Studies on pre-germinated seeds for designing metering mechanism of power operated paddy seeder

UK Dhruw, AK Verma and Aditya Sirmour

Abstract

Rice is one of the most important crops in India with a total area of 44 million ha and a production of 110 million tonnes. The physical properties was studied for dry, 1-day soaked with 12h, 24h, 36h, 48h germination condition of paddy, to design different seed metering mechanism. Pre-germinated paddy seeding in wet condition is often recommended as an alternative to manual transplanting. However, no information is available on the influence of the level of pre-germination on crop growth parameters. Therefore, this study was conducted to determine the effect of the incubation period of pre-germinated paddy seed on the plant population, crop growth and yield. Plant population, crop growth and yield were higher for the pre-germinated seed as compared to dry and water soaked seed. The incubation period 36 h and sprout length of 2-5 mm was observed to be optimum for maximum plant population and grain yield.

Keywords: Pre-germinated seeds, designing metering mechanism, power operated paddy seeder

Introduction

Pre-germinated paddy seeding in puddle soil is often recommended as an alternative to manual transplanting. However the level of pre-germination of the seed is not clean. Also, suitable machinery for seeding paddy in puddle soil has been slow in developing and manual broadcasting of pre-germinated seed has been the main operation of sowing by the farmers and agronomist. The seed used for broadcast sowing ranges from dry seeds to sprouted seeds upto 5mm or more. No information is available on the influence of sprout length of the seed on the crop growth parameters. In the context of developing suitable machine for seedy paddy in both dry and wet puddle field, this information is critical importance for developing metering mechanism. Therefore study was undertaken to determine the effect of sprout length of pre-germinated seed on the plant population, crop growth, and yield in puddled soil.

Material and Methods

Soil physico-chemical characteristics

In order to determine the mechanical and chemical composition of soil in experimental plot, soil samples were collected randomly from the experimental site up-to 30 cm depth with the help of soil auger. A composite sample was drawn from mixed representative samples by dividing repeatedly till the amount of representative samples remain about 250 g and then it was used for analysis.

Seed

As paddy seed may be sown after soaking, it was thought prudent to measure dimensions of dry as well as soaked paddy. The size and shape of selected paddy varieties were determined. The observed values for the mean length, breadth, thickness and equivalent diameter of the paddy varieties was done for 24 h water soaking with incubation period 12, 24, 36 and 48 h.

Seed germination

Seed germination test was taken under different level of germination i.e. dry seed, 24 h water soaking with 12 h germinated seed, 24 h germinated seed, 36 h germinated seed and 48 h germinated seed were taken. 300 seed from each of the germination level condition was taken and sown into randomized block field and plant population after 7 days was noted.
The design methods were adopted as given by Sharma and Mukesh (2010) for seed metering mechanism.

**Design of metering device**

The metering mechanism helps to meter regulate the paddy with its uniform rate and spacing. The metering mechanism maintains the sowing rate of the seeder. While designing the metering mechanisms for power operated paddy seeder, prime considerations were given to use simple design and not to cause any mechanical damage to paddy, low cost and easily pick of grains. Hence the cup feed metering mechanism was chosen for maintaining plant to plant distance within the row. The design methods were adopted as given by Sharma and Mukesh (2010) for seed metering mechanism.

**Results and Discussion**

**Physical Characteristics of Paddy Seeds**

The length, width and thickness of 100 seeds of paddy in different condition (i.e. dry seed, 12 h pre-germinated, 24 h pre-germinated, 36 h pre germinated and 48 h pre germinated seed) randomly selected and measured with the help of vernier calliper. The average length, width and thickness of 100 seeds of MTU 1010 were observed and presented in Table 2.

**Table 2: Average length, width and thickness of dry seed**

<table>
<thead>
<tr>
<th>Length, mm</th>
<th>Width, mm</th>
<th>Thickness, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>SD</td>
<td>CV (%)</td>
</tr>
<tr>
<td>9.18</td>
<td>0.16</td>
<td>1.70</td>
</tr>
<tr>
<td>2.41</td>
<td>0.06</td>
<td>2.61</td>
</tr>
<tr>
<td>1.93</td>
<td>0.03</td>
<td>2.79</td>
</tr>
</tbody>
</table>

The variety of paddy seeds taken for the study was MTU-1010 and shape was cylindrical. The average length was found to be 9.18 mm. The SD and coefficient of variance was calculated to be 0.16 mm and 1.70 per cent respectively. Similarly average width was found to be 2.41 mm. The SD and coefficient of variance was calculated to be 0.06 mm and 2.61 percent respectively. Similarly average thickness was found to be 1.93 mm. The SD and coefficient of variance were calculated to be 0.05 mm and 2.79 per cent respectively. The average sprout length under different incubation period is shown in Table 2.

**Table 3: Length of sprout at different germination pattern**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Soaking time, h</th>
<th>Incubation period, h</th>
<th>Average, mm</th>
<th>SD, mm</th>
<th>CV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24</td>
<td>12</td>
<td>0.68</td>
<td>0.04</td>
<td>5.66</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>24</td>
<td>1.23</td>
<td>0.04</td>
<td>3.15</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>36</td>
<td>1.94</td>
<td>0.12</td>
<td>6.04</td>
</tr>
<tr>
<td>4</td>
<td>24</td>
<td>48</td>
<td>2.93</td>
<td>0.17</td>
<td>5.94</td>
</tr>
</tbody>
</table>

For the pre-germinated paddy seeding, the paddy seeds were generally soaked in water for a particular time and then incubation period to get germinated seeds. In pre-germinated seeding 24 h soaking time and various incubation periods like 12 h, 24 h, 36 h and 48 h were taken. These pre-germinated sprout length were measured by vernier calliper by taking samples of each germination condition. The desired sprout length required for wet seeding was about 1.5- 2.5 mm.

**Germination test of paddy seed at laboratory condition**

Seed germination test was taken under different level of germination i.e. dry seed, 12 h germinated seed, 24 h seed germination test was taken under different level of germination condition.
germinated seed, 36 h germinated seed and 48 h germinated seed were taken. 300 seed from each of the germination level condition was taken and sown into randomized block field and plant population after 7 days was noted.

Table 4: Germination percentage of paddy seed

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Number of seed taken</th>
<th>Average Germination reading</th>
<th>Average Germination test of paddy seed, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₁</td>
<td>300</td>
<td>184</td>
<td>61.4</td>
</tr>
<tr>
<td>T₂</td>
<td>300</td>
<td>187</td>
<td>62.3</td>
</tr>
<tr>
<td>T₃</td>
<td>300</td>
<td>202</td>
<td>67.3</td>
</tr>
<tr>
<td>T₄</td>
<td>300</td>
<td>238</td>
<td>79.3</td>
</tr>
<tr>
<td>T₅</td>
<td>300</td>
<td>227</td>
<td>75.7</td>
</tr>
</tbody>
</table>

The plant germination of paddy seed from the dry seed was observed as 61.2 per cent. The pre-germination test of paddy seed incubation period from 12 h, 24 h, 36 h and 48 h after 24 h of soaking the germination percentage was obtained as 62.7 %, 67.2 %, 79.3 and 74.2 % respectively.

Conclusions

On the basis of the results from the laboratory experiment of physical characteristics of paddy seeds (MTU 1010), for developing metering mechanism for power paddy seeder, following conclusion could be drawn.

1. The germination and grain yield of dry seeds was significantly lower than pre-germination paddy seed.
2. With incubation period of 36h and 24h soaking period seed with sprout length of 1.94 mm.
3. The plant germination of dry paddy seed was observed as 61.2% and the pre-germination test of paddy seed with incubation period from 12h, 24h, 36h, 48h after 24h soaking was obtained as 62.7%, 67.2%, 79.3% and 74.2% respectively.
4. Cup type metering unit can be developed for successful sowing of dry seed as well sprouted seed for power operated paddy seeder.

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References