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A review on influence of seed pre treatment on germination parameters of papaya (*Carica papaya* L.)

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Abstract
Papaya is a trendy fruit and it is famous for nutritional and medicinal values. As compare to any other fruit crops, it comes early in bearing, produces fruits in a year and per unit area of fruit production of papaya is quite high. The major criterion for successful cultivation of papaya is quality seedlings. Commercial propagation of papaya is seed. The tissue culture technique of propagation limited to research laboratories only. The papaya seeds loose viability in a small period and therefore their seeds cannot be stored for long period. In case of seed germination, gibberellic acid play important role in m plant growth and development processes. Cow urine is a unique product of dairy which has tremendous properties such as being manure, antimicrobial, and disinfectant. Bio-fertilizers are micro-organisms that enhancing the nutrient supply to the host plant to support the growth of plants when given to seeds.

Keywords: Papaya, seed, gibberellic acid, media, cow urine, bio-fertilizers

Introduction
Papaya (*Carica papaya* L.) is a succulent fruit of a large plant belongs to the Caricaceae family. In many countries, papaya is used for breakfast fruit and also used as juices, salads, sherbets and confectionary items. Papaya is mainly propagated by seed. Papaya seeds should be collected from ripe, healthy fruits, free from pests and diseases for propagation. Sometimes, the papaya seeds failing germination because seeds lose their viability in short period. For more rapid and uniform germination removal of a mucilaginous covering from the seed coat is helpful than sarcotesta intacted seeds. For easy removal of sarcotesta, fermentation for two to three days of seeds in a bucket of water. When mixed wood ash with fermented seeds and are rubbed lightly in with gunny cloth, it easily breaks the mucilaginous covering. The seeds are then thoroughly washed with water to remove exogenous material. The seeds should be sown immediately, or they can be stored in airtight containers after shade dry.
Cow urine is considered as special and is important constituent of the mixture named as "Panchgavya". It contains many minerals and about 1.21 percent N_2, 0.01 percent P_2O_5 and 1.35 percent K_2O (Subramaniyam, 2005) [38], and also have trace elements (Munoz, 1988) [44], and growth regulators (Kamalam and Rajappan, 1989) [20].
Cocopeat is appropriate material for growing media and 25-30 percent pore space is found in cocopeat. Fine structure is required for proper growth and development of any seedlings. Furthermore, cocopeat is a prosperous nutrients source and it can be used with other growing materials for mixing.
According to Edwards (2009) [14] vermi-compost is a peat-like substance have more porosity, microbial activity, water holding capacity, good aeration and drainage which makes it an excellent conditioner of soil. Many literature reveals that vermi-compost contains growth regulators materials, such as humic acid for propagation purpose (Muscsolo *et al.*, 1999) [45], it can be mixed in appropriate quantity with soil in for growing media.
Phosphate solubilize bacteria and Nitrogen fixing bacteria (Azotobacter spp.) is identified that it produces many plant growth hormones, which often improved the root and shoot growth.
The beneficial effect of bio-fertilizers use is well established in many fruit crops like papaya (Sukhade *et al.*, 1995) [39] and banana (Gogoi *et al.*, 2004) [16]. But, very few works has done for the use of bio-fertilizers in papaya seeds.
For successful seedling production of papaya, proper germination of seed and seedling growth are most essential consideration for nursery.
As the germination rate of papaya seed is affected by different pre-sowing treatments. A wide range of pre-sowing seed treatments including the plant growth regulators i.e. gibberellic acid and growing media i.e. cocopeat are used to increase the seed germination in several fruit crops.

Influence of seed pre treatment on germination parameters

1. Influence of seed pre treatment on days taken to germination

Dhankar and Singh (1996) [13] showed, aonla seeds treated with gibberellic acid 250 ppm and thio-urea 250 ppm solution for 72 hours found significant early germination of aonla seedling under Gujarat condition.

Gholap *et al.* (2000) [15] observed that, aonla seeds of cv. Banarasi required minimum time for germination (15.33 days) when treated with GA_3 200 ppm than control under conditions of Akola.

Pampanna and Sulikeri (2000) [29] noticed that, sapota seeds taken days for germination were lowest (11.50 days) in case of GA_3 400 ppm.

Kumar *et al.* (2008) observed the treatments soaking of water (12 hrs), 1 percent potassium nitrate (10 min), 100 ppm gibberellic acid (10 min), cow urine (12 hrs), cow dung (12 hrs), Amrit pani 3 percent (3 hrs) and Panchagavya 3 percent (12 hrs) on germination of seeds. All the treatments have taken minimum days for germination significantly as compared to control.

Shinde *et al.* (2008) [35] reported that, pre-sowing seed treatments affect the germination percentage of Rangpur lime (*Citrus limonia*) seeds. They were treated with GA_3 (40, 60 and 80 ppm), KNO_3 (1.0, 1.5 and 2.0%), NAA (40, 60 and 80 ppm), different concentration of thio-urea, distilled water (control), cow dung paste and cow urine. They noticed that 80 ppm gibberellic acid showed maximum germination 93.33 percent subsequently 90.00 percent and 86.66 percent with the 80 ppm naphthalene acetic acid application and cow dung paste, correspondingly.

Karthikeyan *et al.* (2009) [21] stated that, coconut seed nut took less time for germination (92.40) in the media contains and and vermi-compost in the ratio of 3:1. Abirami *et al.* (2010) [1] reported that, nutmeg seeds were showed early germination (42.10 days) in equal ratio of soil, coir dust, sand and vermi-compost growing media under conditions of Kerala.

Babu *et al.* (2010) [4] observed that seeds of papaya treated with 100 ppm gibberellic acid have 66.17% percent germination and also taken less time for seed germination (29.73 days).

Barche *et al.* (2010) [6] reported that, papaya seeds cv. Hybrid Mayuri soaked in GA_3 500 ppm taken minimum time (15 days) for completion of germination under Madhya Pradesh conditions.

Patil *et al.* (2012) [32] reported the effect of different concentrations of gibberellic acid 50, 100 and 150 ppm, potassium nitrate 1.0, 1.5 and 2.0 percent, Napthalene acetic acid 50, 100 and 150 ppm, thio-urea 1.0, 1.5 and 2.0 percent and control (water soaked). They stated that gibberellic acid @ 150 ppm resulted minimum days (3.34 days) taken for germination under condition of laboratory when soaking of seeds for 24 hours.

Bhardwaj *et al.* (2013) [8] stated that treatment containing vermi- compost + sand + pond soil (1:1:1) with 2 cm layer of cocopeat on top of the polybags effect seed germination and seedling growth of papaya cv. Red Lady and revealed that it takes less time for imbibitions (9.37 days) and least germination period (3.22 days).

Desai *et. al.* (2017) [12] reported that gibberellic acid 150 mg per litre soaking for 12 hours, significantly taken the less days (7.55 and 9.44) for seed germination and they also recorded considerably highest germination percentage at 10 and 20 days after sowing are 77 percent and 87 percent, respectively.

2. Influence of seed pre treatment on rate of emergence

Shinde *et al.* (2008) [35] studied the effect of different concentrations of GA_3 at 40, 60 and 80 ppm, Napthalene acetic acid at 40, 60 and 80 ppm, thio-urea 1.0, 1.5 and 2.0 percent, KNO_3 1.0, 1.5 and 2.0 percent, cow dung paste and cow urine on germination of seed, germination rate and germination percentage of Rangpur lime (*Citrus limonia*). They were treated with distilled water (control), Gibberellic acid at 80 ppm given 93.33 percent maximum seed germination, subsequently 90.00 percent with the application of Napthalene acetic acid at 80 ppm and 86.66 percent with cow dung paste treatment.

Bharti *et al.* (2009) [9] observed the growing media effect on germination parameters of Aonla and stated that soil, sand and farmyard manure in the equal ratio yielded maximum seed germination percentage (74.00).

Deb *et al.* (2010) [11] revealed that treated with gibberellic acid at 100, 150 and 200 ppm, sodium thio-sulphate at 20, 25 and 30 ppm and mixtures of micronutrient affect the rate of germination of papaya seeds.

Bhardwaj *et al.* (2013) [8] observed that, germination of seed and seedling growth of papaya cv. Red Lady affected by different growing media. They revealed that the treatment containing vermi-compost + sand + pond soil at the ratio of 1:1:1 with 2 cm cocopeat layer on polybags top given maximum emergence rate (43.34).

Mandal *et al.* (2015) [25] observed different media and many growth regulators to treat papaya seeds and stated soil + coco peat + farmyard manure (2:1:1) and GA_3 (500 ppm) given maximum germination in papaya seeds.

Mamta *et al.* (2017) [24] noticed that the treatment dual inoculation with Azoto 3 and Phosphate solubling bacteria along with (75%) nitrogen, phosphorus and (100%) potassium considered most helpful, which may be useful in integrated nutrient management under Chhattisgarh agro-climatic condition in papaya.

3. Influence of seed pre treatment on germination percentage

Rao (1975) [33] observed that custard apple seeds treated with cow urine 10 percent for 24 hours given maximum germination percentage as compared to control.

Misra and Verma (1979) [26] revealed that, highest germination ercent 84.00 and 81.33 when Kinnow orange seeds were treated with GA_3 100 ppm and 50 ppm, respectively under Central Himalaya conditions.

Choudhary and Chakrawar (1981) [10] stated that, seeds of Rangpur lime treated with gibberellic acid 40 ppm for 12 hours given 73 to 100 percent germination than control (43.3%).

Srivastava (1984) [37] stated that, seeds of sapodilla treated with gibberellic acid 50 ppm had the maximum germination followed by potassium nitrate 1 percent and 0.5 percent while the seeds treated in boiling water for 1 minute did not showed any effect on germination of seed.

Hore and Sen (1985) [19] revealed that, germination percent of Bael seeds was highest 51.66, when treated with gibberellic acid (100 ppm) and superior as compare to any treatments.

Banker (1987) [5] reported that, karonda seeds affected by treatment with gibberellic acid at 100 ppm for 24 hours have

highest seed germination as compare to 25 ppm and 50 ppm of GA_3 application for 24 hours.

Begum *et al.* (1987) [7] stated that, papaya seeds treated with gibberellic acid 50 to 200 mg per liter as pre-sowing treatments increased the germination, which was higher than water soaking treatments under Pantnagar conditions.

Palanisamy *et al.* (1987) [28] evaluated germination percent of papaya seeds by two trials. In first, seeds of papaya were dried then treated with different solutions at 100 and 500 ppm gibberellic acid, 0.2% potassium nitrate, 200 ppm thio-urea). Germination percentage increased from 10 percent to 96 percent from 0 to 35 days. In second, maximum germination percent 98 was found after treatment of seeds in 100 ppm gibberellic acid for 12 hours. Their study showed that pre-soaking of fresh seeds with gibberellic acid 100 ppm was found useful for seed dormancy breaking and recorded 98 percent germination and very poor germination in untreated control 25 percent.

Kumar *et al.* (1991) [23] found that, soaking of seeds of guava with gibberellic acid 100 ppm increased seed germination up to 60 (%) in comparison to 46 (%) in untreated seeds.

Sankaranarayanan and Vijaya kumar (1994) [34] revealed that due to hard seed coat of tamarind, has poor and slow seed germination. Soaking of tamarind seeds with cow urine 10 percent for 24 hours increasees the germination (%) from 37 to 72.6 percent as compare to untreated seeds.

Ak *et al.* (1995) [2] reported the effect of gibberellic acid treatment at 0, 125, 250, 500 and 1000 ppm quantity for 24 hours or 48 hours on pistachio (*Pistachio vera*) seed germination. The highest 73.33 germination percent was found with gibberellic acid with 125 ppm quantity for 48 hours.

Dhankar and Singh (1996) [13] revealed that, maximum germination 75.98 percent in laboratory and 64.14 percent in pots was obtained, when aonla seeds of cv. Anand-2 were treated with 250 ppm gibberellic acid.

Pampanna and Sulikeri (2001) [30] found that, seeds of sapota treated with gibberellic acid + ethrel each at 400 ppm gave maximum germination 90 percent than other treatments.

Singh *et al.* (2002) [36] observed the seed soaking effects with 100 ppm gibberellic acid, 1 percent thio-urea, 1000 ppm maleic hydrazide, 1 percent potassium ortho-phosphate and ferulic acid for 12 hours on jackfruit seed germination and growth. The maximum germination 95.33 percent was found in 100 ppm gibberellic acid treatment of seeds.

Zhao Chun Xiang *et al.* (2004) [43] revealed that papaya seeds soaked with 50 mg gibberellic acid resulting in 83.70 percent germination. Handa *et al.* (2005) [18] found that, ratio of sand, soil and farmyard manure (1:1:2) considerably affect the *Albizia amara* seed germination.

Suryakantha *et al.* (2005) [40] reported that, guava seeds of cv. Taiwan and Allahabad Safeda given highest germination of 86 and 70 percent respectively, when subjected to chilling and gibberellic acid at 100 ppm under North Karnataka conditions.

Gunes and Gubbuk (2006) [17] noticed seed germination on different cultivars of papaya (Red Lady, Sunerise Solo, SS-45, Tainung, Sel-42 and BH-65) with soaking of GA_3 and found 250 ppm gibberellic acid for 24 hours given highest germination percent.

Shinde *et al.* (2008) [35] observed the seed treatments effect with different doses of NAA, GA_3, thio-urea, KNO_3 and cow urine and cow dung paste on Rangpur lime seeds. They revealed that 80 ppm gibberellic acid given highest germination 93.33 percent subsequently 90.00 percent and 86.66 percent with the Naphthalene acetic acid at 80 ppm and cow dung paste, correspondingly.

Wankhede *et al.* (2008) [42] stated the effect of GA_3, NAA, cow urine and cow dung treatments on khirni (*Manilkara hexandra*) seed germination. The maximum germination 93.17 percent obtained with the gibberellic acid (50 ppm) treatment.

Abirami *et al.* (2010) [1] noticed considerable differences in germination of nutmeg seeds with twenty one combinations of growing media sowing. Maximum seed germination was found in treatment containing soil: coir dust: sand: vermi-compost at ratio of 1:1:1:1.

Deb *et al.* (2010) [11] revealed that, the seeds of papaya soaked with gibberellic acid at 100, 150 and 200 ppm, sodium thio-sulphate at 20, 25 and 30 ppm and four combinations of zinc sulphate and borax. Among the all treatments, highest seed germination was found in gibberellic acid at (150 ppm) 72.20 percent followed by sodium thio-sulphate (20 ppm) 68.10 percent.

Pathak *et al.* (2011) [31] observed that, highest germination of guava seeds (51.1%) was showed in the treatment having farmyard manure + Pseudomonas maltophilia PM4 or farmyard manure + *Azotobacter chroococcum* at 40 days after sowing.

Anjanawe *et al.* (2013) [3] observed the highest seed germination (65.4%) in 100 ppm gibberellic acid application in papaya seedling cultivar Barwani Red.

Bhardwaj (2013) [8] stated that, papaya seeds sown in media composed of vermi-compost + sand + pond soil at the ratio of 1: 1:1 with layer of 2 centimeter cocopeat at the top of the polybags given highest germination percent (92.71%).

Padma *et al.* (2013) [27] observed that, papaya cv. Surya seeds showed the highest seed germination (93%) with 300 ppm gibberellic acid for 12 hrs followed by 2 percent potassium nitrate for 24 hrs (91%).

Conclusion

Concluded that pre-sowing treatment with bio-fertilizers, plant growth regulators and cow urine has play a noteworthy role in germination parameters of different seeds, ultimately resulting in improved germination percent, rate of emergence of seed and minimum days taken for germination. It may be viable and feasible option for getting healthy seedlings of papaya.

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