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Effect of pre-sowing seed treatments on germination and growth of papaya (*Carica papaya* L.) seedlings cv. red lady

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Abstract

The results of present investigation revealed that among the different organic treatments, panchgavya were found to be most beneficial for improving germination percent (90.03%) and took minimum days for germination (10.16). Similar trend was observed on growth parameters such as height of seedling (4.20, 10.24, 15.01 cm), number of leaves (4.56, 7.30, 11.25), stem girth (15.65 mm), leaf area (46.00 cm²), length of tap root (10.77 cm), number of roots per seedling (18.58), root/shoot ratio (1.92), fresh weight of seedling (6.69 g), dry weight of seedling (1.58 g), survival percentage (84.21%) and minimized mortality percentage (15.62%).

Keywords: Papaya, Pre-sowing, Panchgavya, Seedling

Introduction

The papaya (*Carica papaya* L.) is an important fruit crop of India belongs to family Caricaceae, is grown throughout the tropical and subtropical region of the country. Papaya occupies 2.0 per cent total fruit crop area and 5.3 per cent of total fruit production in India {(5381.73 thousand MT of production from 132.18 thousand hectares with average productivity of 40.71 t ha⁻¹ (Anon., 2015) [1]}. It is now grown in all the tropical and subtropical countries like Australia, Hawaii, Taiwan, Puerto Rico, Peru and Florida, Texas, California, U.S.A., Gold Coast, various parts of Central and South Africa, Pakistan, Bangladesh and India. Papaya is grown in India mainly in Maharashtra, Karnataka, Madhya Pradesh, Uttar Pradesh, Bihar, Gujarat, West Bengal, Tamil Nadu, Kerala, Andhra Pradesh, Assam and Rajasthan. Red lady is choicest variety of papaya grower due to hermaphrodite nature and prolonged shelf life of fruits. But the seed cost of this variety is very high. So, increasing germination per cent and producing more healthy seedling is a challenge for papaya growers. For successful production of papaya vigorous and healthy seedling production is most important as the crop is propagated through seed commercially. Proper seed germination and seedling growth are most important considerations in successful seedling production under nursery. The germination of seeds of *Carica papaya* is reported to be slow, erratic and incomplete (Chako and Singh, 1966; Lange, 1961) [2, 6].

Material and Methods

The present experiment was carried out during 2015-16 at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari in polyhouse condition. A completely randomized design was adopted with three replications. The experiment included nine treatments viz., T₁- Cow dung slurry, T₂- Cow urine (3%), T₃- Amritpani (3%), T₄- Bijamrut (3%), T₅- Novel (1%), T₆- Panchgavya (3%), T₇- Vermiwash (20%), T₈- Water soaking and T₉- Control. Seeds were treated for 3 hours in all the treatments except control. Cow-urine, Amritpani, Bijamrut, Novel liquid fertilizer, Panchgavya and Vermiwash were diluted in deionized water to makeup required quantity suitable for seed treatment. Sowing were done just after the compilation of seed treatments. Sowing of seeds in 13 cm × 7 cm size polythene bags, For improve the drainage, holes were made in polythene bags and filled with potting mixture which was prepared by mixing one parts of red soil, one part of well-rotted FYM and one part of cocopeat. The seeds were sown in polythene bags after soaking as per the treatments. The observations on the parameters listed below were recorded daily for germination parameters and after 45 days for growth parameters.

Results and Discussion

The minimum days taken for germination (10.16) and maximum germination percentage of seedling (90.03%) were recorded in panchgavya (3% for 3 hours) (Table 1). The superiority of this treatment with respect to minimum days required for germination and maximum germination might be due to panchgavya which contains major (N, P, K, S, Ca) and micro nutrients (Zn,Mn,Cu) and the action of microorganisms and growth hormones enhances the metabolic activity of plants supports better seed invigoration. These results are in agreement with the findings of Yallesh *et al.* (2008) [8] and Dawale *et al.* (2011) [4] in mango.

The seedling height at 15, 30 and 45 DAS (4.20, 10.24 and 15.01), maximum number of leaves per seedling at 15, 30 and 45 DAS (4.56, 7.30 and 11.25), maximum leaf area of papaya seedling (46.00 cm²) at 45 DAS and stem girth of papaya seedling (15.65 mm) at 45 DAS was recorded in panchgavya (3% for 3 hours) (Table 1). When papaya seeds treated with 3% panchgavya for 3 hours noted maximum seedling height, number of leaves, stem girth and leaf area that might be due to organic formulation. It contains macro and micro elements and enhancement in photosynthesis and other metabolic activities. In details reason behind that panchgavya is blend of five products obtained from cow, which works on with cosmic energy and with a production of certain hormones and enzymes with enormous increase in beneficial microorganisms may be the reason for this beneficial effect. This endogenous production of GA₃ helps in stem elongation by including cell wall loosening, by increasing the solute concentration by increasing cell wall extensibility, stimulating cell wall synthesis, reducing the rigidity of cell wall by increasing cell division leading to more growth. The results are in conformity with those found by Dawale *et al.* (2011) [4] and Yallesh kumar *et al.* (2008) [8] in mango and Singh *et al.* (2011) [7] in cashew.

The length of tap root at 45 DAS (10.77 cm), the number of roots per seedling and root:shoot ratio (18.58 and 1.92) at 45 DAS was recorded in panchgavya (3% for 3 hours) (table 1). The growth parameters regarding to roots parameters like longest length of tape root, more number of roots per seedling

and root/shoot ratio were found maximum in panchgavya (3% for 3 hours) treated seeds. The differential degree of stimulation of number of roots might be further related to different treatment degrees of production of gibberellins, auxins and vitamins by osmoprimings. The increase in number of lateral roots by different treatments was earlier reported by Chaudhari (2010) in mango. In panchgavya presence of macro nutrients (N, P, K and S) and other micronutrients. Phosphorous is major role in root formation and root development particularly lateral roots and fibrous rootlets and in panchgavya P contains is 4310 ppm and other also beneficial effects of panchgavya in roots. Due to this, there is increase in root parameters with panchgavya treated seeds. These finding is close to those of Singh *et al.* (2011) [7] in cashew.

The maximum fresh and dry weight of papaya seedling at 45 DAS (7.53 g and 1.83g) was recorded in panchgavya (3% for 3 hours) (Table 1). The result of the present investigation revealed that the maximum fresh weight and dry weight of seedling were recorded in panchgavya (3% for 3 hours) treated seeds due to presence of macro nutrients (N, P, K, Ca, S) and other micronutrients (Zn, Cu, Mn) could have been cause for increase vigour of seedlings, which increase growth parameters of seedlings. The results are close conformity with findings of Jangala *et al.* (2014) [5] in cashew.

The survival and mortality percentage of papaya seedling at 45 DAS (88.02% and 11.66%) was recorded in panchgavya (3% for 3 hours) (Table 1). The parameters like survival percentage was found maximum in panchgavya (3% for 3 hours) treated seeds. Presence of plant nutrients, beneficial microbes and plant protection substances could have been cause for increase vigour of seedlings, which increase survival percentage of seedlings. These results are in close conformity with findings of Yallesh *et al.* (2008) [8], Chandel *et al.* (2013) in mango. The result of present studies indicated that, panchgavya (3% for 3 hours) treated seeds minimize mortality percentage because presence of essential plant nutrients (macro and micro), beneficial microorganisms, growth promoting factors, enzymes, antioxidant properties in panchgavya.

Table 1: Effect of pre-sowing seed treatments on different parameters of papaya seedlings.

Treatments	Number of days taken for Germination	Germination (%)	Numbers of leaves			Height of seedling (cm)			Stem girth (mm)	Leaf area (cm ²)	Length of tap root (cm)	No. of root/seedling	Root: Shoot Ratio	FW (g)	DW (g)	Survival (%)	Mortality (%)
			15 (Days)	30 (Days)	45 (Days)	15 (Days)	30 (Days)	45 (Days)									
T ₁ -Cowdung slurry	10.37	88.00 (69.73)	4.35	7.13	11.02	4.12	10.11	14.94	15.60	43.07	10.37	17.50	1.86	7.42	1.77	86.50 (68.44)	12.87 (21.02)
T ₂ - Cow urine (3%)	13.33	73.53 (59.03)	3.33	6.33	10.20	3.42	9.50	12.94	12.55	31.27	7.66	12.83	1.60	5.08	1.10	72.46 (58.34)	27.38 (31.55)
T ₃ - Amritpani (3%)	12.33	82.27 (65.09)	3.45	6.45	10.47	3.59	9.84	13.66	13.90	35.45	8.48	14.80	1.74	6.31	1.29	79.08 (62.78)	20.25 (26.74)
T ₄ - Bijamrut (3%)	12.67	76.27 (60.84)	3.22	6.42	10.41	3.57	9.81	13.16	13.85	33.51	8.42	13.63	1.71	6.24	1.24	75.79 (61.52)	24.28 (29.52)
T ₅ - Novel (1%)	11.66	84.35 (66.69)	3.87	6.85	10.61	3.97	9.91	14.78	15.09	38.22	8.86	16.17	1.77	6.37	1.45	83.42 (65.97)	16.57 (24.02)
T ₆ - Panchgavya (3%)	10.16	90.03 (71.59)	4.56	7.30	11.25	4.20	10.24	15.01	15.65	46.00	10.77	18.58	1.92	7.53	1.83	88.02 (69.74)	11.66 (19.96)
T ₇ - Vermiwash (20%)	10.67	86.17 (68.16)	3.89	6.96	10.63	4.02	9.94	14.80	15.19	39.17	9.81	15.11	1.80	6.69	1.58	84.21 (66.58)	15.62 (23.27)
T ₈ - Water soaking	14.50	68.17 (55.65)	3.13	6.14	9.33	3.08	9.13	12.48	10.14	28.42	6.97	11.70	1.19	4.55	1.05	67.96 (55.52)	32.00 (34.44)
T ₉ - Control	15.00	56.15 (48.53)	2.33	5.94	8.00	2.57	8.51	10.94	8.87	20.17	6.14	9.71	0.97	3.47	0.86	55.33 (48.05)	44.19 (41.66)
S.E(m). ±	0.275	1.868	0.118	0.160	0.197	0.105	0.249	0.324	0.315	0.912	0.240	0.353	0.039	0.198	0.035	1.869	0.515
C.D. 5%	0.97	6.63	0.42	0.57	0.70	0.37	0.88	1.15	1.12	3.23	0.85	1.25	0.141	0.70	0.12	6.63	1.82
C.V. %	3.87	4.13	5.75	4.21	3.35	5.06	4.46	4.12	4.07	4.51	4.83	4.23	4.27	5.76	4.55	4.20	4.92

Conclusions

Based on the above trial conducted in poly house condition, it can be concluded that the papaya seeds soaked for 3 hours and treated with panchgavya gave maximum germination percentage with optimum vegetative growth and survival percentage of papaya seedlings.

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