Int.J.Curr.Microbiol.App.Sci (2017) *6*(12): 85-90

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 6 Number 12 (2017) pp. 85-90**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2017.612.011

Effect of Bio-Priming on Seed Yield and Quality in Pumpkin cv. CO2

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Keywords

Biopriming, Seed Yield characters, Seed quality characters, Pumpkin.

Article Info

Accepted:
04 October 2017
Available Online:
10 December 2017

A B S T R A C T

Vegetables form an important constituent in Indian diet and play a vital role in human nutrition. The experiment was carried out under field condition to study the effect of seed biopriming with various biopriming agents (*Azospirillum*, Phosphobacteria, *Pseudomonas fluorescens*) on yield and yield components of pumpkin cv. CO2. Under laboratory condition it was found that, the best biopriming treatments were non primed seed, hydropriming, biopriming with *Phosphobacteria* 20 % + *Pseudomonas fluorescens* 20 %, biopriming with *Azospirillum* 10 % + Phosphobacteria 20 % + *Pseudomonas fluorescens* 20 %. The performance and productivity of bioprimed seeds under field conditions brought out the positive influence of seeds bioprimed with *Azospirillum* 10 % + Phosphobacteria 20 % + *Pseudomonas fluorescens* 20 % for 12 hr maximizing the plant growth and development, seed yield and quality of resultant seed. The seed yield for this treatment was 304 kg ha^{-1} which accounted for 21 per cent increase over the non-primed seed.

Introduction

Pumpkin *(Cucurbita moschata)* is a gourd-like squash of the genus *Cucurbita* and the family Cucurbitaceae and is native to North America. Pumpkin is one of the widely grown vegetables rich in vital antioxidants, vitamin A, flavonoids, poly-phenolics, antioxidants and terpenoids such as leutin, xanthin and carotenes in abundance.

An improved diet is supposed to have 300 g of vegetables per day per capita, but the average per capita vegetable consumption is reported to be only 120 g in India. The main reason attributed for this is non-availability of adequate quantity of quality seeds. Since, a successful vegetable production is very dependent upon a sustainable supply of quality seeds. Pumpkins are monoecious having both male and female flowers on the same plant. The female flower is distinguished by the small ovary at the base of the petals.

The color of pumpkin is derived from the orange pigments abundant in them. The main nutrients are leutin and both alpha and beta carotene, the latter of which generates vitamin A in the body. Pumpkins are grown all around the world for a variety of reasons ranging from agricultural purposes to commercial and ornamental sales.

The biggest international producers of pumpkins include the United States, Canada,

Mexico, India and China. In India, it is grown mainly in Assam, West Bengal, Tamil Nadu, Karnataka, Madhya Pradesh, Uttar Pradesh, Orissa and Bihar. Many researchers have developed new technologies called "Seed Enhancement Techniques" for improving the quality of seeds before sowing.

Seed priming is the soaking of seeds in a solution of any priming agent followed by drying of seeds that initiates seed germination related process without radical emergence (McDonald, 1999). Various seed priming techniques have been developed including hydro, halo, osmo, thermo, solid matrix and biopriming (Ashraf and Foolad, 2005).

The beneficial effects of priming have been demonstrated for many field and horticultural crops such as barley (Abdulrahmani *et al.*, 2007), maize (Parera and Cantliffe, 1994a), lentil (Ghassemi-Golezani *et al.*, 2008a), chickpea (Ghassemi-Golezani *et al.*, 2008b), sugar beet (Sadeghian and Yavari, 2004) and sunflower (Singh, 1995).

Materials and Methods

The experiment was laid out in Agricultural Research Station at Bhavanisagar in Randomized Block Design with four treatment combinations replicated five. The size of plot was 4 x 10 m^2 (40 m^2) with a spacing of 2 x 2 m with a pit size of 30 x 30 x 30 cm. Observations on growth and yield characters were recorded at harvest. Experimental details are as follows:

Treatment details

T_0 - Nonprimed seed

T_1 - Hydropriming for 12 h

T_2 - Biopriming with Phosphobacteria 20 % +*Pseudomonas fluorescens* 20 % for 12 h

T_3 - Biopriming with *Azospirillum* 10 % + Phosphobacteria 20% + *Pseudomonas fluorescens* 20 % for 12 h.

Seed yield characters

Number of fruits plant^{-1}

The number of fruits harvested from randomly selected ten plants were counted and recorded and the mean values were expressed in whole number.

Weight of fruit plant^{-1}

The fruits harvested from each plant were weighed separately and the mean values were expressed in gram.

Number of seeds fruit^{-1}

Ten fruits were randomly selected from each treatment replication wise from pickings and the seeds were extracted from individual fruits and counted separately.

The mean values were expressed in number.

Seed weight fruit^{-1}

The fruits harvested from each treatment after extraction were weighed separately and the mean value was expressed in kg fruit^{-1}.

Fruit to seed recovery

The fruits harvested from each treatment were weighed and the seeds extracted were weighed separately.

The fruit to seed recovery was worked out as follows and expressed as per cent.

$$\text{Fruit to seed recovery (\%)} = \frac{\text{Dry weight of the seeds}}{\text{Weight of the fruits}} \times 100$$

Seed yield plot^{-1}

The seeds obtained from all the fruits harvested from the plot were extracted cleaned, weighed and the mean value was worked out.

Then the seed yield plot^{-1} was worked out based on the number of plants plot^{-1} and expressed as kg plot^{-1}.

Seed yield ha^{-1}

Seed yield ha^{-1} was arrived by computation using seed yield per plot and expressed in kg ha^{-1}.

Seed quality characters

Seed recovery

The resultant bulk seeds from each treatment were size graded using BSS 4 wire mesh sieve or 16/64″ round perforated metal sieve.

The seeds retained on each sieve were weighed individually and seed recovery was calculated using the following formula and mean was expressed as seed recovery in per cent.

$$\text{Seed recovery (\%)} = \frac{\text{Weight of the seeds retained on sieve}}{\text{Total weight of the seed}} \times 100$$

The seed retained by BSS 4 x 4 wire mesh sieve was selected for assessing the following seed quality.

Hundred seed weight

One hundred seeds were taken from the seeds retained by BSS 4 x 4 sieve from each treatment, replication wise, weighed and the mean was expressed as 100 seed weight in gram.

Results and Discussion

One of the most important problems facing the farmers in developing countries is the heterogeneity and lack of suitable conditions in soil that causes decreasing in germination percentage, unbalanced seedling growth for environmental conditions such as light, nutrient and water. Hence, the present experiment was initiated to study the effect of seed biopriming with various biopriming agents (*Azospirillum,* Phosphobacteria, *Pseudomonas fluorescens*), on yield and yield components of pumpkin cv.CO 2.

The yield attributing parameters *viz.,* number of fruit plant^{-1} and weight of fruit plant^{-1}, number of seeds fruit^{-1} and weight of seeds fruit^{-1} were higher when seeds were bioprimed with *Azospirillum* 10 % + Phosphobacteria 20 % + *Pseudomonas fluorescens* 20 % for 12 h (Table 1).

This accounted for 40, 57, 23 and 36 per cent increase over the nonprimed seed, respectively.

Fruit to seed recovery, seed yield plot^{-1}, seed yield ha^{-1} (Fig. 1), seed recovery and 100 seed weight were also higher in T4 treatment and the per cent increases over nonprimed seed were 22, 20, 21, 10 and 15 per cent, respectively.

Similar results were reported for many crops where seed treatments with *Pseudomonas fluorescens* have increased growth parameters like height, leaf area, fruit length, girth, circumference and 100 seed weight (Suslow and Schroth, 1982; Schippers *et al.,* 1987; Wei *et al.,* 1996; Umesha *et al.,* 1998; Lazarovits and Nowak, 1997; Barka *et al.*, 2000; Niranjan Raj *et al.,* 2003a). Similarly, Aamir *et al.*, (2013) showed that number of pods and yield were higher in mung bean treated with rhizobium and PGPR.

Fig.1 Effect of biopriming on seed yield of pumpkin seeds

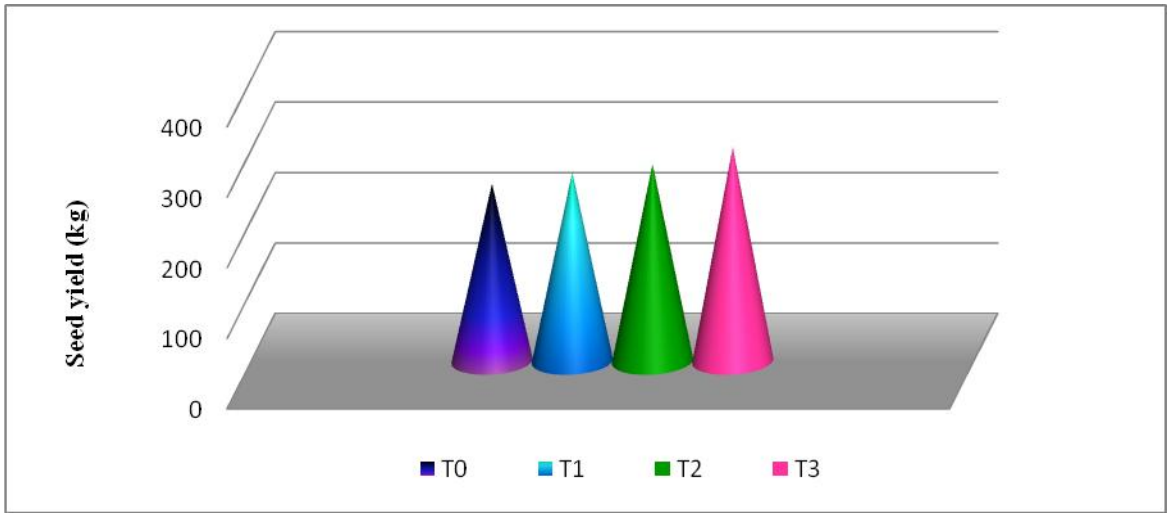

Table.1 Effect of seed biopriming on yield and yield attributing characters of pumpkin cv. CO2

Biopriming treatments (T)	No of fruit plant^{-1}	Weight of fruit plant^{-1} (kg)	No of seeds fruit^{-1}	Seeds weight fruit^{-1} (g)	Fruits to seed recovery (%)	Seed yield plot^{-1} (kg)	Seed yield ha^{-1} (kg)	Seed recovery (%)	100 seed weight (g)
T_0	4.0	7.7	102.9	10.8	0.64	1.01	252	68	10.9
T_1	4.5	9.0	113.5	12.6	0.70	1.07	268	70	11.8
T_2	5.3	10.4	119.5	14.3	0.75	1.12	280	75	12.0
T_3	5.6	12.1	126.5	14.7	0.78	1.21	304	78	12.5
Mean	**4.9**	**9.8**	**115.6**	**13.1**	**0.72**	**1.10**	**276**	**72.8**	**11.8**
SEd	0.07	0.09	1.47	0.14	0.01	0.03	6.86	0.52	0.09
CD (P=0.05)	0.17	0.21	3.21	0.32	0.02	0.06	14.95	1.14	0.19

It is also evident for this study that seed biopriming with *Azospirillum* 10 % + Phosphobacteria 20 % + *Pseudomonas fluorescens* 20 % for 12 h had given results, both by promoting the germination and increasing the yield and quality of pumpkin. Similar effectiveness of combined inoculation of *Rhizobium* and Phosphobacteria (*Bacillus megaterium* and *Pseudomonas striata*) in red gram, black gram, green gram and Bengal gram increased the grain yield. Similarly, Baser-Kouchebagh *et al.*, (2013) showed that biopriming with *Azospirillum*, *Azotobacter*, *Pseudomonas*, increase the crop growth rate, yield and quality on medicinal plants. Sakthivel *et al.*, (2009) reported that the combined treatment (*Pseudomonas* + *Azotobacter* + *Azospirillum*) have higher fruit yield in tomato variety PKM-1.

Gravel *et al.*, (2007) reported the capacity of two microorganisms, *Pseudomonas putida* subgroup B strain1 and *Trichoderma atroviride*, to promote the reproductive growth of tomato plants under typical hydroponic growing conditions. The plant growth stimulation is, most likely, the synergic result of numerous modes of action exhibited by each microorganism tested, including a regulation in the concentration of

IAA in the rhizosphere and a regulation of the concentration of ethylene within the roots. They showed that *Pseudomonas putida* subgroup B strain1 and *Trichoderma atroviride* could be used as plant growth-promoting microorganisms to improve the productivity of greenhouse tomato crops under hydroponic conditions in inert or organic media.

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How to cite this article:

Sivakalai, R. and Krishnaveni, K. 2017. Effect of Bio-Priming on Seed Yield and Quality in Pumpkin cv. CO2. *Int.J.Curr.Microbiol.App.Sci.* 6(12): 85-90.
doi: https://doi.org/10.20546/ijcmas.2017.612.011