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## Organics and bio- fertilizers effect on germination process of papaya at nursery level (*Carica papaya* L.)

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### Abstract

Papaya (*Carica papaya* L.) is an important fruit crop of tropical world. An experiment was conducted during the year 2017-2018 at College of Horticulture, Anantharajupeta, to study the influence of organics and bio-agents on process of germination in papaya (*Carica papaya* L.) cv. Red lady. The present investigation was envisaged to produce robust, healthy seedlings by decreasing the duration of seedlings to be kept at nursery, before transplanting in the main field. Required growth of the seedlings was achieved through combined application of organics and bio-agents along with the potting medium. The experiment was laid out in a Randomized Block Design with three replications. The results shows that different combinations of potting media mixed with organics (neem cake and castor cake) and bio-fertilizers (VAM and *Trichoderma harzianum*), recorded earlier germination (7.00days), highest germination index (1.88), days taken for 50% germination (10.67), germination% (99.33%) and number of days taken for appearance of plumule (7.33), days taken for appearance of first true leaves (9.67) was recorded in potting mixture enriched with castor cake, *T. harzianum* and *A.M* fungi (T<sub>9</sub>).

**Keywords:** Organics, bio-agents, germination characters of papaya seedlings

### Introduction

Papaya (*Carica papaya* L.) is an important fruit crop of tropical world and is popularly known as wonder fruit of the tropics. Papaya belongs to the family caricaceae and is native of Tropical America (Hofmeyr, 1945) [7] with a diploid chromosome number 2n=18. It is introduced to India during the 16<sup>th</sup> century, (Kumar and Abraham, 1943) [8]. Papaya is grown extensively as a filler plant in orchards and also an ideal fruit for growing in a kitchen garden, backyards of home, especially near the cities and big towns (Chadha, 1992) [3] moreover as intercrop in homestead gardens. Papaya fruit is prized for its curative properties such as piles, dyspepsia of spleen and liver, digestive disorders diphtheria and skin blemishes. In India, with a little difference in planting season, it is successfully cultivated in almost all the states with an area of 1.38 lakh hectares and production of 61.45 lakh MT ha<sup>-1</sup> (NHB, 2016-17). In Andhra Pradesh, papaya is cultivated in an area of 13.56 thousand hectares with a production of 1288.58 thousand MT ha<sup>-1</sup> respectively (Anonymus, 2017). In A.P., kadapa district is the largest producer of papaya with 6000 acres area under papaya cultivation. Our college is located amidst of papaya fields and around nursery are involved in propagation and selling of seedlings to different part of A.P district.

Neem cake (*Azadirachta indica*) is considered as the rich source of plant nutrients (5.2% N, 1.0% P and 1.4% K) (Ramanathan, 2006) [12]. Castor cake (*Ricinus communis*) is a rich source of N, P, K and micronutrients considered as good value manure with a good source of nitrogen (4.37% N, 1.85% P<sub>2</sub>O<sub>5</sub> and 1.39% K<sub>2</sub>O). It helps in mineralization process of plant nutrients during decomposition (Tandon, 1992) [16].

Bio-Fertilizers contain microorganisms which are able to mobilize the nutrients from unusable form to usable form by biological processes (Athani *et al.*, 2009) [2]. *Arbuscular mycorrhiza* (AMF) fungi are mutualistic associations existing between fungi and roots of many higher plants. AM associations have been shown to reduce damage caused by soil-borne plant pathogens (Clark and Zeto, 1996 a & b) [4,5]. Papaya is known to exhibit a strong growth response to colonization by AM fungi (Sukhada, 1989) [15].

*Trichoderma* spp. produce or release a variety of compounds that induce localized or systemic resistance response in plants (Cubillos-Hinojosa *et al.*, 2011) [6]. Hence, balanced nutrition including organic, bulky organic manures and a few bio-fertilizers is the key factor to enhance plant growth, yield and fruit quality. So no one has to show more interest in supplying balanced nutrition at nursery level itself. Hence, management of seedlings at nursery level and planting in the main field plays a vital role during production and productivity of papaya.

## Materials and Methods

The experiment was carried out during 2017, conducted in a randomized block design (RBD) comprising of 9 treatments, replicated thrice with 25 Red lady papaya seeds per replication was sown @ one seed per poly bag of size 6"x4" inches. The experimental material comprised of, F<sub>1</sub> hybrid seeds of papaya cv. "Red Lady" were procured from authorized dealers of "known-you seed" company. Rly Kodur, Y.S.R Kadapa district. Totally three raised beds were prepared with the size of 1 m width, 8m length and 15 cm height, the poly bags were arranged before sowing of the seeds. Beds were kept weed free throughout the experimental period. Treatments details are T<sub>1</sub> – Control (FYM+ Soil + Sand (1:1:1)), T<sub>2</sub> – Neem cake (10g/ poly bag), T<sub>3</sub> – Castor cake (10g/ poly bag), T<sub>4</sub> – Neem cake (10g) + *A.M* fungi (5g), T<sub>5</sub> – Neem cake (10g) + *T.harzianum* (3g), T<sub>6</sub> – Neem cake (10g) + *T. harzianum* (3g) + *A.M* fungi (5g), T<sub>7</sub> – Castor cake (10g) + *A.M* fungi (5g), T<sub>8</sub> – Castor cake (10g) + *T. harzianum* (3g), T<sub>9</sub> – Castor cake (10g) + *T. harzianum* (3g) + *A.M* fungi (5g). The observations on germination characters viz., number of days taken for germination, germination index, 50% of germination and germination percentage were recorded on daily basis. The experimental data were statistically analyzed by following standard procedures of Panse and Sukhatme, 1985<sup>[10]</sup>.

## Results and Discussion

Getting quick germination is a desirable character in papaya to reduce the duration of papaya at nursery. From the data it was observed that minimum number of days taken to initiate germination was differed significantly among the treatments. Minimum number of days (7.00) taken for germination was recorded in T<sub>9</sub> (castor cake+ *T. harzianum* + *A.M* fungi) which is on par with T<sub>7</sub> (castor cake+ *A.M* fungi) (7.67). Three possible mechanisms one acidification of media, second chelation of metabolites, finally redox activity by the *Trichoderma*. Those three reasons could have played the important role in quick germination of papaya seedlings (Altomare *et al.*, 1999)<sup>[1]</sup>. *A.M* Fungi produced the growth promoting substances which have enhanced the seed germination. Whereas, more number of days (10.33) was recorded in the treatments without Organics and Biofertilisers. Germination index of papaya seedlings was differed significantly among the treatments. The highest germination index (1.88) was observed in T<sub>9</sub> (castor cake+ *T. harzianum* + *A.M* fungi) which was statistically superior over the other treatments. reasons may be the influence of *Glomus mosseae* increased the permeability of air and water through seed coat, which favored the early germination. Biological sources of nutrients and organics which supplied plant nutrients in balanced form could be the possible reason for early germination. Castor cake released nitrogen slowly and supplied other macro and micronutrients which in turn would have supported plant growth. While, the lowest germination index (1.15) was recorded in T<sub>1</sub> (control) followed by T<sub>2</sub> (neem cake) (1.28).

The data revealed that different organics and bio-fertilizers has got positive influenced on germination percentage.

Significantly, least number of days (10.67) taken for 50% germination was noticed in T<sub>9</sub> (castor cake + *T. harzianum* + *A.M* fungi) which was on par with T<sub>6</sub> (neem cake + *T. harzianum* + *A.M* fungi) (11.00 days) and highest germination percentage (98.33%) was observed in T<sub>9</sub> (castor cake+ *T. harzianum* + *A.M* fungi). It is on par with T<sub>7</sub> (castor cake+ *A.M* fungi) (95.67%). This may be castor cake improved physical properties of soil and conserved nutrients against leaching losses. So it improved the early germination of plants as obtained by Patel *et al.* (2012)<sup>[11]</sup> in banana. Similar reasons could have increased the 50% germination and also germination index in papaya seedlings. whereas, minimum germination percentage (87.00%) was recorded in T<sub>1</sub> (control) followed by T<sub>3</sub> (castor cake) (90.33%), T<sub>4</sub> (neem cake + *A.M* fungi) (90.67%), T<sub>2</sub> (neem cake) (91.00%), T<sub>8</sub> (castor cake + *T. harzianum*) (91.33%) and T<sub>5</sub> (neem cake + *T.harzianum*) (91.67%).

Similar results were also noticed by Yedidia *et al.* (2001) in cucumber, Mukhtar (2008) in okra, Azrami *et al.* (2011) in tomato, Thoke *et al.* (2011) in jamun, Kumar *et al.* (2014) in chickpea with *T. harziaum*, Vasantha *et al.* (2014) in tamarind and Chiranjeevi *et al.* (2018) in aonla seedlings with VAM, and Patel *et al.* (2012)<sup>[11]</sup> with castor cake in banana.

All germination parameters were significantly higher values are recorded in growth substrate combination with organic and bio fertilizer treatments are enhanced the early germination, germination index, days taken for 50% germination and percentage of germination was recorded more than 90% among all the treatments compared with control. However highest germination parameters was recorded in T<sub>9</sub> (castor cake + *T.harzianum* +*A.M* fungi).

The number of days taken for appearance plumule was significantly differed among all the treatments compared with control. Appearance of plumule was noticed earlier days (7.33) in T<sub>9</sub> (castor cake + *T. harzianum* + *A.M* fungi), which is on par with T<sub>7</sub> (castor cake + *A.M* fungi) (8.00 days). Whereas, the maximum number of days (10.67) taken for emergence of plumule was recorded in T<sub>1</sub> (control) is followed by T<sub>3</sub> (castor cake) (9.67 days).

There was a significant difference among the treatments with regard to the appearance of first true leaves. Appearance of first true leaves was observed earlier at 9.67 days in T<sub>9</sub> (castor cake + *T. harzianum* + *A.M* fungi) which is on par with T<sub>7</sub> (castor cake + *A.M* fungi) (10.00). Reasons could have been organics combine with *A.M* Fungi and *Trichoderma* might have boosted the growth of seedlings leading to enhanced growth of seedlings. Rupnawar and Navale (2000) conducted an experiment on pomegranate and observed that mycorrhizal treatment were superior over non-mycorrhizal treatment in pomegranate. Organics in combination with fungi will hasten the process of decomposition. This could have led the emergence of leaf primordia in early stages of germination process. While, more number of days (13.67) taken for appearance of first true leaves was recorded in T<sub>1</sub> (control) followed by T<sub>3</sub> (castor cake) (13.33) and T<sub>2</sub> (neem cake) (13.30).

**Table 1:** Effect of Organics and Bio agents on germination of Papaya seeds

S. No.	Treatment details	No. of days taken for germination	Germination index	No. of day taken for 50% germination	% of Germination	Number of days taken for appearance first plumule	Number of days taken for appearance first true leaves
1.	T <sub>1</sub> - Control	10.33	1.15	14.67	87.00	10.67	13.67
2.	T <sub>2</sub> - Neem cake	8.67	1.28	13.00	91.00	9.00	13.00
3.	T <sub>3</sub> - Castor cake	9.33	1.34	12.33	90.33	9.67	13.33
4.	T <sub>4</sub> - Neem cake + <i>A.M</i> fungi	9.00	1.46	12.00	90.67	9.33	11.67
5.	T <sub>5</sub> - Neem cake + <i>T.harzianum</i>	8.33	1.36	11.67	91.67	8.67	10.67
6.	T <sub>6</sub> -Neem cake + <i>T. harzianum</i> + <i>A.M</i> fungi	8.00	1.47	11.00	94.33	8.33	10.33
7.	T <sub>7</sub> - Castor cake + <i>A.M</i> fungi	7.67	1.66	11.33	95.67	8.00	10.00
8.	T <sub>8</sub> - Castor cake + <i>T. harzianum</i>	8.67	1.44	12.33	91.33	9.00	11.00
9.	T <sub>9</sub> -Castor cake + <i>T. harzianum</i> + <i>A.M</i> fungi	7.00	1.88	10.67	99.33	7.33	9.67
10.	SE(m) ±	0.41	0.04	0.32	1.68	0.44	0.38
11.	C.D. (5%)	1.22	0.14	0.97	5.06	1.32	1.14

### Conclusion

The different potting mixture treatments with organic manures and bio-fertilizers on germination of papaya seeds revealed that, potting mixture enriched with castor cake, *T. harzianum* and *A.M* Fungi (T<sub>9</sub>) enhanced the germination index, maximum germination percentage and reduced days taken for germination, days to 50% germination, minimum number of days taken to appearance of plumule and appearance of first true leaves. Finally concluded that the organic manures with bio-fertilizers should be preferred for use as a beneficial growth activator, especially for a vigorous healthy seedlings for quicker germination and for production of healthy robust seedlings in just 35 days.

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