Innovative technique for enhancement of seed germination and seedling establishment of cucurbits

*(Cucumis sativus L.)*

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Abstract: Cucurbits belong to the family Cucurbitaceae. It is an important group of vegetables across the globe. Few of the cucurbits are also being used as fruit. Cucumber can be used as fruit as well as vegetable. The immature cucumber generally used as salad and fruit, whereas, mature cucumber can be used as vegetable. Most of the cucurbits have hard seed coat, leading to uneven germination and irregular crop stand in the field. Modern agricultural research has brought hybrid varieties in most of the vegetable crops. Hybrid seeds of those crops are produced manually, thus the seed cost is very high. So, germination percentage of the seed must be very high along with the high speed of germination is desirable to minimize the investment on seed. To enhance the germination percentage, farmers have innovated many techniques. One of those techniques studied in detail in this edeavour, such as, germination of cucumber (*Cucumis sativus*). Doing this practice, the seed imbibed uniformly, which improved speed of germination leading to good crop-stand in the field. Farmers’ technique of seed pre-conditioning and sowing of pre-germinated seeds has been found better than the common practice of sowing in dry soil.

Key Words: Cucumber, Hydropriming, Innovative technique, Seed germination


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INTRODUCTION

Cucumber (*Cucumis sativus* L.) is one of the Asiatic species and member of Cucurbitaceae. It is grown throughout the world to be consumed as fresh fruits, as slicing cucumber and as pickles in immature stage. Cucumber is regarded as the fourth most important vegetable crop after tomato, cabbage and onion. It can be grown round the year selecting suitable varieties in particular season.

It is one of the very low calories vegetable; provides just 15 calories per 100 g. It contains no saturated fats or cholesterol. Cucumber peel is a good source of dietary fiber that helps reduce constipation, and offers some protection against colon cancers by eliminating toxic compounds from the gut. It is a very good source of potassium, an important intracellular electrolyte. Potassium is a heart friendly electrolyte; helps reduce blood pressure and heart rates by countering effects of sodium. It contains unique anti-oxidants in good ratios such as β-carotene and α-carotene, vitamin-C, vitamin-A, *zea-xanthin* and *lutein*. These compounds help act as protective scavengers against oxygen-derived free radicals and reactive oxygen species (ROS) that play a role in aging and various disease processes. Cucumbers have mild diuretic property probably due to their high water and potassium content, which helps in checking weight gain and high blood pressure. They are surprisingly have high amount of vitamin K, provides about 17 µg of this vitamin per 100 g. Vitamin-K has been found to have potential role in bone strength by promoting osteotrophic (bone mass building) activity. It also has established role in the treatment of Alzheimer’s disease patients by limiting neuronal damage in their brain.

Germination of most light-requiring seeds and some dark-germinating seeds is phytochrome controlled (Yaniv *et al.*,...
Cucumber seeds are dark-germinating, light-inhibited seeds (Mancinelli, 1975). Germination is the first developmental step in the life cycle of a plant to produce a new germination and the ability to accomplish this task is a prerequisite to start this cycle (Bewley, 1997). Germinability is not a predictable event that ensures a plantlet will have a successful life cycle. Don’t risk planting cucumber seeds in the soil and hoping for good germination as the cucumber seed is very costly, particularly the hybrid cucumber seeds. Poor weather conditions and wet soil can quickly turn the seeds to mush and it may end up replanting the seeds to get a good crop. Replanting will give an un-uniform crop stand or it may reduce the number of plants per unit area and ultimately it will reduce the production per unit area. Lengthy rainy season in northern part of West Bengal makes it difficult to get dry soil for its sowing.

Thus, few progressive farmers of this region developed an innovative technique of seed germination before sowing in the main field, which ensure establishment of seedling uniformly all over the field. Germinating the cucumber seeds before planting them gives a nice head start on the season. In this endeavour, pre-germinated seeds were planted to ensure good germination percentage and subsequently a uniform crop stand with a control- common practice of sowing in soil directly.

**MATERIAL AND METHODS**

The experiments were conducted in the farmer’s field at Ghokshadanga, Mathabhanga Block of Cooch Behar District, West Bengal. Eight progressive farmers were selected for this purpose. Two local cultivars and a hybrid (Mailani) of cucumber have been selected for the trials based on the local preference. Truthfully labeled seeds of those genotypes were collected from the local market. Treatments were the innovative method of planting of germinated seed and common practice of sowing in the field directly. The experiment was repeated in eight farmer’s fields. The plot size was 50 × 10 m, which could accommodate 480 plants were per plot.

**Treatments:**

*Common practices:*

Seeds were sown manually (one seed per pit) directly in the dry soil. Observation on germination was taken on 5th day of sowing. Germination (%) was calculated based on the emergence of seedling to the number of seeds sown.

*Innovative practice:*

Banana leaf sheath of 6 × 10 inch size has been prepared. Leaf sheath was split open parallel. Split banana sheath contains hundreds of square-shaped compartments (Fig. 1). Cucumber seeds were placed inside the alternate square-shaped compartments and covered with the second half of the leaf sheath. The leaf sheath impregnated with cucumber seeds were then buried in the soil at 5 cm depth. On fourth day, the banana leaf sheaths were taken out of the buried soil. The germinated seeds were then sown in the field (one germinated seed per pit). Germination was considered when the radical protruded 2 mm.

Germination (%) and seedling establishment (%) were calculated using the following formula:

\[
\text{Germination percentage} = \frac{\text{No. of seed germinated}}{\text{No. of seeds sown}} \times 100
\]

![Fig. 1: Banana leaf sheath with cucumber seeds in alternate square-shaped compartments](image)

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**RESULTS AND DISCUSSION**

The analysis of variance showed significant differences among the varieties, treatments and interaction between varieties-treatments for seed germination, seedling establishment and yield (Table 1).

**Seed germination:**

Germination (%) of all the genotypes was more than 90% (Table 2). Highest germination (%) has been reported in Local cultivar-2 when seeds were hydro-primed under dark following farmers’ innovative practice of seed germination (Table 2). It has also been noted that seedling establishment (%) were high in all the genotypes when seeds were preconditioned using farmers’ innovative technique (Table 3). This result corroborates with the previous findings (see review of Nerson, 2007), who reported that seed hydro-priming and preconditioning to a seed lot in order to improve its germination and emergence (Khan, 1992). This pre-sowing hydration treatment improves seedling synchronization and
finally establishment (Herdecker and Coolbear, 1977). The
lowest germination percentage was observed in Mailani (a
hybrid varity) with the common practice of sowing of seeds
directly in the dry soil. The germination speed was also very
slow in this treatment (data not presented). The uneven
germination led a uneven crop stand and subsequently
reduction in yield. Variability in germination in any seed lot or
population includes inter-plant and within plant sources. The
variable germinability of seeds in-plant is mainly due to
different fruit developing at different times and positions, but
may be also a result of different seed position in the same fruit
as reported in cucumber (Jing et al., 2000).

Seedling establishment:
Highest seedling establishment (%) was also observed
in Local cultivar-2, when seeds were conditioned before
sowing using farmers’ innovative technique (Table 2). It was
also noted that seedling establishment (%) were high in all
the genotypes when seeds were preconditioned using farmers’
innovative technique (Table 3). Heydecker et al. (1973),
Heydecker and Coolbear (1977) also reported that the
preconditioning of cucumber seeds improve seedling
establishment. The reason for the better seedling
establishment may be the seeds preconditioning coupled with
the sowing of germinated seeds and rejecting the non-
germinated seeds. For the second case, direct sowing of seeds
in the field, there was no scope for rejecting the non-viable
and damaged seeds, which ultimately given uneven
germination leading to uneven crop stand.

Yield:
Seed preconditioning and sowing of germinated seeds
positively reflected on fruit yield (Table 2 and 3). Highest
yield (5.55 q/500 m²) was reported for the Local cultivar-2 for

Table 1: ANOVA for the effect of innovative treatment on seed germination, seedling establishment and yield

<table>
<thead>
<tr>
<th>Source</th>
<th>d.f.</th>
<th>Seed germination (%)</th>
<th>Seedling establishment (%)</th>
<th>Yield (kg/500 m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>47</td>
<td>8.1000</td>
<td>8.8640</td>
<td>2447.4463</td>
</tr>
<tr>
<td>Replication</td>
<td>7</td>
<td>1.6941</td>
<td>0.4720</td>
<td>149.258</td>
</tr>
<tr>
<td>Treatment</td>
<td>5</td>
<td>68.4223**</td>
<td>79.4980**</td>
<td>21963.621**</td>
</tr>
<tr>
<td>Error</td>
<td>35</td>
<td>0.7638</td>
<td>0.3175</td>
<td>119.059</td>
</tr>
<tr>
<td>Variety (V)</td>
<td>2</td>
<td>12.8213**</td>
<td>25.6984**</td>
<td>7345.395**</td>
</tr>
<tr>
<td>Treatment (T)</td>
<td>1</td>
<td>307.7494**</td>
<td>322.9218**</td>
<td>93545.021**</td>
</tr>
<tr>
<td>VT</td>
<td>2</td>
<td>4.3599**</td>
<td>11.5857**</td>
<td>791.146**</td>
</tr>
<tr>
<td>Error</td>
<td>35</td>
<td>0.7638</td>
<td>0.3175</td>
<td>119.059</td>
</tr>
</tbody>
</table>

Table 2: Effect of innovative treatment on seed germination, seedling establishment and yield

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Treatments</th>
<th>Characters*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Seed germination (%)</td>
<td>Seedling establishment (%)</td>
</tr>
<tr>
<td>Mailani (hybrid)</td>
<td>Common practice</td>
<td>93.07 d</td>
</tr>
<tr>
<td></td>
<td>Innovative practice</td>
<td>99.24 a</td>
</tr>
<tr>
<td>Local cultivar-1</td>
<td>Common practice</td>
<td>94.77 c</td>
</tr>
<tr>
<td></td>
<td>Innovative practice</td>
<td>99.71 a</td>
</tr>
<tr>
<td>Local cultivar-2</td>
<td>Common practice</td>
<td>95.88 b</td>
</tr>
<tr>
<td></td>
<td>Innovative practice</td>
<td>99.97 a</td>
</tr>
</tbody>
</table>

*Values bearing same letter in the column are not significantly different at P=0.05 of LSD

Table 3: Mean values of effects of varieties and treatments

<table>
<thead>
<tr>
<th>Treatments/ Varieties</th>
<th>Characters*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Seed germination (%)</td>
</tr>
<tr>
<td>Treatments</td>
<td></td>
</tr>
<tr>
<td>Common practice</td>
<td>94.58 b</td>
</tr>
<tr>
<td>Innovative practice</td>
<td>99.64 a</td>
</tr>
<tr>
<td>Varieties</td>
<td></td>
</tr>
<tr>
<td>Mailani (hybrid)</td>
<td>95.63 b</td>
</tr>
<tr>
<td>Local cultivar-1</td>
<td>97.88 a</td>
</tr>
<tr>
<td>Local cultivar-2</td>
<td>97.77 a</td>
</tr>
</tbody>
</table>

*Values bearing same letter in the column are not significantly different at P=0.05 of LSD
its even germination and quick seedling establishment. Another reason for higher in Local cultivars was the longer fruiting duration as compared to the hybrid variety- Mailani.

Finally it can be concluded that the farmers’ innovative technique of seed preconditioning and sowing of germinated seeds of cucumber enhance seed germination, seedling establishment leading in enhancement of yield (Table 3). Thus, the farmers of this region are suggested to go for preconditioning of cucumber seeds and sowing of germinated seeds as described in Materials and Methods section of this article for yield enhancement.

REFERENCES


