International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 12, Issue 8, 2020, pp.-9775-9777.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

# ENHANCING BRINJAL SEED GERMINATION USING BIOPRIMING SEED TREATMENT

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Received: April 10, 2020; Revised: April 26, 2020; Accepted: April 28, 2020; Published: April 30, 2020

**Abstract:** The brinjal seeds were bio primed with liquid biocontrol agent *Psuedomonas fluorescens* in five different concentrations *viz*., 5, 10, 15, 20 and 25% by adopting seed to solution ratio of 1;1 by volume by volume basis for 6 h (already standardised) and evaluated for seed and seedling quality characters along with hydroprimed and nonprimed seed. The results revealed that, seeds bioprimed with *P. fluorescens* at 15% concentration for 6h increased the speed of germination by 12.8 percent, germination by 10 percent, root length by 11.1 percent and shoot length by 29.4 percent over nonprimed seeds. The percent increase over nonprimed seed for the drymatter production and vigour index was 15.1 and 30.3 percent, respectively.

**Keywords:** *Brinjal seeds, Bio priming, Pseudomonas fluorescens, Germination and vigour index*

**Citation:** Jeyavelan M., *et al*., (2020) Enhancing Brinjal Seed Germination Using Biopriming Seed Treatment. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 12, Issue 8, pp.- 9775-9777.



**Academic Editor / Reviewer:** Dr Prabhu Narayan Meena, Dr Pratibha Gupta

## Introduction

Seed is the basic input in agriculture. Good quality seeds will help in obtaining higher yields. Quality seeds are capable of catalyzing the potential of all other inputs in the agriculture. Unless the usage of good quality seeds investing on all other inputs like fertilizer, water and pesticides will not be beneficial to the farmer. Therefore, it is necessary to make the availability of good quality seeds to farmers in order to improve the productivity. Availability of quality seed to the farmer at an affordable price and in time is considered crucial for enhancing and sustaining the agricultural productivity.

In the view to supply higher quality seeds to farmer's, researchers have developed new technologies called seed quality enhancement techniques like seed priming. Seed priming is a simple process in which it is a cost-effective technique to improve germination behavior of seeds, promote faster germination and uniformity in germination. Biological seed treatments may provide an alternative to chemical control. The biological seed treatment that refers combination of seed hydration (Physiological aspect of disease control) and inoculation (Biological aspect of disease control) of seed with beneficial organism to protect seed is referred as bio priming. It improved the germination rate and uniformity and reduced the emergence time of many vegetables and some field crops [1-10]. There has been considerable interest in the application of beneficial microorganisms to seeds over the last 15 years including bacteria and fungi that promote plant growth as well as biological disease-causing agents [11-13]. The majority of the studies have largely taken the form of direct application or coating of bacteria and fungi on to seeds as cells, spores or biomass, often in some type of formulation or in combination with a pesticide, following which the seed have been either used immediately or after a drying back period. An alternative approach is the application of beneficial microorganisms to seeds through priming that alters imbibition rate. Because of the environmental conditions developed during priming, the potential for microbial proliferation on the seeds exists and several studies have demonstrated the ability of applied microorganisms to establish on seeds during different priming or pre germination processes.

In any seed treatment, optimum dose (concentration) of seed treating agent is very important in addition to duration of treatment and seed to solution ratio in case liquid form of seed treatment. In view of the above facts, a study was designed to standardise the optimum dose of liquid formulation of bio control agent namely, *Pseudomonas fluorescens* for brinjal to enhance the initial seed quality characters.

## Material and Methods

Genetically pure seeds of brinjal (*Solanum melongena* L.) cv. CO 2 obtained from the Department of Vegetable crops, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore formed the base material for this study. The liquid biocontrol agent *Pseudomonas fluorescens* obtained from the Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore were used for this study. The laboratory experiments were carried out at the Department of Seed Science and Technology, Tamil Nadu Agricultural University, Coimbatore. The brinjal cv. CO 2 seeds were bioprimed with liquid *P. fluorescens* in different concentrations *viz*., 5, 10, 15, 20 and 25 % to standardize the optimum concentration by adopting seed to solution ratio of 1:1 as volume by volume basis for 6h (already standardised), for hydropriming simple water was used for soaking. The nonprimed seeds formed the control. After priming, the seeds were shade dried at room temperature to bring back to the original moisture content and evaluated for the following physiological seed quality parameters.

### Speed of germination

Four replicates of hundred seeds each were used to test the speed of germination from different treatments. The seeds showing radicle protrusion were counted every day from second day after sowing until 14 days. Every day the number of seeds germinated was counted, by using the following formula the speed of germination was calculated. The results were expressed in numbers [14].

Seeds of Germination = $X/Y + X_2\text{-}X_1/Y_2 + \ldots\ldots + X_n\text{-}X_{n-1}/Y_n$

$X_1$- Number of seeds germinated at first count

Table-1 *Standardization of biopriming agent and its concentration on seed quality parameters in brinjal*

| Treatments | Parameters | | | | | |
|---|---|---|---|---|---|---|
| | Speed of germination | Germination (%) | Root length (cm) | Shoot length (cm) | Dry matter production (mg seedlings $^{-10}$) | Vigour index |
| Nonprimed seed | 7.0 | 82 (64.90) | 7.2 | 3.4 | 1.12 | 869 |
| Hydropriming for 6h | 7.4 | 86 (68.03) | 7.4 | 3.6 | 1.18 | 946 |
| *P. fluorescens* at 5% for 6h | 7.5 | 86 (68.03) | 7.1 | 4.1 | 1.23 | 980 |
| *P. fluorescens* at 10% for 6h | 7.7 | 88 (69.73) | 7.7 | 4.2 | 1.25 | 1065 |
| *P. fluorescens* at 15% for 6h | 7.9 | 92 (73.57) | 8.0 | 4.4 | 1.29 | 1132 |
| *P. fluorescens* at 20% for 6h | 7.3 | 85 (67.21) | 7.5 | 4.0 | 1.22 | 978 |
| *P. fluorescens* at 25% for 6h | 7.4 | 86 (68.03) | 7.7 | 3.8 | 1.24 | 989 |
| Mean | 7.5 | 86 (68.03) | 7.5 | 4.0 | 1.22 | 994 |
| SEd | 0.13 | 1.07 | 0.11 | 0.06 | 0.01 | 15.65 |
| CD (P = 0.05) | 0.27 | 2.25 | 0.23 | 0.14 | 0.03 | 32.88 |

*(Figures in parentheses indicates arcsine values)*

$X_2$- Number of seeds germinated at second count
$X_n$- Number of seeds germinated on nth count
$Y_1$- Number of days from sowing to first count
$Y_2$- Number of days from sowing to second count
$Y_n$- Number of days from sowing to nth count

**Germination (%)**
Four replicates of 100 seeds each were germinated by using paper (Between paper) medium under the test conditions of 25±2°C temperature and 90±3% RH maintained in a germination room illuminated with fluorescent light. After the test period of 14 days the number of normal seedlings in each replication was counted and expressed in percentage [15].

**Root length (cm)**
From the randomly selected ten normal seedlings at the time of germination count from each replication the root length of seedlings was measured from the point of attachment of seed to the tip of primary root. The calculated mean values were expressed in centimetre.

**Shoot length (cm)**
The seedlings used for measuring root length were also used for measuring shoot length. The shoot length was measured from the point of attachment of seed to tip of the leaf and the mean values were expressed in centimetre.

**Drymatter production (mg seedlings -10)**
Ten normal seedlings from the germination test were selected at random, dried in shade for 24h and then, in a hot air oven maintained at 850C for 48 h and allowed to cool in a desiccator for 30 minutes. The dried seedlings were weighed in an electronic digital balance and the mean values were expressed in mg per 10 seedlings [16].

**Vigour index**
Vigour index value was computed using the following formula and the mean values were expressed in whole number [17].
Vigour index = Germination (%) x Seedling length (cm)

**Statistical Analysis**
The data obtained from various experiments were analysed for the 'F' test of significance [18]. The percent values were transformed to angular (Arc-sine) values before analysis wherever necessary. The critical difference (CD) was calculated at 5 percent (P = 0.05) probability level and wherever 'F' value is non-significant it is denoted by 'NS'.

**Results and Discussion**
Statistically significant differences were observed in speed of germination, germination percentages, root and shoot lengths, drymatter production and vigour index [Table-1]. The seeds bioprimed with *P. fluorescens* at 15% for 6h recorded significantly the highest speed of emergence (7.9) followed by seeds bioprimed with *P. fluorescens* at 10% (7.7) which was on par with each other. The nonprimed seed recorded the lowest value of 7.0. For germination percent, seeds bioprimed with *P. fluorescens* at 15% recorded the highest germination (92%) followed by the seeds bioprimed with *P. fluorescens* at 10% (88%) and *P. fluorescens* at 5% (86%) compared to nonprimed seed (82%). The improvement in germination noticed with optimum dose was 10 percent higher than nonprimed seed and 6 percent over hydroprimed seed. The seeds of tomato, chilli, and brinjal bioprimed with *P. fluorescens* performed better in terms of their germination percentages compared to seeds treated with *T. viride* or *T. harzianum* [19].
Brinjal seeds bioprimed with *P. fluorescens* at 15% recorded significantly the highest mean root length of 8.0 cm. The lowest values of 7.2 and 7.4 were recorded for nonprimed and hydroprimed seeds. The root length recorded 11.1 and 8.1 percent increase over nonprimed and hydroprimed seeds, respectively. Shoot length was more (4.4 cm) in seeds bioprimed with *P. fluorescens* at 15%. The improvement in shoot length noticed for the optimum dosage was 29.4 and 22.2 percent over nonprimed and hydroprimed seeds.

The enhancement in the seedling growth noticed in this study could be attributed to the production of plant growth regulators such as gibberellins, cytokinins and indole acetic acid; increased availability of minerals and other ions; and more water uptake [20]. Early seedling emergence as a result of an enhanced rate of germination following bio-priming for 12 h with 60% (w/v) *P. fluorescens* agreed with the findings of [21], who reported that germination was advanced by 2.0 to 2.5 days when tomato seeds were bioprimed with *P. fluorescens*. The improvement in seed germination and seedling vigour parameters under laboratory conditions due to seed biopriming with liquid *P. fluorescens* might be due to the production of growth promoting substances produced by the fungal colonies.
Influence of biocontrol agent *P. fluorescens* on seedling length and vigour
T1 - Nonprimed seed
T2 - Hydropriming for 6 h
T3 – Biopriming with *P. fluorescens* at 5% for 6 h
T4 - Biopriming with *P. fluorescens* at 10% for 6 h
T5 - Biopriming with *P. fluorescens* at 15% for 6 h
T6 - Biopriming with *P. fluorescens* at 20% for 6 h
T7 - Biopriming with *P. fluorescens* at 25% for 6 h
A significant increase in the drymatter production was registered in seeds bioprimed with *P. fluorescens* 15% (1.29 mg) as against nonprimed seed (1.12 mg). The computed vigour index values were significant among various treatments. Where, the seeds bioprimed with
*P. fluorescens* at 15% has recorded the highest vigour index value of 1132 followed by the seeds bioprimed with 10% (1065) and remained significantly superior to all other treatments. The improvement in seedling vigour in respect to *P. fluorescens* at 15% was 30.3 and 19.7 percent over nonprimed and hydroprimed seeds, respectively (Table 1). The effectiveness of biopriming *with P. fluorescens* was also evident in improvement of seed germination and seedling vigour in maize [2], pearl millet [22], sorghum [23] and rice [24,4]. Similar improvement in seed quality characters was in brinjal [8] (*P. fluorescens* at 40% for 6h as powder formulation), bhendi [6] (*P. fluorescens* at 60% for 12h) and in chilli [25] (*P. fluorescens* 60% for 12h).

The improvement in seed quality characters by biocontrol agents in the present study is in accordance with [26] and reported that auxin, gibberellin and cytokinin are synthesised and produced when the seeds are inoculated with biocontrol agent. Tien *et al.* (1979), Cacciari *et al*. (1989) and Tiwary *et al*. (1998) the production of gibberellins and cytokinins on seed treatment with biocontrol agent was clearly established [27-29].

**Conclusion**

Brinjal seeds bio primed with liquid form of *Pseudomonas fluorescens* at 15% by adopting the seed to solution ratio of 1:1 for 6h enhanced the seed and seedling quality characters.

**Application of research:** Bio priming is a pre sowing seed treatment to enhance the seed quality using bio control agent which is very important in addition to duration of treatment and seed to solution ratio in case liquid form of seed treatment.

**Research Category:** Bio priming

**Acknowledgement / Funding:** Authors are thankful to Tamil Nadu Agricultural University, Coimbatore, 641003, Tamil Nadu, India

**** Research Guide or Chairperson of research: Dr K. Malarkodi**
University: Tamil Nadu Agricultural University, Coimbatore, 641003, India
Research project name or number: MSc Thesis

**Author Contributions:** All authors equally contributed

**Author statement:** All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

**Study area / Sample Collection:** Seed Science and Technology

**Cultivar / Variety / Breed name:** CO 2

**Conflict of Interest:** None declared

**Ethical approval:** This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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