Rice (*Oryza sativa* L.) is the prime source of food for nearly half of the World's population. It is the staple food for nearly 65 per cent of the population in India. The use of low-quality seeds is one of the major causes of low productivity of rice in India. Farmers generally use their own seeds from previous harvest stored in the improper storage and packaging conditions. So, the seed germination and the vigour were poor already. Therefore, it is imperative to have appropriate techniques in order to improve the rice seed germination and vigor. Now-a-days organic based materials are used to invigourate the seeds. The tender coconut water, cow's urine and cowdung slurry extract, other researchers have been reported to be useful to harden the seeds with greater benefits.

Coconut water is very well known for its content of enzyme and growth promoting substances especially cytokinin. Cytokinins promote the nutrient mobilization (sugars, amino acids etc...) and these biocontents might synergistically interact with amino acid "tryptophan" to form the indole acidic acid (IAA) in germinating seeds to bring enhancement in seedling growth.

Panchagavya is an organic product recommended for crop improvement in organic agriculture. It is used as a foliar spray, soil application along with irrigation, as well as seed treatment to enhance the growth and yield. Panchagavya has played a significant role in providing resistance to pests and diseases, resulting in increased overall yields. It has resulted in positive effect on growth and productivity of crops. Hence the study focused on to evaluate the effect of different organic solutions for its seed invigorative influence with different doses on seed germination and vigour.

**MATERIALS AND METHODS**

The experiment was conducted at the Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University. Genetically pure seeds of rice cv. CO 43 were obtained from Tamil Nadu Rice Research Institute, Aduthurai. The commercial product of Panchagavya was obtained from Tamil Nadu Agricultural University (TNAU), Coimbatore, India. Cow's urine utilized in the study was collected from the animal husbandry farm whereas the vermiwash is a watery extract of vermicompost and wash of earthworms present in the medium. Fresh vermiwash were collected from the vermicompost unit. The starter solution used in the study was a mixture of cowdung, cow's urine and palm sugar with a ratio of 1:1:0.25. The mixture was kept for 24 hours for fermentation and then used. Coconut water utilized in the study was collected from the tender coconut formed 5 to 7 months after spathe exertion. The rice seeds were soaked in the respective organic solutions for 16 hours duration. The untreated seeds were taken as control.
Table-1. Influence of organic seed invigoration in rice cv. CO 43

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Rate of imbibition (%)</th>
<th>Speed of germination</th>
<th>Germination percentage (%)</th>
<th>Root length (cm)</th>
<th>Shoot length (cm)</th>
<th>Dry matter production (g 10 seedling$^{-1}$)</th>
<th>Vigour index</th>
</tr>
</thead>
<tbody>
<tr>
<td>T₀</td>
<td>0.25</td>
<td>13.00</td>
<td>82.00 (53.73)*</td>
<td>14.07</td>
<td>9.60</td>
<td>97.90</td>
<td>1564.55</td>
</tr>
<tr>
<td>T₁</td>
<td>20.30</td>
<td>24.30</td>
<td>97.50 (80.95)*</td>
<td>25.20</td>
<td>13.50</td>
<td>120.00</td>
<td>3773.25</td>
</tr>
<tr>
<td>T₂</td>
<td>09.80</td>
<td>20.00</td>
<td>92.50 (74.11)*</td>
<td>19.00</td>
<td>10.00</td>
<td>107.40</td>
<td>2645.50</td>
</tr>
<tr>
<td>T₃</td>
<td>10.47</td>
<td>19.90</td>
<td>90.00 (71.56)*</td>
<td>21.20</td>
<td>11.65</td>
<td>99.50</td>
<td>2956.50</td>
</tr>
<tr>
<td>T₄</td>
<td>21.20</td>
<td>23.10</td>
<td>94.00 (75.82)*</td>
<td>22.50</td>
<td>12.75</td>
<td>109.80</td>
<td>3313.50</td>
</tr>
<tr>
<td>T₅</td>
<td>09.00</td>
<td>16.50</td>
<td>85.00 (67.22)*</td>
<td>18.25</td>
<td>10.55</td>
<td>105.50</td>
<td>2448.00</td>
</tr>
<tr>
<td>T₆</td>
<td>30.34</td>
<td>19.10</td>
<td>90.00 (71.58)*</td>
<td>19.60</td>
<td>10.85</td>
<td>104.50</td>
<td>2740.50</td>
</tr>
<tr>
<td>Mean</td>
<td>14.48</td>
<td>19.41</td>
<td>87.71</td>
<td>19.97</td>
<td>11.27</td>
<td>106.37</td>
<td>2777.4</td>
</tr>
<tr>
<td>SEd</td>
<td>0.27</td>
<td>0.46</td>
<td>0.60</td>
<td>1.11</td>
<td>0.30</td>
<td>0.97</td>
<td>195.35</td>
</tr>
<tr>
<td>CD(P=0.05)</td>
<td>0.60</td>
<td>1.00</td>
<td>1.30</td>
<td>2.40</td>
<td>0.65</td>
<td>2.10</td>
<td>420.00</td>
</tr>
</tbody>
</table>

[*Figures in parentheses are sine transformed values]

[T₀ - Dry seed (control), T₁ - Panchagavya - 4%, T₂ - Vermiwash - 50%, T₃ - Starter solution - 10%, T₄ - Coconut water - 50%, T₅ - Cow's urine - 50%, T₆ - Water soaking]

The experiment was laid out in a completely randomized design with four replications. The treatments viz., T₀ - Dry seed (control), T₁ - Panchagavya - 4%, T₂ - Vermiwash - 50%, T₃ - Starter solution - 10%, T₄ - Coconut water - 50%, T₅ - Cow's urine - 50%, T₆ - Water soaking. The treated seeds were air dried and used for recording the following observations viz., rate of imbibition, germination percentage, speed of germination, root length (cm), shoot length (cm), dry matter production (g 10 seedlings$^{-1}$) and vigour index. The data were analysed using ‘F’ test for significance.

RESULTS AND DISCUSSION

Organic products are natural substances containing growth regulators and nutrients in different proportions. Though their utility has been well established, for the selectivity of botanicals, the present study was carried out on different organic solutions at different concentrations which showed a significant improvement in seed germination and vigour over control.

Rate of imbibition was low in organic solutions of panchagavya, vermiwash, starter solution, cow's urine and coconut water, as compared to water soaking (30.34%) in rice cv. CO 43 (Table-1). In cv. CO 43 the seeds treated with 4% panchagavya resulted in higher germination (97.50 %) and higher speed of germination (24.30) than control (Table-1) followed by coconut water at the concentration of 50 % which accounted for an increase of (94.00 % and 23.10 respectively).

The results on cv. CO 43 revealed that, soaking the seeds in 4% panchagavya for 16 hours had the highest root length (25.20cm) and highest shoot length (13.50 cm) than control and water soaking. Among the different organic solutions, the seed soaked in 4 % concentration of panchagavya has recorded higher dry matter production (120 g) than control (97.90) and water soaked seeds (104.50). Similarly, the seedling vigour (3773.2) was also higher with 4 % concentration of panchagavya than control (1564.55) and water soaked seeds (2740.50) which are presented in Table-1.

The decrease of imbibition rate in organic solutions was probably due to the increased concentration of the solutes and osmotic potential of the solution. The ability of seeds to absorb water from the solution is determined by the osmotic potential of the solution.

The studies clearly indicated that there were significant improvement in the seed invigoration with Panchagavya fortified seeds and might be due to the action of microorganisms and growth hormones (IAA and GA3) which are present in the Panchagavya. Panchagavya possess almost all the major nutrients, micronutrients and growth hormone which enhances the metabolic activity of plants and supports better seed...
invigoration. Panchagavya contains bacteria producing plant growth promoting substances as well as bacteria having biological deterrent activities. Microbes such as Rhizobium, Azotobacter, Azospirillum, Phosphorous solubilizing bacteria, Trichoderma and Pseudomonas present in Panchagavya act as liquid bio fertilizer and bio-pesticides. Sometimes seed germination and seedling quality characteristics were reduced with increasing concentration levels and duration with organic fortification which might be due to supra optimal dose of the organic product which is normally specific to crops. Similarly, it is reported that 100 per cent germination was recorded in coconut water 50 per cent as compared to 88 per cent germination in control. It also increased the shoot length and dry matter production of seedlings as well as vigour index. Presence of growth promoting substances and bio active compounds in coconut water might have stimulated the hydrolysis of endospermal reserves for translocation to growing embryo to provide energy source and produce vigourous seedlings.

Panchagavya as foliar spray on 10th, 20th, 30th, 40th, and 50th days after planting gave better germination, growth and yield of New Zealand spinach (Tetragonia tetragonoides). Under pre-sowing condition, the green gram seedlings showed significant growth increase at 4% concentration of Panchagavya. The paddy seeds treated with Panchagavya enhanced the seed germination by 91% and with higher vigour index value of 1036. It is also reported that Panchagavya is the most effective growth promoter in brinjal (Solanum melongena) and tomato (Lycopersicon esculentum) than other organic promoters. The seed treatment and foliar application of panchagavya helps in improving the plant growth and reducing the disease incidence of rice. Hence it is clearly evident that the rice seeds could be treated with 4% Panchagavya to enhance the seed germination and vigour of seedlings.

REFERENCES