Potash Management in Rainfed Transplanted Paddy in Lowland Rice Soils

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Abstract: An experiment was conducted at Agricultural Research Station (Paddy), Sirsi during 2000-01, 2001-02 and 2002-03 involving both soil and foliar applied potassium to find out the best combination for attaining the maximum yield. The experiment consisted of soil applied K at different doses (100 % RDK, 150 % RDK and 200 % RDK) and foliar applied K @ 1 % through Muriate of Potash (10 g l⁻¹) (No Spray, One spray at 45 DAP, One spray at 60 DAP and Two sprays at 45 & 60 DAP) totally making twelve treatment combinations. The results revealed that various levels of soil applied potassium failed to bring about any significant difference in yield (grain and straw) as well as on economics (gross and net returns). On the contrary, foliar application of potassium found to increase yields of rice significantly. On an average over three years, the maximum grain yield, gross and net returns recorded with 1% spray at 60 DAP (6305 kg ha⁻¹, Rs.41,674 and Rs.27,505/ha respectively) were on par with 1% spray at 45 DAP and 1% spray both at 45 and 60 DAP. Significantly the lowest grain yield, gross and net returns (6029 kg ha⁻¹, Rs.39,812/ha and Rs.25,741/ha respectively) were recorded in no K spray treatment. The influence of foliar spray on straw yield was not significant. Among the interactions, combined application of 150% K + 1 % spray at 60 DAP and 100 % K + 1 % spray at 60 DAP recorded maximum grain (8080 kg ha⁻¹) and straw (8673 kg ha⁻¹) yield respectively during 2000 as compared to rest of the treatment combinations.

Keywords: Rainfed transplanted rice, potash, foliar application, yield, economics

Introduction

Rice is one of the important cereal crops of this zone covering about 79 per cent of the cultivable area. But the yield of this crop is declining/stagnating in recent years even though normal recommended package of practices have been followed. The low available potassium in the soil, low nutrient holding capacity of the soil and heavy leaching of the nutrients from the soil due to high rainfall of this region have been identified as the limiting factors for getting higher yield of rice. Hence, it is high time to enhance the normal dose of K which is one of the important major nutrients in plant nutrition. In addition to enhanced dose of K, foliar application of K is the other option to counteract the leaching losses of K besides influencing on the yield. With this information, following investigation was carried out involving both soil and foliar applied Potassium to find out the best combination for attaining the maximum yield.

Material and Methods

A field experiment was conducted at Agricultural Research Station (Paddy), Sirsi of the University of Agricultural Sciences, Dharwad, Karnataka during kharif seasons of 2000-01, 2001-02 and 2002-03. The research station comes under hill zone of Karnataka. The experiment consisted of soil applied K at different doses (100% recommended dose of K (RDK), 150 % RDK and 200 % RDK) and foliar applied K in the form of Muriate of Potash (No spray, One spray at 45 DAP, one spray at 60 DAP and two sprays at 45 and 60 DAP) totally making 12 treatment combinations replicated thrice in a factorial RBD. Twenty-five days old seedlings of rice variety Abhilash were used in the experiment. Two to three seedlings were planted at each hill. The fertilizers were applied in accordance with the treatments. Recommended dose of fertilizer used was 75 kg N, 75 kg P₂O₅ and 87.5 kg K₂O ha⁻¹. The 50 per cent each of N and K₂O and entire dose of P₂O₅ was applied at the time of transplanting. The first top dressing was done with 25 per cent N and remaining 50 per cent K₂O at 25 days after planting (DAP) and the second top dressing with remaining 25 % N was done at 50 days after planting the crop. In foliar application treatments, K was given in the form of 1% Muriate of Potash (MOP) as per the treatments. The crop was attended with all the practices/operations as per the recommendations in the package of practices. The crop was harvested when it attained maturity and grain and straw yield were recorded separately as per the treatments. The economics was worked out based on the prevailing market prices of both inputs and output during the year of experimentation. The data of individual years and pooled data was analyzed statistically as per the factorial RBD under M-STAT-C programme.

Results and Discussion

The results are presented in Tables 1. The grain and straw yield were not influenced significantly by different levels of potassium applied through soil during all the years of study as well as in pooled data. It indicates that there is no response for application of even high dose of potassium through soil. This was mainly because of high leaching nature of soil coupled with high rainfall during crop growth period. In a pot culture experiment, Pillai and Anasuya (1997) also revealed that no significant differences in grain and straw yield of rice beyond 75 kg K₂O ha⁻¹. Similar results were obtained in a field study by Surekha et al. (2003). On the contrary, there was significant response by rice for grain yield due to foliar application of
### Table 1. Grain and straw yield of rainfed transplanted rice as influenced by potash management practices

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Grain Yield (kg ha(^{-1}))</th>
<th>Straw Yield (kg ha(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil application of K (S)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(S_x - 100%) RDK (87.5 kg ha(^{-1}))</td>
<td>7394</td>
<td>5755</td>
</tr>
<tr>
<td>(S_x - 150%) RDK (131.25 kg ha(^{-1}))</td>
<td>7545</td>
<td>5711</td>
</tr>
<tr>
<td>(S_x - 200%) RDK (175.0 kg ha(^{-1}))</td>
<td>7401</td>
<td>5780</td>
</tr>
<tr>
<td>S.Em(^{±})</td>
<td>82</td>
<td>85</td>
</tr>
<tr>
<td>C.D. at 5%</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Foliar application of K (F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(F_x - ) No spray</td>
<td>7016</td>
<td>5732</td>
</tr>
<tr>
<td>(F_x - 1%) spray at 45 DAP</td>
<td>7496</td>
<td>5823</td>
</tr>
<tr>
<td>(F_x - 1%) spray at 60 DAP</td>
<td>7728</td>
<td>2739</td>
</tr>
<tr>
<td>(F_x - 1%) spray at 45 &amp; 60 DAP</td>
<td>7549</td>
<td>5701</td>
</tr>
<tr>
<td>S.Em(^{±})</td>
<td>96</td>
<td>98</td>
</tr>
<tr>
<td>C.D. at 5%</td>
<td>281</td>
<td>NS</td>
</tr>
</tbody>
</table>

### Table 2. Economics of rainfed transplanted rice as influenced by potash management practices

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Gross Returns(Rs.ha(^{-1}))</th>
<th>Net Returns (Rs.ha(^{-1}))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil application of K (S)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(S_x - 100%) RDK (87.5 kg ha(^{-1}))</td>
<td>48634</td>
<td>37923</td>
</tr>
<tr>
<td>(S_x - 150%) RDK (131.25 kg ha(^{-1}))</td>
<td>49476</td>
<td>37716</td>
</tr>
<tr>
<td>(S_x - 200%) RDK (175.0 kg ha(^{-1}))</td>
<td>48883</td>
<td>38068</td>
</tr>
<tr>
<td>S.Em(^{±})</td>
<td>470</td>
<td>570</td>
</tr>
<tr>
<td>C.D. at 5%</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Foliar application of K (F)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(F_x - ) No spray</td>
<td>46597</td>
<td>37627</td>
</tr>
<tr>
<td>(F_x - 1%) spray at 45 DAP</td>
<td>48917</td>
<td>38499</td>
</tr>
<tr>
<td>(F_x - 1%) spray at 60 DAP</td>
<td>50902</td>
<td>37916</td>
</tr>
<tr>
<td>(F_x - 1%) spray at 45 &amp; 60 DAP</td>
<td>49574</td>
<td>37568</td>
</tr>
<tr>
<td>S.Em(^{±})</td>
<td>542</td>
<td>658</td>
</tr>
<tr>
<td>C.D. at 5%</td>
<td>1590</td>
<td>NS</td>
</tr>
</tbody>
</table>

Interactions (SxF)

| S.x F |                                  |                               |                               |                             |                               |                               |                               |                             |

| S.x F |                                  |                               |                               |                             |                               |                               |                               |                             |

| S.x F |                                  |                               |                               |                             |                               |                               |                               |                             |

| S.x F |                                  |                               |                               |                             |                               |                               |                               |                             |

| S.x F |                                  |                               |                               |                             |                               |                               |                               |                             |

| S.x F |                                  |                               |                               |                             |                               |                               |                               |                             |

| S.x F |                                  |                               |                               |                             |                               |                               |                               |                             |

| S.x F |                                  |                               |                               |                             |                               |                               |                               |                             |

| S.x F |                                  |                               |                               |                             |                               |                               |                               |                             |

| S.x F |                                  |                               |                               |                             |                               |                               |                               |                             |
potassium compared to no foliar application. On an average over three years, maximum grain yield was recorded with application 1% MOP spray at 60 DAP (6305 kg ha\(^{-1}\)) followed by 1% MOP spray 45 DAP (6230 kg ha\(^{-1}\)) and 1% MOP spray both at 45 and 60 DAP (6249 kg ha\(^{-1}\)) and were found to be on par with each other but significantly superior over no spray (6029 kg ha\(^{-1}\)). In a field experiment by Kalyanasundaram and Surendirakumar (2003), recorded the highest grain yield of rice with inclusion of 1% MOP spray at panicle initiation and booting stage. The influence of foliar spray on straw yield was not significant. The interaction effect of soil and foliar applied K was significant during 2000 only. Among the different interactions, maximum grain yield was recorded with application of 150 % RDK (131.25 kg K ha\(^{-1}\)) + foliar spray of 1% K at 60 DAP (8080 kg ha\(^{-1}\)) and straw yield was maximum with application of 100 % RDK + foliar spray of 1% K at 60 DAP (8673 kg ha\(^{-1}\)).

The gross and net returns were not influenced significantly by different levels of potassium applied through soil during all the years as well as in pooled data (Table 2). The pooled analysis on gross and net returns indicated that application of K through foliar spray (1%) was found to record significantly higher gross and net returns compared to no spray. However, there was no significant difference in gross and net returns among different foliar spray treatments. Maximum gross and net returns were realized with application of K through foliar spray (1%) at 60 DAP (Rs. 41,674 and Rs.27,505 ha\(^{-1}\), respectively) followed by 45 DAP (Rs.40,979 and Rs.26,811 ha\(^{-1}\), respectively) and both at 45 and 60 DAP (Rs.41,231 and Rs.26,965 ha\(^{-1}\), respectively). In a similar experiment, Kalyanasundaram and Surendirakumar (2003) also obtained higher gross and net returns with 1% MOP spray at panicle and booting stage in rice. The interaction effect of K application through soil and foliar spray on gross and net returns was significant during 2000 only. Combined application of 150% K + 1% K spray at 60 DAP (S,F,) recorded maximum gross returns (Rs.52531 ha\(^{-1}\)) and net returns (Rs. 38567 ha\(^{-1}\)) compared to rest of the combinations.

References

