Effect of GA$_3$ and growing media on seed germination of papaya (Carica papaya L.) cv. Pusa Nanha

Ramesh Chand Choudhary, Jyoti Kanwar, Hitesh Agarwal, Om Prakash Kumawat and Jitendra Bhandari

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Abstract

The present study was carried out to investigate “Effect of GA$_3$ and growing media on seed germination of papaya (Carica papaya L.) cv. Pusa Nanha”. The study revealed that the treatments comprised combinations of soil, FYM, and vermicompost with varying levels of GA$_3$. The result indicated that GA$_3$ 200 ppm is found to be the most effective for better germination of papaya seedlings. Among different growing media the treatment soil + FYM + vermicompost (1:1:1) was recorded higher values of germination parameters that are germination percentage, germination period, seed vigour (%), and germination index. The treatment combination of GA$_3$ 200 ppm and growing media of soil: FYM: vermicompost (1:1:1) was found most suitable for growing of papaya nursery.

Keywords: Cucumber, boron, yield, quality, konkan

Introduction

Papaya is botanically known as Carica papaya L. and belongs to the family Caricaceae, is originated from tropical America (Hafmer, 1990) and introduced in India during 16th century from Malacca (Kumar and Abraham, 1983). Papaya occupies 2.0 percent of total fruit crops area and 5.3 percent of total fruit production in India. It occupies a cultivated area of 126.0 thousand ha with an annual production of 5508.0 thousand MT with average productivity of 43.7 MT/ha (Anonymous, 2016). Papaya is generally propagated by seed (Cheema and Dhan, 1930) and it is interested by the researchers due to the presence of gelatinous sarcotesta preventing germination and dormancy (Lange, 1961). Gibberellins act in the mobilization of seed reserves during the germination process. Therefore, GA$_3$ considered as an important germination promoters which increased the seed germination of papaya (Zanotti and Barros, 2014). Growing media plays an important role in seed germination and subsequent vegetative growth of seedlings (Srivastava et al., 1998). Media not only acts as a growing place but also as a source of nutrient for plant growth. The soil is usually used as a basic medium because it is cheapest and easy to procure (Bhardwaj, 2013). Vermicompost provides sufficient levels of oxygen to roots, adequate storage of water and nutrient for the plants. FYM is having good water holding capacity as well as sufficient porosity.

Material and methods

The present investigation was carried out at Shade net house, Department of Fruit Science, K.N.K. College of Horticulture, Mandsaur (M.P.), Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior (M.P.) during the year 2016-2017. The experiment was laid out in Factorial Complete Randomized Block Design. The experiment comprised of sixteen treatments with combination of GA$_3$ and growing media. Gibberellic acid (GA$_3$) presoaking for 12 hours with three concentrations i.e. GA$_3$ 100 ppm, 150 ppm, 200 ppm and Control as water soaking of seeds and different growing media used in different ratio i.e. Soil as control, Soil: FYM (1:1), Soil: Vermicompost (1:1) and Soil: FYM: Vermicompost (1:1:1).

Keywords: Cucumber, boron, yield, quality, konkan
Results and Discussion

Effect of GA3

The results (Table 1) revealed that the maximum (78.33 %) seed germination was observed in treatment G_A3 200 ppm as compare to untreated seeds (55.00 %). The shortest germination period (10.75 days) was observed in treatment G_A3 200 ppm where as longest germination period (15.58 days) was found in untreated seeds. Similarly, the highest seed vigour (84.17 %) was observed in treatment G_A3 200 ppm as compare to untreated seeds (67.17 %). The promising effect of GA3 as pre-sowing treatment to the seeds replaced the dormancy mechanism of the seeds resulting in early germination (Khan, 1981) [11]. Gibberellic acid acts on the embryo and causes synthesis of hydrolyzing enzymes particularly α-amylase and protease and this hydrolyzed food is utilized for growth of embryo and thereby germination enhanced (Paleg, 1965) [15] and reduced number of days until germination (Nagano et al., 2010) [13]. Similar results were reported by Dhankhar et al. (1997) [9] in aonla; Bherce et al. (2010) and Babu et al. (2010) [4, 3] in papaya. The result of germination index was observed non-significant.

Growing media

Among different media significantly treatment M1 (Soil + FYM + vermicompost (1:1:1)) had maximum germination percentage (72.08 %) followed by M2 (Soil + vermicompost (1:1)) (69.17 %) and minimum (57.92 %) in M0 (Soil). The shortest germination period (11.50 days) was observed in treatment M1 (Soil + Vermicompost + FYM (1:1:1)) and longest germination period (13.75 days) found in M0 (control). Similarly, highest seed vigour (78.50 %) was recorded in treatment M1 (Soil + Vermicompost + FYM (1:1:1)) and lowest (68.00 %) in M0 (control). The promising effect of M1 on seed germination might be due to its appropriate cation exchange capacity for retention of nutrients and having the properties of good water holding capacity as well as sufficient porous, so that permitting adequate moisture and exchange of gasses between the germination growth media and the embryo, that is essential for rapid and uniform germination of seeds Narayan et al. (2008) and Bihari et al. (2009) [14, 6] reported in Aonla, Parasana et al. (2013) [16] in mango. The effect of media on germination index was recorded non-significant.

Interaction effect

Interaction effect of G1M1 (Soil + Vermicompost + FYM (1:1:1) + GA3 – 200 ppm) recorded highest seed vigour (86.67 %) followed by G1M2 (85.00 %), G1M1 (83.33 %) and G1M0 (81.67 %). Lowest seed vigour (53.33 %) was recorded in G1M0. The promising effect of GA3 on seed germination might be due to its participation in the activity of alpha-amylase, which catalyzes the starch conversion in to simple carbohydrates and chemical energy is liberated which is used in the activation of embryo resulting effective germination (Anjanawe et al., 2013) [1]. The growing media also increase beneficial effect of all components in improving physical, biological and chemical properties of media as soil provides natural support, FYM provides proper aeration, vermicompost gives warm condition and high water holding capacity while FYM as organic manure provided better nutrition to the germinating of seedlings (Hartmann and Kester, 1997). Further the vermicompost also provides a uniform physical structure which ensures close contact between seed and media, increases steady moisture supply, facilitates root respiration and encourages overall plant growth. It exhibits a beneficial effect on soil health and all these attributes might enhance the seed germination and seedling growth of moringa at the initial stage (Chatterjee and Choudhari, 2007) [7]. However, the other observation parameters like germination percentage, germination period and germination index affected non-significantly by interaction of GA3 and growing media.

Table 1.

| Treatment | Treatment details | Germination percentage (%) | Germination period(days) | Seed vigour (%) | Germination index |
|-----------|-------------------|----------------------------|--------------------------|----------------|------------------|
| G0        | Untreated seed    | 55.00 (47.91)              | 15.58                    | 67.17 (55.25)  | 1.17             |
| G1        | GA3– 100ppm       | 65.00 (49.33)              | 12.67                    | 68.73 (54.49)  | 1.19             |
| G2        | GA3– 150ppm       | 71.25 (57.64)              | 11.75                    | 73.67 (59.15)  | 1.22             |
| G3        | GA3– 200ppm       | 78.33 (63.02)              | 10.75                    | 84.17 (66.70)  | 1.34             |
| SE(m)     |                   | 1.82                       | 0.30                     | 1.26           | 0.07             |
| C.D. at 5%|                   |                            |                          |                |                  |
| M0        | Soil              | 57.92 (49.64)              | 13.75                    | 68.00 (55.85)  | 1.14             |
| M1        | Soil + FYM (1:1)  | 62.92 (52.59)              | 13.00                    | 71.83 (58.17)  | 1.18             |
| M2        | Soil + Vermicompost (1:1) | 69.17 (56.89) | 12.50 | 74.50 (59.95) | 1.29             |
| M3        | Soil + Vermicompost + FYM (1:1:1) | 72.08 (58.77) | 11.50 | 78.50 (62.63) | 1.32             |
| SE(m)     |                   | 1.82                       | 0.30                     | 1.26           | 0.07             |
| C.D. at 5%|                   |                            |                          |                |                  |
| G0M0      | Untreated seeds + Soil | 43.33 (41.14)          | 17.00                    | 53.33 (46.90)  | 1.05             |
| G0M1      | Untreated seeds + Soil + FYM (1:1:1) | 56.67 (48.83) | 15.67 | 64.67 (53.53) | 1.09             |
| G0M2      | Untreated seeds + Soil + Vermicompost (1:1) | 56.67 (48.91) | 15.33 | 72.33 (58.29) | 1.26             |
| G0M3      | Untreated seeds + Soil + Vermicompost +FYM (1:1:1) | 63.33 (52.75) | 14.33 | 78.33 (62.26) | 1.27             |
| G1M0      | GA3– 100 ppm + Soil | 53.33 (46.90)          | 14.00                    | 64.67 (53.53)  | 1.06             |
| G1M1      | GA3– 100 ppm + Soil + FYM (1:1:1) | 56.67 (48.83) | 13.00 | 67.00 (54.92) | 1.17             |
| G1M2      | GA– 100 ppm + Soil + Vermicompost (1:1) | 60.00 (50.83) | 12.67 | 67.33 (55.21) | 1.18             |
| G1M3      | GA– 100 ppm + Soil + Vermicompost +FYM (1:1:1) | 60.00 (50.75) | 11.00 | 72.33 (58.29) | 1.34             |
| G2M0      | GA– 150 ppm + Soil | 66.67 (54.76)          | 12.67                    | 72.33 (58.29)  | 1.16             |

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| Treatment                  | Germination (%) | Rooting (%) | O.R. (%) | C.D. @ 5%  |
|----------------------------|-----------------|-------------|----------|------------|
| G2M1 GA 150 ppm + Soil + FYM (1:1) | 70.00 (56.77)   | 12.33       | 72.33 (58.29) | 1.17       |
| G2M2 GA 150 ppm + Soil + Vermicompost (1:1) | 73.33 (58.98)   | 11.33       | 73.33 (58.91) | 1.33       |
| G2M3 GA 150 ppm + Soil + Vermicompost + FYM (1:1:1) | 75.00 (60.05)   | 10.67       | 76.67 (61.12) | 1.22       |
| G3M0 GA 200 ppm + Soil | 68.33 (55.75)   | 11.33       | 81.67 (64.67) | 1.29       |
| G3M1 GA 200 ppm + Soil + FYM (1:1) | 68.33 (55.95)   | 11.00       | 83.33 (65.93) | 1.28       |
| G3M2 GA 200 ppm + Soil + Vermicompost (1:1) | 86.67 (68.83)   | 10.67       | 85.00 (67.38) | 1.37       |
| G3M3 GA 200 ppm + Soil + Vermicompost + FYM (1:1:1) | 90.00 (71.54)   | 10.00       | 86.67 (68.83) | 1.43       |
| SE(m)                      | 3.65            | 0.61        | 2.53     | 0.15       |

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