressed at 30 DAS, being statically identical with same rate as fully basal application (2747 kg/ha) which were significantly higher by 10.46 and 8.88 per cent over control, respectively. Further, both these treatments also registered statistical significance by 7.07 and 5.53 per cent over K application three splits treatment, respectively.

Biological yield :

Data presented in Table 4 reveal that potassium application @ 30 kg ha^{-1} irrespective of different methods significantly increased the biological yield of barley over control. The maximum biological yield (5930 kg ha^{-1}) was recorded with K treatment as ½ basal + ½ top dresses at 30 DAS which was found at par with the same K rate as fully basal dose. The increases in biological yield with aforesaid treatment were of the order and was higher by 6.03, 8.25 and 4.40, 6.59 per cent the same K rates as ½ basal + ½ top dressed in two equal splits at (30 and 60 DAS) and no potassium control treatment, respectively. Application of 30 kg K ha^{-1} as ½ basal + ½ top dressed in two splits though improved biological yield over control treatment but failed to gain statistical significance.

Harvest index :

Data presented in Table 4 show that higher harvest index was recorded with 30 kg K ha^{-1} as full basal and ½ basal + ½ top dressing at 30 DAS which were significantly higher by 2.15 and 2.02 per cent over no potassium control treatment, respectively. Further, 30 kg K ha^{-1} as ½ basal + ½ top dressing in two equal splits (at 30 and 60 DAS) failed to gain statistical significance over control in respect of harvest index. These results and discussion corroborate with the findings of Kolar and Grewal (1994), Thakur and Patel (1998) and Islam *et al.* (2008). Moreover, fertilizer efficiency of K is low because of its fixation in soil and losses through leaching. Similar work related to the topic was also done by Wajid *et al.* (2004) on wheat , Gupta *et al.* (2003) on mungbean, Singh *et al.* (2000) on rice and wheat, Fageria *et al.* (1991) wheat and barley, Brag (1972) wheat and pea.

Conclusion :

On the basis of results of the present investigation, it may be concluded that yield of barley can be maximized with application of 30 kg K ha^{-1} as fully basal, or ½ basal + ½ top dressing at 30 DAS. These results are only indicative and require further experimentation for confirmation before making final recommendation.

Literature Cited

Anonymous (2009). Rajasthan agriculture statistics at a glance. Commissionerate of Agriculture, Jaipur, RAJASTHAN (INDIA).

Brag, H. (1972). The influence of potassium on the transpiration rate and stomatal opening in *Triticum aestivum* and *Pisum sativum*. *Plant Physiol.,* **26** (2) : 250-255.

Fageria, N.K., Baligar, V.C. and Jones, C.A. (1991). Wheat and barley In: Growth and mineral nutrition of field crops. Marcel Dekker, NEW YORK, U.S.A.

Gupta, P.K., Sharma, N.N., Acharya, H.K., Gupta, S.K., Mali, G.C., Henry, A., Kumar, D. and Singh, N.B. (2003). Response of mungbean to zinc and iron on vertisols in south-eastern plain of Rajasthan. *Adv. Arid Leg. Res.*, 259-262.

Islam, M.A., Shamsuddoha, A.T.M., Bhuiyan, M.S.I. and Mirza, Hasanuzzaman (2008). Response of summer onion to potash and its application methods. *American–Eurasian J. Agron.,* **1** (1): 10-15.

Kolar, J. and Grewal, H. (1994). Effect of split application of potassium on growth, yield and potassium accumulation. *Ferti. Res.,* **39** (3) : 217-222.

Prasad, K. and Chouhan, R.P.S. (2000). Rice response to rate and time of application of potassium in an upland eco-system. *J. Potassium Res.,* **16** (¼) : 32-34.

Rathore, B.S. (2006). Response of barley (*Hordeum vulgare L.*) to nitrogen and potassium under irrigated condition of North Western Rajasthan. M.Sc. Thesis, Rajasthan Agricultural University, Bikaner, RAJASTHAN (INDIA).

Singh, J., Sharma, H.L. and Singh, C.M. (2000). Effect of levels and phases of potassium application on growth and yield of rice and wheat. *J. Pot. Res.,* **16**(1-4): 35-40.

Singh, V. and Singh, R. (2002). Effect of potassium and magnesium application on yield, quality and uptake of nutrient in wheat. *J. Potassium Res.,* 109–111 pp.

Thakur, D.S. and Patel, S.R. (1998). Growth and sink potential of rice as influenced by the split application of potassium with FYM in inceptisols of eastern central India. *J. Potassium Res.,* **14** (1/4): 73-77.

Wajid, A., Hussain, A., Ahmed, A., Rafiq, M., Goheer, A.R. and Ibrahim, M. (2004). Effect of sowing date and plant density on growth, light interception and yield of wheat under semi arid condition. *Internat. J. Agric. Biol.,* **6**: 1119-1123.

Webliography

Dogra, S. (2008). Barley farming the next big thing Business standard. 22 May. Retrieved 3 February 2010, from <*http://www.business-standard.com/india/news/barley-farmingnext-big-thing/323702.*