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 K₂O levels and it was maximum at 200 kg K₂O ha⁻¹. Boll size was significantly increased with the application of potash and maximum boll size was observed in plants where K₂O was applied at 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 K₂O levels and it was maximum in variety CIM443 at 200 kg K₂O 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 into 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; Zuqiaja 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 K₂O levels (K₁, K₂ and K₃) at a depth of 2.5 cm (where as K₁ with no potassium, K₂ with 100 kg K₂O ha⁻¹ and K₃ with 200 kg K₂O 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 K₂O ha⁻¹ and 200 kg K₂O 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 bol formation stage (after 90 days of seeding) the pods were sampled from all the treatments. For boll weight and size, 20 bolls from each treatment were taken randomly. Boll weight 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).

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

<table>
<thead>
<tr>
<th>K₂O kg ha⁻¹/ Varieties</th>
<th>CIM443</th>
<th>CIM109</th>
<th>CIM446</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>3.05E</td>
<td>1.97G</td>
<td>2.6F</td>
<td>2.5C</td>
</tr>
<tr>
<td>100</td>
<td>3.50D</td>
<td>2.76F</td>
<td>4.29B</td>
<td>3.52B</td>
</tr>
<tr>
<td>200</td>
<td>3.80C</td>
<td>2.83EF</td>
<td>4.59A</td>
<td>3.74A</td>
</tr>
<tr>
<td>MEAN</td>
<td>3.45B</td>
<td>2.52C</td>
<td>3.88A</td>
<td></td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>K₂O kg ha⁻¹/ Varieties</th>
<th>CIM443</th>
<th>CIM109</th>
<th>CIM446</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2.5DE</td>
<td>2.46EF</td>
<td>2.41F</td>
<td>2.47C</td>
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<tr>
<td>100</td>
<td>2.66ABC</td>
<td>2.59CD</td>
<td>2.59CD</td>
<td>2.61B</td>
</tr>
<tr>
<td>200</td>
<td>2.72A</td>
<td>2.69AB</td>
<td>2.71A</td>
<td>2.71A</td>
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<tr>
<td>MEAN</td>
<td>2.64A</td>
<td>2.58B</td>
<td>2.5B</td>
<td></td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>K₂O kg ha⁻¹/ Varieties</th>
<th>CIM443</th>
<th>CIM109</th>
<th>CIM446</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>8.01C</td>
<td>4.89F</td>
<td>5.83E</td>
<td>6.08C</td>
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<tr>
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<td>8.48BC</td>
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<tr>
<td>200</td>
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<td>6.97D</td>
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<td>8.42A</td>
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<tr>
<td>MEAN</td>
<td>8.65A</td>
<td>5.85C</td>
<td>7.51B</td>
<td></td>
</tr>
</tbody>
</table>

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

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 K₂O ha⁻¹. The mean maximum boll weight (3.74 g) was observed at K₂O 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 K₂O levels and it was maximum at 200 kg K₂O ha⁻¹ (Table 1). The interaction between varieties and K₂O levels was highly significant for boll weight. Similar results have been 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 K₂O ha⁻¹. The maximum mean boll size of 2.71 cm was found at K₂O 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 K₂O levels and it was maximum at 200 kg K₂O ha⁻¹ (Table 2). The interaction between varieties and K₂O levels was significant for boll size. Similar results have been 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 K₂O level of 20 kg ha⁻¹. The maximum mean seed cotton yield of 8.42 g was produced at 200 kg K₂O 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 CIM109. Seed cotton yield per plant was increased significantly with increasing K₂O levels in all the varieties and it was maximum at 200 kg K₂O ha⁻¹ (Table 3). It indicated that application of an appropriate dose of K₂O was required to obtain maximum seed cotton yield. Similar results have been reported by Toper et al. (1992), Wahdan et al. (1994), Abd-EL-aal and Makram, (1996), Reddy et al. (2000). 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.

References


