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Effect of Potash on Boll Characteristics and Seed Cotton Yield in Newly Developed Highly Resistant Cotton Varieties

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Abstract: A pot experiment was conducted at National Agricultural Research Center (NARC), Islamabad to study the effect of potash on boll weight, boll size and seed cotton yield in the newly developed highly resistant cotton varieties namely CIM443, CIM109 and CIM446 during the year 1999. The results revealed that boll weight was increased significantly with increasing K_2O levels and it was maximum at 200 kg K_2O ha^{-1}. Boll size was significantly increased with the application of potash and maximum boll size was observed in plants where K_2O was applied @ 200 kg ha^{-1}. However, no significant difference was observed in boll size of different varieties. Seed cotton yield increased significantly in all varieties with increasing K_2O levels and it was maximum in variety CIM443 at 200 kg K_2O ha^{-1}. In conclusion, the boll characteristics are improved and seed cotton yield increased significantly with the application of an appropriate dose of potash in the newly developed highly resistant cotton varieties.

Key words: Potash, boll, seed cotton yield

Introduction

Increasing world population and pressures to produce abundant food and fiber have a natural tendency to increase land area devoted to agricultural production. This scenario can bring land in to production that is not suited for production of desired crop. Often, this land can be infertile, highly erodible, or both. If the potassium (K) fertility is neglected in annual management programs, it can become a problem in either established fields or new land just brought into production. This dilemma is especially important for cotton producers because cotton appears to be more sensitive to K deficiencies than many other raw crops (Cope, 1981). Cotton may be more sensitive because the root system of cotton is less dense than that of other crops (Gerik *et al*., 1987).

Knowledge of potassium requirements for cotton growth and development is needed for efficient production. It is well documented that high yields require good growing conditions. The detrimental effect that deficient levels of K can have on lint yield and fiber quality of cotton has been well documented by many researchers (Bennett *et al*., 1965; Cassman *et al*., 1990; Minton and Ebelkar, 1991). The relationship between plant nutrient status and soil test K levels is also useful information. Often, however the correlation between plant nutrition status and yield is relatively low because many other factors can limit crop yields (Adeli, 1994). Potash plays a vital role to improve cotton growth and yield components such as seed cotton yield, boll and seed mass and fiber traits (Wallace, 1938; Sabino *et al*., 1995). Potash application significantly increased yield and yield components in cotton (Chu *et al*., 1994; Zuojia and Renling, 1996; Harris *et al*., 1998). Boll parameters such as boll weight and boll size significantly increased by adding potash (Abd-EL-Aal *et al*., 1990; Azab *et al*., 1993; Abou-Zahid and EL-Haddad, 1997). Keeping in view, the above mentioned importance of potassium for cotton yield, present study was carried out to determine the effect of potash on boll weight, boll size and seed cotton yield in three cotton varieties namely CIM443, CIM109 and CIM446 under control conditions of glasshouse.

Materials and Methods

Studies on the effect of various K levels on boll weight, boll size and seed cotton yield of three cotton varieties namely CIM443, CIM109 and CIM446 were carried out in the glasshouse of National Agricultural Research Center (NARC), Islamabad during July to December 1999. The experiment was conducted in pots in complete randomized design (CRD) with four replications. Seeds of three cotton varieties namely CIM443, CIM109 and CIM446 pretreated with fungicide pecton were planted at three K_2O levels (K_0, K_1 and K_2) at a depth of 2.5 cm (where as K_0 with no potassium, K_1 with 100 kg K_2O ha^{-1} and K_2 with 200 kg K_2O ha^{-1}). Nitrogen (urea) was applied at the rate of 150 kg ha^{-1} and phosphorus (potassium dihydrogen phosphate) at the rate of 75 kg ha^{-1} to all pots. Potassium was applied as potassium chloride (KCl) at the rate of 100

kg K_20 ha^{-1} and 200 kg K_20 ha^{-1}. The amount of each fertilizer was calculated on the basis of 7 kg soil per pot. The calculated amount of each fertilizer was applied by dissolving the fertilizer grade in distilled water in each pot. All phosphorus and potash was applied at the time of sowing while nitrogen was applied in four splits (at the time of sowing, 10 days after seeding, 25 days after seeding and at flower initiation stage). All other agronomic and cultural practices including plant protection measures were kept for all pots.

At boll formation stage (after 90 days of seeding) the bolls were sampled from all the treatments. For boll weight and size, 20 bolls from each treatment were taken randomly. Boll size was determined with the help of vernier caliper. Boll weight and boll size were measured for all the varieties in each K treatment and average was calculated for a single boll. Seed cotton yield from each replication was recorded at each K level 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 an LSD at P (0.05).

Results and discussion

The effect of potash on boll weight, boll size and seed cotton yield was determined by analysis of variance. Results indicated that potash application had significant effects on these parameters.

The effect of potash application on boll weight was highly significant. Over all the boll weight was increased by 46.7% with application of 200 kg K_2O ha^{-1}. The mean maximum boll weight (3.74 g) was observed at K_2O level of 200 kg ha^{-1} (Table 1) 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 CIM446. Boll weight in all the varieties increased significantly with increasing K_2O levels and it was maximum at 200 kg K_2O ha^{-1} (Table 1). The interaction between varieties and K_2O levels was highly significant for boll weight. Similar results have reported by Azab *et al.* (1993), Wahdan *et al.* (1994), Abdel Malak and Makram (1996) and Reddy *et al.* (2000). However, Abd-EL-Aal *et al.* (1990) have observed that boll weight was slightly affected by potash application. Application of potassium significantly increased the boll size. Overall the boll size was increased by 9.71% with 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 (Table 2). Mean maximum boll size of 2.64 cm was found in variety in CIM443 and minimum mean boll size of 2.57 cm was found in variety CIM446. Boll size increased significantly with increasing K_2O levels and it was maximum at 200 kg K_20 ha^{-1} (Table 2). The interaction between varieties and K_2O levels was significant for boll size. Similar results have reported by Reddy *et al.* (2000). There was a significant increase in seed cotton yield per plant with the application of potassium. Overall seed cotton yield increased by 34.48% at K_2O level of 200 kg ha^{-1}. The maximum mean seed cotton yield of 8.42 g was produced at 200 kg K_2O $ha^{-1}$and the mean minimum seed cotton yield of 6.08 g was produced by control plants (Table 3). Mean maximum seed cotton yield of 8.65 g was found in variety CIM443 and minimum mean seed cotton yield of 5.85 g was found in variety in CIM109. Seed cotton yield per plant was increased significantly with increasing K_2O levels in all the varieties and it was maximum at 200 kg K_2O ha^{-1} (Table 3). It indicated that application of an appropriate dose of K_2O was required to obtain maximum seed cotton yield. Similar results have reported by Toper *et al.* (1992), Wahdan *et al.* (1994), Abdel-Malak and Makram, (1996), Reddy *et al.* (2000). In conclusion, the boll characteristics are improved and seed cotton yield increased significantly with the application of

Table 1: Effect of potash on cotton boll weight (g)

K_2O	Boll weight (g)			
kg ha^{-1}/Varieties	CIM443	CIM109	CIM446	Mean
0	3.05E	1.97G	2.6F	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)	Varieties**	0.28		
	K levels**	0.13		
	Interaction**	0.23		

Table 2: Effect of potash on cotton boll size (cm)

K_2O	Boll size (cm)			
kg ha^{-1}/Varieties	CIM443	CIM109	CIM446	Mean
0	2.5DE	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	2.64A	2.58B	2.5B	
C.V (%)	2.18			
LSD (0.05)	Varieties**	N.S.		
	K levels**	0.06		
	Interaction**	0.097		

Table 3: Effect of potash on seed cotton yield (g)

K_2O	Seed cotton yield per plant (g)			
kg ha^{-1}/Varieties	CIM443	CIM109	CIM446	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)	Varieties**	0.94		
	K levels**	0.29		
	Interaction**	0.50		

N.S. Non Significant
* Significant at 5% level of probability
** Significant at 1% level of probability

an appropriate dose of potash in the newly developed highly resistant cotton varieties.

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