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Optimization of seedling density as influenced by seed rate for mechanical transplanting

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Introduction

Mechanization of rice cultivation, including transplanting, is spreading in Bangladesh in order to reduce the cost of production, the need for labour and to increase productivity of rice cultivation. Quality seedlings are a key factor for the success of mechanical rice transplanting. Seeding density in the seedling tray has considerable influence on seedling quality, and hence on plant establishment and the percentage of missing hills in the field after transplanting. There are combined effects of seedling adjustment options of the rice transplanter and seedling density on number of plants per hills and percentage of missing hills. Rice grain size and shape in terms of length, breadth and length-breath ratio differs among rice varieties. Based on size and shape, rice grain can be classified as bold, medium and slender, long and extra long (Belsnio, 1992). This study, conducted during the irrigated dry season of 2013-14, aimed to identify the optimum seed rate for quality seedlings production to minimize the percentage of missing hills. In addition, suitable seedling adjustment option of the rice transplanter for different seedling densities were identified to maintain optimum numbers of seedlings per stock (plants/hill) by the rotary picker of the transplanter.

Materials and Methods

Rice varieties BR3 (L/B ratio=2.77), BRRI dhan28 (L/B ratio=3.87), BRRI dhan29 (L/B ratio=3.62) and BRRI dhan50 (L/B ratio=1.85) were selected as bold, medium and slender and extra long grain types, respectively. Daedong DP 480 model rice transplanter was used to test the number of plants per hill and percentage of missing hills for identifying the optimum density of seedlings of different varieties under different seed rate. Germination percentage was 90, 86, 89 and 87% for BR3, BRRI dhan28, BRRI dhan29 and BRRI dhan50, respectively. Seed rates were 100, 120, 130, 140, 150 and 160 gram of seeds/tray. Stroke area of the rotary picker (area of cut) under 9 seedling adjustment options of the rice transplanter was measured to find out the number of effective strokes per tray and number of trays required per hectare. Width of cut during stroke of the rotary picker under each of the 9 seedling adjustment options was 1.2 cm whereas depth of cut per stroke of the picker started from 1.12 cm for option 1 with the increments of 0.8 cm with successive options. As seedling adjustment options changed from 1 to 9, the number of strokes per tray decreased from 1200 to 656 and the number of trays per hectare for transplanting increased from 185 to 339.

Results

Percentages of the seedlings emerged from the sown seeds decreased from 61 -70% to 54 -59% with increasing seed rate irrespective of the variety. Seedlings height ranged from 197 mm for BRRI dhan50 to 179 cm for BR3. Averaged across the four varieties, plant height increased from 178 mm with 100 grams of seeds/tray to 186 mm for 130 grams of seeds/tray and decreased from 185 mm with 140 grams of seeds/tray to 182 mm for 160 grams of
seeds/tray. Highest seedling strength (0.04 gram/cm) was observed for BR3 and lowest (0.02 g/cm) for BRRI dhan50. Interaction of variety and seed rate also showed significant effect on seedling strength. With increased seed rate, seedling strength decreased.

Average number of plants per stock of the rotary picker of the rice transplanter increased and percentage of missing hills decreased with increasing both seed rate and seedling adjustment options of the rice transplanter irrespective of variety (Table 1). In case of bold grain paddy, seedlings per stroke and percentage of missing hills for the seed rate of 130, 140 and 150 g of seeds/tray varied from 3.2-5.4 to 3.5-6.4 and 14-4 to 13-3 respectively for 5 to 8 seedlings adjustment options of the rice transplanter which is almost same. Seedlings per stroke and percentage of missing hills of medium and slender grain paddy (BRRI dhan28 and BRRI dhan29) for the seed rate of 140, 150 and 160 g of seeds/tray was found to be almost the same (2.7-6.8 to 3.0-6.8 and 12-3 to 12-1 respectively), for 5 to 7 seedlings adjustment options of the rice transplanter. However, there was minimum difference of seedlings per stroke and percentage of missing hills among 120, 130 and 140 gram of seeds/tray (2.5-6.8 to 2.5-8.6 and 12-2 to 11-1 respectively) for the options of 3-7 for extra long and slender paddy (BRRI dhan50).

**Table 1.** Seedlings per stroke and percentage of missing hills as affected by seed rate and seedling adjustment options of the rice transplanter

<table>
<thead>
<tr>
<th>Seeds/tray</th>
<th>BR3 Seedlings/stroke and % of missing hills for 1 to 9 seedling adjustment options of the transplanter</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 g</td>
<td>BRRI dhan28 Seedlings/stroke 2.5-4.6 % of missing hills 27-14</td>
</tr>
<tr>
<td>120 g</td>
<td>BRRI dhan28 Seedlings/stroke 2.6-5.1 % of missing hills 22-10</td>
</tr>
<tr>
<td>130 g</td>
<td>BRRI dhan28 Seedlings/stroke 3.2-5.4 % of missing hills 14-4</td>
</tr>
<tr>
<td>140 g</td>
<td>BRRI dhan28 Seedlings/stroke 3.3-5.9 % of missing hills 13-4</td>
</tr>
<tr>
<td>150 g</td>
<td>BRRI dhan28 Seedlings/stroke 3.5-6.4 % of missing hills 13-3</td>
</tr>
<tr>
<td>160 g</td>
<td>BRRI dhan28 Seedlings/stroke 2.9-5.3 % of missing hills 14-5</td>
</tr>
</tbody>
</table>

**Conclusion**

Based on missing hills and number of seedling per hills under different seedling adjustment options, 130g of seed/tray for bold grain, 140 g/tray for medium and slender grain and 120 g/tray for extra long and slender paddy were suitable for the studied transplanter.

**References**

Belsnio B (1992) The anatomy and physical properties of the rice grain. Towards integrated commodity and pest management in grain storage, FAO Corporate documents repository. URL: http://www.fao.org/docrep/x5048E/x5048E00.htm