Asian Journal of Plant Sciences

ISSN 1682-3974

science alert

ANSInet
an open access publisher
http://ansinet.com

Asian Journal of Plant Sciences 2 (8): 602-604, 2003
ISSN 1682-3974

Effect of Potash Application on Seed Cotton Yield and Yield Components of Selected Cotton Varieties-I

M. Ehsan Akhtar, Aneela Sardar, M. Ashraf, Maqbool Akhtar and M. Zameer Khan
Potash Development Institute, National Agricultural Research Center, Islamabad, Pakistan
[1]Department of Biological Sciences, Quaid-e-Azam University, Islamabad, Pakistan
[2]Sugarcane Program, National Agricultural Research Center, Islamabad, Pakistan

Abstract: A pot experiment was conduced in a glasshouse at the National Agricultural Research Centre (NARC), Islamabad to study the effect of application potash on boll weight, boll size and seed cotton yield in selected cotton varieties, namely CIM-443, CIM-109 and CIM-446 during summer 1999. Potash as MOP was applied @ 0, 100 and 200 kg K_2O ha^{-1} along with basal application of N and P @ 150 and 75 kg P_2O_5 ha^{-1}. The results showed that boll weight and size increased significantly with increasing K_2O levels of application and they were maximum at 200 kg K_2O ha^{-1}. However, no significant difference was observed in the boll size of different varieties. Seed cotton yield also increased significantly in all the varieties with increasing K_2O. The magnitude of response was variable and maximum response was observed in case of CIM-446 followed by CIM-109 and CIM-443.

Key words: Potash, MOP, boll weight, boll size, boll number, seed yield, cotton varieties

Introduction

Potassium is one of the major plant nutrients. It is vital to many physiological processes as it perform a umber of functions. It activates more than 80 enzymes in plants and has a direct role in photosynthesis and transport of photosynthates to other plant parts. It also controls the stomatal activity, hence the water balance. Potassium improves nitrogen metabolism and does not allow low molecular weight nitrogen compounds to accumulate, thus result in more proteins (Tisdale *et al.,* 1992). It improves crop yields and quality of fruit and vegetables, imparts tolerance against pests and disease and resistance against drought and environmental stress, (Kerby and Adams, 1985).

In Pakistan N and P fertilizers are being used @ 125 kg N and 25 kg P_2O_5 ha^{-1}, the use of K is negligible (0.7 kg K_2O ha^{-1}) (Saleem, 2002). The low use of K fertilizer in cotton may have serious consequences, as it appears to be more sensitive to K deficiencies than many other row crops (Cope, 1981); as the root system of cotton is less dense than that of other crops (Gerrik *et al*., 1987). K not only effect the yield of cotton (Toper *et al*., 1992; Wahdan *et al*., 1994; Abdel Malak and Makram, 1996; Reddy *et al*., 2000. But also has a strong effect on the fiber quality (Subino *et al.,* 1995; Bennet *et al*., 1965; Cassman *et al*., 1990).

Cotton is the major cash crop of Pakistan and it plays an important role in the national economy. Its contribution is more than 60% of the total foreign exchange and in domestic edible oil it is about 85%, (MINFAL, 2001). Cotton production once jumped up during eighties (80s) and than production drastically decreased due to virus infestation in the country. Since 1990, scientists have been making efforts to combat this problem in the country. One of the aspects to combat the problem was the development and introduction of virus resistant varieties and some virus resistant varieties were developed. Keeping in view the significance of cotton in Pakistan and role of K in cotton virus resistant varieties were collected from the Cotton Research Institute, Multan and were studied for their response to potash application.

Materials and Methods

The study on the effect of various K levels on boll weight, boll size and seed cotton yield of three selected cotton varieties were carried out in a glass house of the National Agricultural Research Centre, Islamabad during July 1999 to December 1999. The experiment was conducted in pots in a complete randomized design (CRD) with four replications. There was seven kg of soil in each pot. The soil was analyzed for physical and chemical characters methods given by (Winkelman *et al*., 1990). Seeds of three cotton varieties namely CIM-443, CIM-109 and CIM-446 pretreated with fungicide pecton were planted at three K_2O levels (K_0, K_{100} and K_{200}) (K_0 with no potassium, K_{100} with 100 kg K_2O ha^{-1} and K_{200} with 200 kg K_2O ha^{-1}) at a depth of 2.5 cm. Nitrogen was applied as urea at the rate of 150 kg N ha^{-1} and phosphorus as potassium di-

hydrogen phosphate @ 75 kg P_2O_5 ha^{-1} to all pots. Potassium was applied as potassium chloride (KCl) @ 100 and 200 kg K_2O ha^{-1}. The calculated amount of each fertilizer was applied by dissolving the fertilizer in distilled water. All the phosphorus and potash was applied at the time of sowing while nitrogen was applied in four equal splits: at the time of sowing, 10 days after seeding, 25 days after seeding and at flower initiation stage. All the other agronomic and cultural practices including plant protection measures were the same for all pots. At boll formation stage (after 90 days) from each treatment were taken randomly. Boll size was determined with the help of vernier caliper. Seed cotton yield from each replication was recorded in all varieties and averaged for a single plant. The data collected were statistically analyzed by the analysis of variance technique (Steel and Torrie, 1984). Means were separated by using LSD at P 0.05.

Results and Discussion

Soil analysis: The soil for pot study was collected from the Rasulpur soil series, sandy loam in texture, mixed, hyperthermic, udic, ustocherptic camborthids. The area from where the soil was collected lies in medium to high rainfall area. The soil was normal with pH 7.43 and ECe 1.01 dS m^{-1}. Soil had low plant available N, P and K (Table 1).

Effect of potash on boll weight: The effect of potash application on boll weight was highly significant. Overall the boll weight was increased by 46.7% with the application of 200 kg K_2O ha^{-1}. The maximum mean boll weight (3.74 g) was observed at K_2O level of 200 kg ha^{-1} (Table 2) and the minimum boll weight (2.55 g) was observed in control plants. Mean maximum boll weight of 3.83 g was found in variety CIM-443. Boll weight in all the varieties increased significantly with increasing K_2O levels and it was maximum at 200 kg K_2O ha^{-1} in CIM-446 variety. The interaction between varieties and K_2O treatments was highly significant for boll weight. Similar results have been reported by Azab *et al.* (1993), Wahdan *et al.* (1994), Abdul Mlak and Makram (1996) and Reddy *et al.* (2000).

Effect of potash on boll number and size: Boll number also increased with increasing k levels. However the trend of increase in boll number and boll size was statistically non significant (Table 3). Application of potassium significantly increased the boll size (Table 4). Overall the boll size was increased by 9.71% with the application of 200 kg K_2O ha^{-1}. The maximum mean boll size of 2.71 cm was found at K_2O level of 200 kg ha^{-1} and the minimum mean boll size of 2.47 cm was observed in control plants. Mean maximum boll size of 2.64 cm was found in variety CIM-443 and minimum mean boll size of 2.57 was found in variety CIM-446. Boll size increased significantly with increasing K_2O levels and it was maximum at 200 kg K_2O ha^{-1} in CIM-443 variety. The interaction between varieties and K treatments was significant for cotton boll size. Similar results have been reported by Reddy *et al.* (2000).

Effect of potash on seed cotton yield: There was a significant increase in seed cotton yield per plant with the application of potassium. Overall seed cotton yield increased by 38.48% at K_2O level of 200 kg ha^{-1} and the minimum mean seed cotton yield of 6.08 g was produced by control plants (Table 5). Mean maximum seed cotton

Table 1: Characteristies of soil used for the experiment

Characteristic		Characteristic	
Textural class	Loam	HCO_3^- (me L^{-1})	3.33
pH	7.42	Cl^{-1} (me L^{-1})	1.83
ECe (dS ml^{-1})	1.01	Ca+Mg (me L^{-1})	13.33
CO_3^{2-} (me L^{-1})	2.00	K (me L^{-1})	70.00

Table 2: Effect of potash application on boll weight (g) of cotton

Potash treatment (K_2O kg ha^{-1})	Boll weight (g) CIM-443	CIM-109	CIM-446	Mean
0	3.05e	1.97g	2.62f	2.55c
100	3.50d	2.76f	4.29b	3.52b
200	3.80c	2.83ef	4.59a	3.74a
Mean	3.45b	2.52c	3.83a	

C.V. (%) 3.89 LSD (0.05) Varities** 0.28
K levels** 0.13 Interaction** 0.23

Table 3: Effect of potash application on boll number of cotton

Potash treatment (K_2O kg ha^{-1})	Boll number CIM-443	CIM-109	CIM-446	Mean
0	4	4	4	4
100	4	5	4	4.33
200	6	5	6	5.66
Mean	4.66	4.66	4.6	

C.V. (%) 3.89

Table 4: Effect of potash application on cotton boll size (cm)

Potash treatment (K_2O kg ha^{-1})	Boll size (cm) CIM-443	CIM-109	CIM-446	Mean
0	2.53de	2.46ef	2.41f	2.47c
100	2.66abc	2.59bcd	2.59cd	2.61b
200	2.72a	2.69ab	2.71a	2.71a
Mean	2.64	2.58	2.57	

C.V. (%) 2.18 LSD (0.05) Varities N.S.
K levels** 0.06 Interaction* 0.097

Table 5: Effect of potash application on seed cotton yield per plant (g)

Potash treatment (K_2O kg ha^{-1})	Seed cotton yield per plant (g) CIM-443	CIM-109	CIM-446	Mean
0	8.01c	4.85f	5.83e	6.08c
100	8.48bc	5.74e	8.30c	7.50b
200	9.44a	6.97d	8.85b	8.42a
Mean	8.65a	5.85c	7.51b	

C.V. (%) 3.86 LSD (0.05) Varities** 0.94
* Significant at 5% level of probality K levels** 0.29
** Significant at 1% level of probality Interaction** 0.50
N.S. = Non significant

yield of 8.65 g was found in variety CIM-443 and minimum mean seed cotton yield of 5.85 g was found in variety CIM-109. Seed cotton yield per plant increased dignificantly with increasing K_2O levels in all the varieties and it was maximum at 200 kg K_2O ha^{-1}. It indicated that application of an appropriate dose of an appropriate dose of K_2O was required to obtain maximum seed cotton yield. These results are supported by the findings of Toper *et al.* (1992), Wahdan *et al.* (1994), Abdel Malak and Makram (1996) and Reddy *et al.* (2000).

In conclusion, it is evident that the potash application increased seed cotton yield significantly in all the cotton varieties studied and the balanced use of fertilizers including potash to cotton in fields would help in increasing yield.

Acknowledgments

The results presented in this paper are part of the research work conducted under the project entitled "Potash Use for Enhancing Crop Productivity" funded by Ministry of Food, Agriculture and Livestock, Government of Pakistan. The project is being implemented by Dr. M. Ehsan Akhtar, Potash Development Institute, NARC Islamabad. Ms. Aneela Sardar, presented part of this work for her M. Phil Thesis in the Department of Biological Sciences, Quaid-e-Azam University Islamabad, Pakistan.

References

Abd.El-Aal, H.A., A.I.H. Yaseen and S.M.F. El-Ganel, 1990. Effect of NPK on yield and some yield components of Giza 75 variety. Annals of Agric. Sci. Fac. Agric. Ain-Shams Univ. Cairo, Egypt, 35: 709-722.

Abdul-Malak, K.K.I. and E.A. Mukrum, 1996. The proper dose of potassium fertilizer and its application timing for Giza 83 cotton cultivar grown in upper Egypt. Annals Agric. Sci. Ain. Shmas Univ. Cairo, Egypt, 41: 663-670

Abou-Zaid, M.K.M. and E. El-Haddad, 1997. Future of Egyptian cotton production in the new desert land Egypt. Yield and yield components of Giza 70 cultivars as affected by nitrogen and potassium fertilization. Alexandria J. Agric. Res., 42: 73-80.

Adeli, A., 1994. Potassium management effects on cotton yield, nutrition and soil test level. Ph.D. dessertation, Mississippi State University, Mississippi State, Mississippi.

Azab, A.S.M., M.M. Fatma, Ahmad and S.H.M. El-Halawany, 1993. Response of Egyptian cotton to potassium fertilization. Egypt. J. Appl. Sci., 8: 486-493.

Bebbett, O.L., R.D. Rouse, D.A. Ashley and B.D. Doss, 1965. Yield, fiber quality and potassium content of irrigated cotton as affected by rates of potassium. Agron. J., 57: 269-299.

Cassman, K.G., T.A. Kerby, B.A. Roberts, D.S. Bryant and S.L. Higashi, 1990. Potassium nutrition effects on lint yield and fiber quality of Acala cotton. Crop Sci., 30: 672-677.

Gerrik, T.T., J.E. Morrison and F.W. Chichester, 1987. Effects of controlled-traffic on siol physical properties and crop rooting. Agron. J., 79: 434-438.

Harris, G., P. Dugger and D. Riehter, 1998. Nitrigen and potassium fertilization of cotton on Atlantic Coast Flatwoods Soils. Proc. Beltwide Cotton Conferences. S. Diego. California, 1: 652-654.

Kerby, T.A. and F. Adams, 1985. Potassium nutrition of cotton. In:R.D. Munson (Ed.) Potassium in Agric, Medison, Wisconsim, USA., pp: 843-860.

Minfal, 2001. Agricultural Statistic of Pakistan, Ministry of Food, Agric. and Livestock, Islamabad, Pakistan.

Minton, E.B. and M.W. Ebelhar, 1991. Potassium and aldicarb-disulfoton effects on varticillium wilt, yield and quality of cotton. Crop Sci., 31: 209-212.

Reddy, K.R., H.F. Hodges and J. Varco, 2000. Potassium nutrition of cotton. Bulletin 1094, Mississippi Agricultural and Forestry Experiment Station, Mississippi.

Sabino, M.P., J.I. Kondo and N.M. Silva, 1995. Effects of liming and potassium fertilizer on agronomic characteristics, technological properties of fibers of cotton. Bragatia, 54: 385-392.

Saleem, M.T., 2002. Fertilizer review 2002, Pakistan situation. Farming Outlook, 1: 24-27.

Steel, R.G.D. and J.H. Torrie, 1984. Principiles and procedures of statistics. 2nd ed. McGrow Hill Book Co. Singapore.

Tisdale, S.L., W.L. Nelson, J.D. Beaton and J.L. Havlin, 1997. Soil Fertility and Fertilizers. Macmillan Pub. Co. New York.

Toper, G.R., Bridge and M.W. Ebelhar, 1992. Variety response to surface, deep banded and split applications of potassium. Proc. Belwide Cotton Conf. Cotton Soil Management and Plant Nutrition Conference, USA, 3:139.

Wahdan, A.G., M.H.H. Ghourab and O.M.M. Wassel, 1994. Physiological effect of potassium fertilizer and some micronutrients on productivity and chemical composition of Egyptian cotton (Giza 76). Menfiya J. Agric. Res., 19: 1651-1663.

Winkleman, E., R.W.A. Rice, R. Amin and M.B. Tahir, 1990. Methods manual soil laboratory. BARD, PARC, Islamabad, Pakistan.