Effect of Different Sources and Levels of Potash on Yield and Oil Content of Spring Sunflower

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Abstract
A field experiment was conducted to compare the response of sunflower cultivar SF-187 to muriate and sulphate of potash, each at 0.50, 100 and 150 kg ha⁻¹. Different sources and levels of K did not significantly affect the plant height, stem diameter, 1000-achene weight and harvest index. However, leaf area per plant, stalk yield, number of achene head⁻¹, seed yield and oil contents were affected significantly by K₂O levels. A significant increase in seed yield and oil contents was observed up to 100 kg ha⁻¹ but both these parameters were decreased beyond this limit. A decrease of 26 and 20 per cent in seed yield was noted by potassium application at the rate of 150 kg ha⁻¹ in the form of sulphate of potash and muriate of potash respectively. The application of potash more than 100 kg ha⁻¹ seems to be uneconomical to sunflower in Faisalabad conditions.

Introduction
Judicious use of fertilizer is considered one of the most important factor which could increase sunflower yield on per unit area bases. Among nutrients applied potassium is one of the most essential element for plant growth. Its role is well documented in photosynthesis enzyme activity, synthesis of protein, carbohydrates and enabling to resist against pest and diseases (Tisdale et al., 1985). Increased intensity of cropping and introduction of high yielding varieties have resulted in considerable drain of potassium and crops are becoming responsive to potassium fertilization (Malik et al., 1989). Ogunsre et al. (1980) reported that the K₂O decreased yield of sunflower by 24 per cent in the absence of added P₂O₅. Sarkar et al. (1987) assessed response behaviour of increasing doses of K on sunflower and they reported that there was an optimum level for each of the physiological parameters viz. leaf area index, crop growth rate and net assimilation rate for ensuring high yield potential of sunflower. Al-Nawaz (1988) studied the effect of potassium ranging from 0-150 kg ha⁻¹ in yield and growth characteristics of sunflower and reported that K rate had no effect on plant height and head diameter but affected the 1000-seed weight, seed yield and oil yield. He concluded that optimum rate was 80 kg K₂O ha⁻¹. Skin et al. (1988) reported that seed yields of sunflower were highest with 80 kg K₂O. Ahmad (1989) concluded that plant height, number of seeds head⁻¹ 1000-achene weight were positively affected by application of K. Highest yield was obtained with 75-150-125 NPK kg ha⁻¹. Ahmad (1993) reported that K application did not significantly affect the leaf area plant⁻¹, stem diameter, plant height and stalk yield. Whereas, number of achene per head, 1000-achene weight and seed yields were affected significantly. The effect of potassium application on the oil content of sunflower seed is somewhat controversial. Gaur et al. (1987) found that application of potassium had no effect on seed oil contents. On the other hand Glas et al. (1988) reported that K had a negative influence on sunflower seed oil content. Similarly Curric et al. (1988) reported that seed oil contents were lowest (45.0 %) with the highest fertilizers. But Nazir et al. (1987) and Ahmad (1993) reported that oil contents of sunflower seed were increased by potassium fertilizers. Present experiment was therefore planned to determine the effect of different sources and levels of potash on yield, growth characteristics and oil content of spring sunflower in Faisalabad conditions.

Materials and Methods
The experiment was conducted on sandy loam soil having 0.075 per cent N, 7.44 ppm P₂O₅ and 185 ppm K. Experiment was laid out in randomized complete block design with four replications having a net plot size of 2.4 x 7 m. The crop was sown with the help of dibbler in 60 cm apart rows on March 1, 1995. The potassium was applied at the rate of 0, 50, 100 and 150 kg ha⁻¹ in the form of muriate and sulphate of potash. Nitrogen and phosphorus were applied at the rate of 100 kg and 75 kg ha⁻¹ respectively. Whole dose of phosphorus, potash and half nitrogen were applied at sowing and remaining half dose of nitrogen was applied with 1st irrigation. Interplant distance of 30 cm was maintained by thinning at 3-4 leaf stage. Earthing up was done after second irrigation to prevent lodging. To eradicate weeds hand hoeing was done after 1st irrigation. Ten plants from each plot were randomly selected to record number of leaves per plant, leaf area per plant, plant height, stem diameter, head diameter, number of achene per head and 1000-achene weight. Achene oil contents were determined as suggested by A. O. A. C. (1984). Sun dried heads from each plot were threshed manually. Seeds were cleaned, weighed and then converted to tones per hectare.

The data were analysed by using Fisher's analysis of variance technique and treatment means were compared by using least significance difference test at 5 percent probability level (Steel and Torrie, 1984).
Table 1: Growth, yield and oil contents of sunflower as influenced by potassium levels and sources.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Levels</th>
<th>Plant height (cm)</th>
<th>Leaf area plant (cm²)</th>
<th>Stem diameter (cm)</th>
<th>Head diameter (cm)</th>
<th>No. of achene head</th>
<th>1000-achene weight (g)</th>
<th>Seed yield (t ha⁻¹)</th>
<th>Oil seed content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>Control</td>
<td>178.27</td>
<td>2748.82c</td>
<td>2.42NS</td>
<td>21.40NS</td>
<td>1119.8b</td>
<td>57.3 NS</td>
<td>2.04 c</td>
<td>34.07</td>
</tr>
<tr>
<td>T₂</td>
<td>50 kg SOP ha⁻¹</td>
<td>179.32</td>
<td>4033.57 ab</td>
<td>2.42</td>
<td>21.52</td>
<td>1264.5c</td>
<td>61.67</td>
<td>2.62 b</td>
<td>36.47</td>
</tr>
<tr>
<td>T₃</td>
<td>100 kg SOP ha⁻¹</td>
<td>180.02</td>
<td>4535.22 a</td>
<td>2.98</td>
<td>21.85</td>
<td>1297.2a</td>
<td>62.49</td>
<td>3.20 a</td>
<td>43.27</td>
</tr>
<tr>
<td>T₄</td>
<td>150 kg SOP ha⁻¹</td>
<td>177.55</td>
<td>3339.32 bc</td>
<td>2.17</td>
<td>21.87</td>
<td>1301.5a</td>
<td>64.93</td>
<td>3.37 a</td>
<td>38.65</td>
</tr>
<tr>
<td>T₅</td>
<td>50 kg MOP ha⁻¹</td>
<td>178.97</td>
<td>3387.62 bc</td>
<td>2.20</td>
<td>22.10</td>
<td>1257.3c</td>
<td>61.78</td>
<td>2.65 b</td>
<td>36.47</td>
</tr>
<tr>
<td>T₆</td>
<td>100 kg MOP ha⁻¹</td>
<td>170.62</td>
<td>4099.35 ab</td>
<td>2.99</td>
<td>22.40</td>
<td>1285.8b</td>
<td>62.61</td>
<td>3.15 a</td>
<td>42.45</td>
</tr>
<tr>
<td>T₇</td>
<td>150 kg MOP ha⁻¹</td>
<td>170.04</td>
<td>3717.55 abc</td>
<td>2.14</td>
<td>21.35</td>
<td>1284.2b</td>
<td>67.52</td>
<td>3.25 a</td>
<td>38.10</td>
</tr>
</tbody>
</table>

Values followed by same letters are statistically non-significant NS = Non-significant.

Results and Discussion

Plant height was statistically similar in all treatments under study. Highest plant height (180.02 cm) was observed where 100 kg SOP was applied. The minimum plant height (170.04 cm) was recorded where 150 kg MOP was applied (Table 1). The results are in agreement with those of Ahmad (1993) and Al-Nawaz (1988) but are contradictory to those of Ahmad (1989) who reported that plant height was significantly affected by K₂O application. These contradictory results might be due to variation in fertility status of the soil.

The leaf area plant⁻¹ at flowering was affected significantly by sources and levels of K application. The potassium applied at the rate of 50 and 100 kg ha⁻¹ in the form of SOP produced statistically similar leaf area plant⁻¹ to 100 and 150 kg potassium applied in the form of MOP. Leaf area was increased with application of potassium upto 100 kg ha⁻¹ either applied as SOP or MOP. Beyond this limit leaf area plant⁻¹ was decreased. The maximum (4535.22 cm²) and minimum (2748.82 cm²) leaf area plant⁻¹ was obtained with the application of 100 kg SOP and control respectively. The increase in leaf area with potassium application might be due to the encouraging effect of K on leaf development through photosynthesis. Similar results were also reported by Ahmad (1993).

Data in Table 1 also showed non-significant effect of potassium application on stem diameter, either applied as SOP or MOP. Maximum stem diameter (2.99 cm) was obtained when potassium was applied in the form of MOP. Minimum stem diameter (2.41 cm) was observed with the application of 150 kg MOP ha⁻¹. Non-significant effect of potassium on stem diameter of sunflower have also been reported by Ahmad (1993). While Ahmad (1989) have reported an increase in stem diameter with the application of K₂O. These contradictory results might have been due to differences in genetic traits of crop plants.

Potassium applied at different rates and different forms do not significantly influence the head diameter and it range from 21.36 to 22.9 cm. These results are contradictory to those of Ahmad (1989). Which might have been due to variation soil fertility or genetic make up of varieties. The achene head⁻¹ were influenced significantly by potassium application. The application of potassium in form of SOP at rates of 150 ha⁻¹ remaining at part with each other produced significantly more achesnes head⁻¹ than other treatments. The potassium application at the rate 50 kg ha⁻¹ in the form of SOP and MOP have statistically similar number of achesnes head⁻¹. The maximum (1301) and minimum (1119.8) achesnes head⁻¹ were obtained with the application of SOP at the rate of 150 kg ha⁻¹ and control, respectively. Ahmad (1993) also reported a significant effect of K₂O application on number of achenes head⁻¹.

Although 1000-achene weight was increased with an increase in potassium rate but this increase could not be related to the level of significance (Table 1). 1000-achene weight increased from 57.3 g (control) to 67.52 g (150 kg ha⁻¹ MOP). Significant increase in 1000-achene weight has been reported by Ahmad (1993).

Seed yield was affected significantly by potash application. All levels of potash as SOP and MOP gave statistically higher seed yield than control. Both sources of potash the rate of 100 and 150 kg ha⁻¹ gave statistically similar yield but significantly higher than 50 kg ha⁻¹ applied as SOP or MOP. The maximum (3.37 t ha⁻¹) and minimum (2.04 t ha⁻¹) seed yield was obtained with potash application at the rate of 150 kg ha⁻¹ as SOP and control respectively. Al-Nawaz (1988), Skin et al. (1988), Ahmad (1989) and Ahmad (1993) have also reported increased seed yield of sunflower with potassium application. Oil contents were influenced significantly by potas...
application. Both sources of potash at the rate of 50 and 100 kg ha⁻¹ gave significantly higher oil content over control. However, significant decrease was observed with potassium rate of 150 kg ha⁻¹ applied as SOP and MOP. The minimum oil content (34.07 %) were observed in control plots. This decrease might have been due to nutrient imbalance. These results are in agreement with those presented by Nazir et al. (1987) and Ahmad (1993) but results are contradictory to those of Gaur et al. (1988). These contradictory results might have been due to difference in fertility status of soil or genetic make up of the crop plants.

Reference