Relative Efficacy of Seed Priming with Vermiwash, Growth Regulators and Bio-controlling Agents in Response to Germination and Invigoration of Okra
(*Abelmoschus esculentus L.*)

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In a field experiment, two varieties of Okra viz: MIS077 and BHINDI No-10 were primed with vermiwash @ 20% and 50%, growth regulators i.e. Indole-3-acetic acid @ 50ppm and 100ppm, Gibberellic acid @ 50ppm and 100ppm, Kinetin @ 50ppm and 100ppm and bio-controlling agents i.e. Trichoderma viride and Trichoderma harzianum v/w for 8 h and one unprimed set was also maintained as control. Seeds after shade drying were tested in three replicates. Observations in respect of seed germination, root and shoot length and seedling dry weight were recorded at initial stage and vigour index I & II was calculated. On the basis of data recorded it is concluded that priming of Okra seeds with all above-mentioned treatments improves seed germination, seedling length, dry weight. Vigour index I which is the multiple of germination % and seedling length and vigour index II that is the multiple of germination % and seedling dry weight was found to be enhanced over unprimed control in both the varieties evaluated. Among all vermiwash @50 % showed significantly superior values for all the above-mentioned characters over rest of treatments.

Key words: Okra, Seed priming, vermiwash, Growth regulators, bio-controlling agents.

Okra is an important vegetable crop grown in India as well as in different tropical and subtropical part of the world. It is economically suitable for cultivation in Indian kitchen garden and also for large-scale commercial production.

Okra is a powerhouse of valuable nutrients, nearly half of which is soluble fiber in the form of gums and pectin. Soluble fiber helps to lower serum cholesterol, reducing the risk of heart disease. The other half is insoluble fiber which helps to keep the intestinal tract healthy, decreasing the risk of some forms of cancer, especially colorectal cancer. It’s high iodine contents control goiter. Okra provides an important source of vitamins, calcium, potassium and other mineral matters which are often lacking in the diet of developing countries (IBPGR, 1990). Being such an important crop there is the need of enhancement in okra production. Now a day’s researchers are using various growth regulators as well as bio-controlling agents for enhancing the crop productivity and also getting positive effect with that but these treatments were not easily available for the poor farmers and also to overcome from this problem vermiwash is a great alternative as it contain plant growth hormones like auxins and cytokinin apart from that also containing nitrogen, phosphorus, potash and other micronutrients. It contains nitrogen-fixing bacteria like Azotobacter sp., Arobactericum sp. and Rhizobium sp. and some phosphate solubilising bacteria. It acts as a
plant tonic and helps to reduce many plant
diseases. The present study was therefore carried
out to evaluate the effect of vermiwash overgrowth
regulators and bio-controlling agents through the
method of priming.

MATERIALS AND METHODS

Seeds of two Okra varieties viz: MIS077(V1)
and BHINDI No-10(V2) were surface sterilized with
0.1% of Ca(OCl)2 for five minutes which will be
treated through the method of priming
with vermiwash @ 20%(T1) and 50%(T2), growth
regulators i.e. Indole-3-acetic acid @ 50ppm(T3)
and 100ppm(T4), Gibberellic acid @ 50ppm(T5)
and 100ppm(T6), Kinetin @ 50ppm(T7) and 100ppm(T8)
and bio-controlling agents i.e. Trichoderma
viride(T9) and Trichoderma harzianum(T10) v/w
for 8 h. Seeds were taken out from the solution and
allowed for shade drying. One set of unprimed
control (T0) was also maintained simultaneously.
After shade drying primed and unprimed seeds of
each variety were tested by using between the
paper methods with three replications according
to ISTA rules (Anon., 1999). Germination and root/
shoot length were recorded after 7th days and at
the same time; the fresh seedlings (root+shoot)
were kept for drying in the oven at 80°C. Dried
samples were weighed with an electronic balance
and vigour index I & II was calculated by following
the method of Abdul-baki and Anderson (1973) as
germination percent x seedling length and
germination percent x seedling dry weight
respectively. Data obtained were analyzed
following the statistical procedure as described
Panse and Sukhatame (1973).

RESULTS AND DISCUSSION

Effect of priming treatment on growth parameters

A study was undertaken for improving the
germination, stand establishment and growth
of okra crop through employing the seed priming
techniques. One open pollinated (OP) okra variety
(MIS 077) and one hybrid okra variety (Bhindi No.
10) were primed with vermiwash @ 20% and 50%,
growth regulators IAA, GA3, Kinetin @ 50 ppm
and 100 ppm, and bio-controlling agents
Trichoderma viride and Trichoderma harzianum.
According to the obtained results primed okra
seeds significantly enhanced the germination %,
seedling length (cm.), dry weight (g.) and vigour in
both the OP and hybrid variety of okra over
unprimed control.

Table 1. Showing the response of priming on germination percentage, Seedling length, and Dry weight in Okra

<table>
<thead>
<tr>
<th>Treatments</th>
<th>MIS 077(V1)</th>
<th>Bhindi No.10(V2)</th>
<th>Mean</th>
<th>MIS 077(V1)</th>
<th>Bhindi No.10(V2)</th>
<th>Mean</th>
<th>MIS 077(V1)</th>
<th>Bhindi No.10(V2)</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (T0)</td>
<td>70.3</td>
<td>80.6</td>
<td>75.5</td>
<td>22.8</td>
<td>23.9</td>
<td>23.35</td>
<td>1.37</td>
<td>1.47</td>
<td>1.42</td>
</tr>
<tr>
<td>Vermiwash 20% (T1)</td>
<td>75.3</td>
<td>84.3</td>
<td>79.83</td>
<td>28.9</td>
<td>29.1</td>
<td>29</td>
<td>1.70</td>
<td>1.74</td>
<td>1.72</td>
</tr>
<tr>
<td>Vermiwash 50% (T2)</td>
<td>95.6</td>
<td>97.3</td>
<td>96.5</td>
<td>31.3</td>
<td>31.5</td>
<td>31.4</td>
<td>2.34</td>
<td>2.52</td>
<td>2.43</td>
</tr>
<tr>
<td>IAA@50 ppm (T3)</td>
<td>72.3</td>
<td>82.3</td>
<td>77.335</td>
<td>29.7</td>
<td>28.8</td>
<td>29.25</td>
<td>1.48</td>
<td>1.55</td>
<td>1.515</td>
</tr>
<tr>
<td>IAA@100 ppm (T4)</td>
<td>82.6</td>
<td>87.6</td>
<td>85.165</td>
<td>30.2</td>
<td>30.0</td>
<td>30.1</td>
<td>1.88</td>
<td>1.79</td>
<td>1.835</td>
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<tr>
<td>GA3@50 ppm (T5)</td>
<td>76.6</td>
<td>83.0</td>
<td>79.8</td>
<td>28.3</td>
<td>26.2</td>
<td>27.25</td>
<td>1.57</td>
<td>1.54</td>
<td>1.555</td>
</tr>
<tr>
<td>GA3@100 ppm (T6)</td>
<td>88.0</td>
<td>91.0</td>
<td>89.5</td>
<td>28.9</td>
<td>29.0</td>
<td>28.95</td>
<td>1.98</td>
<td>1.96</td>
<td>1.97</td>
</tr>
<tr>
<td>Kinetin@50 ppm (T7)</td>
<td>78.0</td>
<td>85.3</td>
<td>81.665</td>
<td>26.1</td>
<td>27.5</td>
<td>26.8</td>
<td>1.64</td>
<td>1.66</td>
<td>1.65</td>
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<tr>
<td>Kinetin@100ppm (T8)</td>
<td>92.0</td>
<td>93.6</td>
<td>92.83</td>
<td>26.9</td>
<td>28.5</td>
<td>27.7</td>
<td>1.99</td>
<td>2.00</td>
<td>1.995</td>
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<td>T. viride (T9)</td>
<td>81.6</td>
<td>87.6</td>
<td>84.66</td>
<td>26.1</td>
<td>27.9</td>
<td>27</td>
<td>1.73</td>
<td>1.89</td>
<td>1.81</td>
</tr>
<tr>
<td>T. harzianum (T10)</td>
<td>82.0</td>
<td>89.3</td>
<td>85.665</td>
<td>28.7</td>
<td>28.6</td>
<td>28.65</td>
<td>1.84</td>
<td>1.90</td>
<td>1.87</td>
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<tr>
<td>Mean</td>
<td>81.4</td>
<td>87.5</td>
<td>85.5</td>
<td>27.9</td>
<td>28.3</td>
<td>28.3</td>
<td>1.77</td>
<td>1.82</td>
<td></td>
</tr>
<tr>
<td>Variety (V)</td>
<td></td>
<td></td>
<td></td>
<td>0.3039</td>
<td>0.61357</td>
<td></td>
<td>0.0372</td>
<td>0.07509</td>
<td></td>
</tr>
<tr>
<td>Treatment (T)</td>
<td></td>
<td></td>
<td></td>
<td>0.7128</td>
<td>1.43896</td>
<td></td>
<td>0.0872</td>
<td>0.17611</td>
<td></td>
</tr>
<tr>
<td>V x T</td>
<td>1.0081</td>
<td>2.03499</td>
<td>0.1233</td>
<td>0.24906</td>
<td>0.0222</td>
<td>0.04487</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CV</td>
<td>1.45%</td>
<td>0.53%</td>
<td>1.39%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2. Showing the response of priming on Vigour Index in Okra.

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Vigour Index</th>
<th>Mean</th>
<th>Vigour Index</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MIS 077 (V₁)</td>
<td>Bhindi No.10 (V₂)</td>
<td>MIS 077 (V₁)</td>
<td>Bhindi No.10 (V₂)</td>
</tr>
<tr>
<td>Control (T₀)</td>
<td>1603.75</td>
<td>1927.77</td>
<td>1765.763</td>
<td>118.5702</td>
</tr>
<tr>
<td>Vermiwash 20% (T₁)</td>
<td>2177.04</td>
<td>2454.01</td>
<td>2315.52</td>
<td>128.061</td>
</tr>
<tr>
<td>Vermiwash 50% (T₂)</td>
<td>2994.47</td>
<td>3065.89</td>
<td>3030.183</td>
<td>107.0632</td>
</tr>
<tr>
<td>IAA@50 ppm (T₃)</td>
<td>2148.49</td>
<td>2371.10</td>
<td>2259.801</td>
<td>127.6115</td>
</tr>
<tr>
<td>IAA@100 ppm (T₄)</td>
<td>2496.33</td>
<td>2630.10</td>
<td>2563.216</td>
<td>156.9293</td>
</tr>
<tr>
<td>GA₃@50 ppm (T₅)</td>
<td>2167.78</td>
<td>2174.60</td>
<td>2171.19</td>
<td>127.82</td>
</tr>
<tr>
<td>GA₃@100 ppm (T₆)</td>
<td>2994.47</td>
<td>3065.89</td>
<td>3030.183</td>
<td>107.0632</td>
</tr>
<tr>
<td>Kinetin@50 ppm (T₇)</td>
<td>2167.78</td>
<td>2174.60</td>
<td>2171.19</td>
<td>127.82</td>
</tr>
<tr>
<td>Kinetin@100 ppm (T₈)</td>
<td>2543.20</td>
<td>2639.00</td>
<td>2591.1</td>
<td>178.36</td>
</tr>
<tr>
<td>T. viride (T₉)</td>
<td>2353.40</td>
<td>2554.84</td>
<td>2454.119</td>
<td>169.727</td>
</tr>
<tr>
<td>T. harzianum (T₁₀)</td>
<td>2284.218</td>
<td>2479.901</td>
<td>2479.901</td>
<td>160.5154</td>
</tr>
</tbody>
</table>

Among the treatments vermiwash 50% enhanced the maximum germination (96.5%) followed by 100 ppm doses of Kinetin (92.83%), GA₃ (89.5%) and IAA (85.16%) (Table 1). Percent improvement in germination was observed 27.81%, 22.95%, 18.54%, 12.8% (Fig. 1) respectively in these mentioned treatments compared to control (75.5%). Variety V₂ showed enhancive value than V₁ as it is a hybrid variety but if we consider the enhancement of V₁ which is an Open pollinated (OP) variety, its germination improvement with vermiwash 50% treatment (T₂) (95.6%) is maximum than the control of Hybrid variety (V₂) (80.6%) (Table 1). Conclusively OP variety treated with vermiwash 50% can be easily used by farmer instead of hybrid variety that is a cost effective method and promote the organic farming by
protecting the environment from the threat of the use of chemicals in agriculture.

Seedling length is the sum of shoot and root length and it was very much enhanced through seed priming and the maximum enhancement was observed with vermiwash 50% (31.4 cm) (Table 1). This obtained value is 34.47% (Fig 1) enhanced compare to control (23.35 cm).

Seedling dry weight which is a biomass of dried seedlings (root+soot) which is evaluated by calculating the reinvigoration of plant in terms of identifying the plant health and its real accumulated physiological content was also found maximum in vermiwash @ 50% (2.43 g.) (Table 1) which is 72.12 % (Fig 1) more compared to the value of control (1.42 g.)

Vigour index I is the multiple product of germination X seedling length were also recorded maximum in vermiwash 50% (3030.18) (Table 2) which is 27.81% (Fig 2) more than that of control (1765.763) (Table 2) and vigour index II is a multiple products of germination X seedling dry weight was also recorded maximum in vermiwash 50% (234.56) (Table 2) which is 92.51 % (Fig 2) more than that of control (107.47) (Table 2). These results are also in harmony to some extent with the studies of Iqbal & Ashraf, 2007, Harris et al. 2004 in maize, rice, and chickpea, Rashid et al. 2004 in mungbean, Suresh et al. 2005 in chickpea and Rashid et al. 2006 in barley, Nath et al. 2009, Rai and Bansiwal 2008.

REFERENCES

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