Effect of different levels of potassium on chemical properties and soil nutrient status in soybean crop in vertisols

Tupaki Lokya, DV Mali, VV Gabhane, PR Kadu and Anju Vijaysingh Rathod

Abstract
The field experiment was conducted to assess the effect of various levels of potassium on yield of soybean and soil nutrient status on farmer’s field in vertisols at Kanehri, Tq. Barshitakli, Dist. Akola during Kharif 2015-16. The experiment comprised four treatments and six replications as six farmer’s laid out in Randomized Block Design. The treatments comprised of 30:75:00 kg NPK ha^{-1} (T_1), 30:75:30 kg NPK ha^{-1} (T_2), 30:75:60 kg NPK ha^{-1} (T_3) and 30:75:90 kg NPK ha^{-1} (T_4). The results of the present experiment indicated that the soil chemical properties viz., pH, EC and organic carbon were significantly improved with the application of 30:75:90 kg NPK ha^{-1} followed by 30:75:60 kg NPK ha^{-1}. The available N, P and K were improved significantly with the application of 90 kg K_2O ha^{-1} along with recommended dose of N and P.

Keywords: Potassium, farmer’s field, soybean, soil fertility status

Introduction
Soybean (Glycine max. L.) is one of the important oil seed as well as leguminous crop. It is originated in Eastern Asia/China. It is second largest oilseed crop in India after groundnut. Soybean is a miracle “Golden bean” of the 21st century mainly due to its high protein (40%) and oil (20%). In India, it is mainly grown as oil seed as well as pulse crop. It is the cheapest and richest source of high quality protein. It supplies most of the nutritional constituents essential for human health. Soybean occupies an intermediate position between legumes and oilseeds.

Soybean is also called as ‘Gold of soil’ due to its various qualities such as ease in cultivation, less requirement of fertilizer and labour. It builds up the soil fertility by fixing atmospheric nitrogen through nodules. Soybean fixes nitrogen symbiotically and leaves about 25% for succeeding crop. All these qualities have made it an ideal for crop rotation.

Potassium is well known equality nutrient essential for improving quality of produce particularly oilseed crops. The requirement of K to for different crops is varied. In view of the varying response among crops, the present experiment was under taken to study the effect of various levels of potassium on yield of soybean and soil nutrient status on farmer’s field in vertisols.

Material and methods
Field experiment on soybean was conducted on farmer’s field at Kanehri, Tq. Barshitakli, Dist. Akola during Kharif 2015-16 on effect of various levels of potassium on yield of soybean and soil nutrient status on farmer’s field in vertisols. The experiment comprised four treatments and six replications laid out in Randomized Block Design. The treatments comprised of 30:75:00 kg NPK ha^{-1} (T_1), 30:75:30 kg NPK ha^{-1} (T_2), 30:75:60 kg NPK ha^{-1} (T_3) and 30:75:90 kg NPK ha^{-1} (T_4). The representative soil samples from the farmer’s field were collected by using soil auger. The soil samples were air dried in shade and ground to passed through 2 mm sieve. The processed samples were well mixed and stored in clean cloth bags with proper labels for subsequent analysis.

The pH of a soil was measured by a glass electrode pH meter after equilibrating soil with water in the ratio of 1:2.5 soil water suspensions for 30 minutes with occasional stirring (Jackson, 1973) \(^7\). The electrical conductivity of the clear supernatant extract obtained from suspension used for pH was utilized for the electrical conductivity measurement (Jackson,
Results and Discussion

Effect of different level of potassium on chemical properties of soil

Effect of different level of potassium on fertility status of soil

Available N

The application of 30:75:90 kg NPK ha\textsuperscript{1} increased the availability of nitrogen by 7.1% higher and whereas, the application of 30:75:60 kg NPK ha\textsuperscript{1} increased availability of N by 4.9% as compared with the application of 30:75:00 kg NPK ha\textsuperscript{1}. The increase in N status with increased levels of K may be due to better crop growth and resultant biomass production, which on mineralization converted into mineral N, which ultimately resulted into improvement in the N status of soil.

The higher value of available N might be due to synergistic effect of potassium on availability of nitrogen. Similar synergistic results were reported by Tisdale and Nelson (1975)\textsuperscript{[20]}, Bansal et al. (1980)\textsuperscript{[3]}, Katkar et al. (2002)\textsuperscript{[8]} and Rajashekarappa. (2013)\textsuperscript{[14]} they reported that application of higher levels of K significantly increased the available N status over relatively lower levels of potash.

Available P

The effect of potassium levels on availability of phosphorus was found to be significant. The available P ranged between 11.75 to 12.96 kg ha\textsuperscript{1}. However, the higher phosphorus content (12.96 kg ha\textsuperscript{1}) was recorded in the treatment receiving 30:75:60 kg NPK ha\textsuperscript{1}. The lower phosphorus content (11.75 kg ha\textsuperscript{1}) was registered in the treatment receiving 30:75:00 kg NPK ha\textsuperscript{1}.

Similar results were reported by Agrawal et al. (1987)\textsuperscript{[1]}, Regar et al. (2009)\textsuperscript{[16]}, Vidyavathi et al. (2012)\textsuperscript{[21]} and Rajashekarappa et al. (2013)\textsuperscript{[14]} they reported that application of higher levels of K increased the available P status over relatively lower levels of potash.

Available K

Available K content in soil was significantly influenced with the different levels of potassium. The available K content in soil at harvest ranged between 369 to 412 kg ha\textsuperscript{1}. Significantly higher available K (412 kg ha\textsuperscript{1}) was recorded with the treatment receiving 30:75:60 kg NPK ha\textsuperscript{1} followed by application of 30:75:60 kg NPK ha\textsuperscript{1} which was found to be on par with each other. The lowest content of available K (369 kg ha\textsuperscript{1}) was recorded with the treatment of 30:75:00 kg NPK ha\textsuperscript{1}.

The application of 30:75:90 kg NPK ha\textsuperscript{1} significantly increased the status available K by 11.6% over 30:75:00 kg NPK ha\textsuperscript{1}. The application of 30:75:90 kg NPK ha\textsuperscript{1} significantly increased the available K status over relatively lower levels of potash.

Table 1: Effect of different levels of potassium on chemical properties and soil nutrient status

<table>
<thead>
<tr>
<th>Treatments</th>
<th>pH (1:2.5)</th>
<th>EC (dS m\textsuperscript{-1})</th>
<th>Organic carbon (g kg\textsuperscript{-1})</th>
<th>Available nutrients (kg ha\textsuperscript{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N</td>
</tr>
<tr>
<td>30:75:00 kg NPK ha\textsuperscript{1}</td>
<td>7.80</td>
<td>0.28</td>
<td>5.50</td>
<td>183</td>
</tr>
<tr>
<td>30:75:30 kg NPK ha\textsuperscript{1}</td>
<td>7.78</td>
<td>0.30</td>
<td>5.53</td>
<td>187</td>
</tr>
<tr>
<td>30:75:60 kg NPK ha\textsuperscript{1}</td>
<td>7.83</td>
<td>0.32</td>
<td>5.63</td>
<td>192</td>
</tr>
<tr>
<td>30:75:90 kg NPK ha\textsuperscript{1}</td>
<td>7.92</td>
<td>0.33</td>
<td>5.67</td>
<td>196</td>
</tr>
<tr>
<td>SE(m) ±</td>
<td>0.03</td>
<td>0.01</td>
<td>0.03</td>
<td>0.66</td>
</tr>
<tr>
<td>CD at 5 %</td>
<td>NS</td>
<td>NS</td>
<td>0.09</td>
<td>1.98</td>
</tr>
</tbody>
</table>
Conclusion
It can be concluded that, application of 90 kg K₂O ha⁻¹ along with recommended dose of N and P₂O₅ resulted improvement in the nutrient status as well as grain and straw yield of soybean.

References