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## Studies on seed germination and seedling growth of papaya (*Carica papaya* L.) CV. madhubindu as influenced by media, GA<sub>3</sub> and cow urine under net house condition

**Amit Desai, Bharat Panchal, Ashwin Trivedi and Dinesh Prajapati**

**Abstract**

An experiment entitled "Effect of GA<sub>3</sub> and cow urine with different media on seed germination and growth of papaya seedlings (*Carica papaya* L.) cv. Madhubindu under net house condition" was carried out at Horticultural Research Farm, Anand Agricultural University, Anand during June – July, 2016. The treatments comprised combination of soil, vermicompost and cocopeat with varying levels of GA<sub>3</sub> and cow urine. Altogether, 18 treatments were applied in a factorial CRD with three repetitions. The seeds were sown in plug tray which is filled with respective media and treated with GA<sub>3</sub> and cow urine. The results showed that the application of treatment G<sub>3</sub>M<sub>1</sub> [GA<sub>3</sub> @150 mg/l dipping for 12 hours and soil + cocopeat (1:1)] was found better for early germination as well as higher germination percentage and length of root. While, G<sub>6</sub>M<sub>1</sub> [cow urine 10% dipping for 18 hours and soil + cocopeat (1:1)] had enhanced plant growth by increasing seedling height, stem diameter, fresh weight of shoot and leaf area.

**Keywords:** GA<sub>3</sub>, Cow urine, Media, Germination, Papaya Seedling.

**Introduction**

**Papaya (*Carica papaya* L.)** is an important tropical commercial fruit crop of India. It is native to the tropics of the Americas. It is 7<sup>th</sup> important fruit crop of the country after Mango, Citrus, Banana, Apple, Guava and Sapota. According to National Horticulture Board (2015), Papaya occupies 1.8 % of total fruit crop area and 6.3 % of total fruit production in India. It occupies a cultivated area of 133.4 (000 ha) with an annual production of 5699.00 (000 MT/ha) productivity of 42.3 (MT/ha). In Gujarat state, papaya occupies about 19.59 (000 ha) area under cultivation with 1185.47 (000 MT/ha) of fruit production and productivity is 60.50 (MT/ha). Gujarat holds 2<sup>nd</sup> position with 21 % shares in papaya production of the country next to Andhra Pradesh, which has 27.4 % share. Among the various varieties of papaya Pusa Dwarf, Taiwan, Madhubindu, Pusa Delicious have attained the commercial status throughout the country. Gibberellic acid (also called Gibberellin A<sub>3</sub>, GA, and GA<sub>3</sub>) is a hormone found in plants and fungi. GA<sub>3</sub> appears mainly to induce the activity of the gluconeogenic enzymes during early stages of seed germinations. Cow urine contains about 1.21% N<sub>2</sub>, 0.01% P<sub>2</sub>O<sub>5</sub> and 1.35% K<sub>2</sub>O (Subramaniyam, 2005) with micronutrients Fe, Mn, Zn and Cu (Yawalkar, 1996). Media is a substrate that provides the required elements and physical support to the growing plants. Propagation media used in raising horticultural plants in the nursery are mostly organic or inorganic in nature. Papaya is normally propagated by seed and it is interested by researchers due to the presence of gelatinous sarcotesta preventing germination. The effect of media on seed germination and seedling growth has been worked out by various workers (Srivastava *et al.*, 1998 and Annapurna *et al.*, 2007). However, no information is available on cow urine as organic seeds priming and its combination effect with media on germination and growth of the seedlings. Therefore, the present study was initiated to find out seed germination and seedling growth of papaya in GA<sub>3</sub> and cow urine with different media filled in plug trays.

**Materials and Methods**

Present investigation was conducted at Horticulture Research Farm, Anand Agricultural University, Anand, from June- July during the year 2016. The experiment was laid out in a Completely Randomized Design (Factorial) with eighteen (18) treatment combinations and replicated thrice. Fully mature and healthy fruits of papaya cv. Madhubindu were collected. Seeds are extracted and shade drying till the seed are completely dried. These fresh seed were collected and subjected to different pre-sowing treatments. The treatments comprised of six

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levels of GA<sub>3</sub> and cow urine *i.e.* (G<sub>1</sub>)- GA<sub>3</sub> @50 mg/l dipping for 12 hours, (G<sub>2</sub>)- GA<sub>3</sub> @100 mg/l dipping for 12 hours, (G<sub>3</sub>)- GA<sub>3</sub> @150 mg/l dipping for 12 hours, (G<sub>4</sub>)- cow urine 10% dipping for 6 hours, (G<sub>5</sub>)- cow urine 10% dipping for 12 hours, (G<sub>6</sub>)- cow urine 10% dipping for 18 hours as well as three levels of growing medias *i.e.* (M<sub>1</sub>)- soil + cocopeat (1:1), (M<sub>2</sub>)- soil + vermicompost (1:1) and (M<sub>3</sub>) soil + vermicompost + cocopeat (1:1:1). Plug trays of size 38 × 30 × 6 cm<sup>3</sup> (40 cells) were filled with different mixture of growing media according to the treatments. One cell of plug tray contain about 125 g mixture of growing media. One seed of the papaya is dibbled at about 1 to 2 cm depth in each cell of plug trays. For each treatment 50 cells of plug trays filled in every replication and kept in net house having 75% green shade net. Observations were recorded in respect to first germination from the date of sowing up to germination of the first seedling, germination percentage at 10 and 20 DAS by counting number of papaya seeds germinated out of total seed dibbled into the plug trays and its average was calculated, 50% germination were calculated from date of sowing up to 50 per cent germination of seedlings, height of seedlings was measured by metric scale from the top of the shoot to the tip of root of the seedling, length of roots was measured by metric scale from the base of the shoot to tip of the roots, stem diameter was measured with the help of vernier calliper at height 1 cm above ground level, leaf area are measured with the help of leaf area meter, fresh weight of shoot was weighed on digital weighing balance and fresh weight of root was weighed on digital weighing balance at 30 and 45 days after sowing and its average value was calculated.

## Results and Discussion

### Effect of GA<sub>3</sub> and cow urine

Treatments G<sub>3</sub> (GA<sub>3</sub> @150 mg/l dipping for 12 hours) significantly took the minimum days (7.55 and 9.44) for first and 50 per cent germination also recorded significantly highest germination percentage (77% and 87%) at 10 and 20 DAS as well as highest length of root *i.e.* 6.42 cm and 9.91 cm at 30 and 45 DAS, respectively. It might be due to GA<sub>3</sub> helped in physically breaching, thereby removing physiological barriers associated with the impermeable seed coats that cause seed dormancy (Mayer and mayber 1963). Similar results were also obtained by Deb *et al.* (2010) and Kumawat *et al.* (2014) in papaya. Whereas, the treatment G<sub>6</sub> (cow urine 10% dipping for 18 hours) noted significantly the maximum height of seedling *i.e.* 18.52 cm and 35.00 cm, fresh weight of root *i.e.* 1.73 g and 2.34 g, stem diameter *i.e.* 3.69 mm and 4.56 mm at 30 and 45 DAS, respectively and highest fresh weight of shoot *i.e.* 16.42 g as well as the highest leaf area *i.e.* 188.75 cm<sup>2</sup> at 45 DAS. While, significantly the maximum fresh weight of shoot *i.e.* 6.67 g and maximum leaf area *i.e.* 64.13 cm<sup>2</sup> at 30 DAS were found in treatment G<sub>5</sub> (cow urine 10% dipping for 12 hours). This might be due to the auxins present in cow's urine may induce the overall growth of seedlings. Similar results were also obtained by Ambika *et al.* (2014) in cereals, Shinde and Malshe (2015) in khirni, Vanangamudi and Vanangamudi (2003) in tamarind and Shivamurthy and Patil (2006) in wheat.

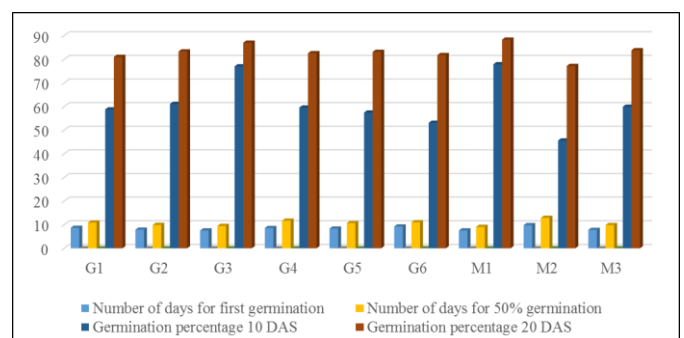
### Effect of growing media

Media M<sub>1</sub> [soil + cocopeat (1:1)] significantly took the minimum days (7.55 and 9.05) required for first and 50 per cent germination as well as highest germination percentage (77.89% and 88.28%) at 10 and 20 DAS, respectively and

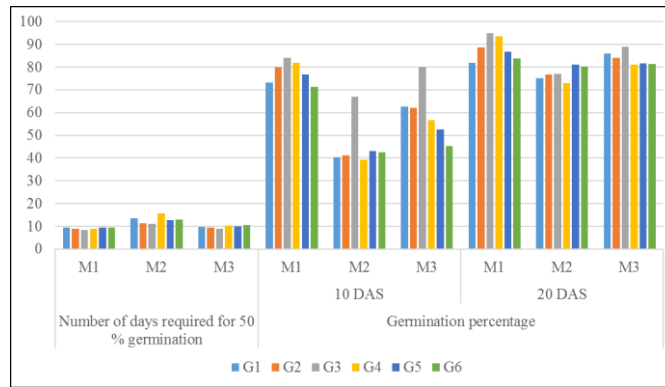
growth attributes *viz.*, height of seedling *i.e.* 19.06 cm and 32.99 cm, length of root *i.e.* 6.04 cm and 9.76 cm, stem diameter *i.e.* 3.56 mm and 4.40 mm, leaf area *i.e.* 57.48 cm<sup>2</sup> and 178.39 cm<sup>2</sup>, fresh weight of shoot *i.e.* 5.61 g and 14.63 g and fresh weight of root *i.e.* 1.43 g and 2.22 g at 30 and 45 DAS, respectively were recorded in same treatment M<sub>1</sub>. This might be due to combination of soil and cocopeat media, attributed proper aeration and high water holding capacity which helped to better growth and development of seedlings. This results were in close confirmity with finding of Bhardwaj (2014), Kumawat *et al.* (2014), Ramteke *et al.* (2015) and Mandal *et al.* (2015) in papaya when they used cocopeat as ingredients of growing media.

### Interaction effect of GA<sub>3</sub> and cow urine

Interaction of G<sub>3</sub>M<sub>1</sub> [GA<sub>3</sub> @ 150 mg/l dipping for 12 hours and soil + cocopeat (1:1)] recorded significantly the minimum days (8.33) required for 50% germination and also recorded significantly highest germination percentage (84.00% and 95.00%) at 10 and 20 DAS, respectively as well as noted maximum length of root *i.e.* 11.00 cm at 45 DAS as compared to rest of the combinations. It might be due to GA<sub>3</sub> acts on the embryo and causes synthesis of hydrolysing enzymes particularly amylase and protease and this hydrolysed food is utilized for grown of embryo and thereby enhanced the germination (Paleg, 1965) and retention of more water and air by media helped in quick and early enzymatic action for synthesis of metabolites for cell multiplication and also enhanced the breakdown of the seed coat resulting in the transformation of embryo into a seedling early enough (Hasan *et al.* 2010) which is helpful for increasing germination of seeds. Similar results were also obtained by Deb *et al.* (2010) and Kumawat *et al.* (2014) in papaya and Patil *et al.* (2012) in rangpur lime. Whereas, the treatment combination G<sub>6</sub>M<sub>1</sub> [cow urine 10% dipping for 18 hours and soil + cocopeat (1:1)] was recorded significantly the maximum seedling height *i.e.* 22.00 cm and 42.00 cm, stem diameter *i.e.* 4.13 mm and 5.11 mm and fresh weight of root *i.e.* 1.80 g and 2.73 g at 30 and 45 DAS, respectively and also found significantly maximum fresh weight of shoot *i.e.* 17.60 g as well as leaf area *i.e.* 210.28 cm<sup>2</sup> at 45 DAS. While, the treatment combination G<sub>5</sub>M<sub>1</sub> [cow urine 10% dipping for 12 hours and soil + cocopeat (1:1)] was recorded significantly the highest fresh weight of shoot *i.e.* 7.49 g as well as leaf area *i.e.* 77.25 cm<sup>2</sup> at 30 DAS. This might be due to the presence of growth promoting substances (auxins) and nutrients in cow urine and proper media which leads to better growth of seedlings. These results were in close agreement with Shinde and Malshe (2015) in khirni when they used cow urine as a seed soaking.



**Fig 1:** Studies on seed germination of papaya (*Carica papaya* L.) cv. Madhubindu influenced by media, GA<sub>3</sub> and cow urine under net house condition



**Fig 2:** Interaction studies on seed germination of papaya (*Carica papaya* L.) cv. Madhubindu influenced by media, GA<sub>3</sub> and cow urine under net house condition

**Table 1:** Studies on seedling growth of papaya (*Carica papaya* L.) cv. Madhubindu influenced by media, GA<sub>3</sub> and cow urine under net house condition

Treatments	Height of seedling (cm)		Length of root (cm)		Stem diameter (mm)		Leaf area (cm <sup>2</sup> )		Fresh weight of shoot (g)		Fresh weight of root (g)	
	30 DAS	45 DAS	30 DAS	45 DAS	30 DAS	45 DAS	30 DAS	45 DAS	30 DAS	45 DAS	30 DAS	45 DAS
G <sub>1</sub>	14.89	31.26	6.20	9.47	3.17	3.94	40.75	163.01	4.47	11.24	1.20	1.47
G <sub>2</sub>	16.41	29.79	5.55	9.09	3.44	4.02	42.68	157.51	5.12	11.77	1.23	1.65
G <sub>3</sub>	16.62	29.61	6.42	9.82	3.38	4.14	46.14	178.60	5.14	13.93	1.32	2.04
G <sub>4</sub>	15.69	28.57	5.50	9.34	3.28	4.05	43.99	147.91	4.41	13.56	1.22	1.95
G <sub>5</sub>	17.61	32.80	5.46	9.59	3.45	4.27	64.13	172.85	6.67	15.66	1.55	2.27
G <sub>6</sub>	18.52	35.00	5.64	8.74	3.69	4.56	61.73	188.75	6.24	16.42	1.73	2.34
S.Em. ±	0.50	0.57	0.18	0.18	0.05	0.08	1.23	3.87	0.11	0.21	0.03	0.06
C.D. at 5%	1.46	1.66	0.52	0.53	0.14	0.25	3.55	11.11	0.32	0.62	0.09	0.17
M <sub>1</sub>	19.06	32.99	6.04	9.76	3.56	4.40	57.84	178.39	5.61	14.63	1.43	2.22
M <sub>2</sub>	13.95	28.68	5.42	8.85	3.26	3.90	44.09	160.47	4.85	13.03	1.28	1.63
M <sub>3</sub>	16.87	31.85	5.93	9.41	3.39	4.19	48.14	165.45	5.57	13.63	1.42	2.01
S.Em. ±	0.36	0.40	0.13	0.13	0.03	0.06	0.87	2.73	0.07	0.15	0.02	0.04
C.D. at 5%	1.03	1.17	0.37	0.37	0.10	0.18	2.51	7.85	0.22	0.44	0.07	0.12
C.V %	9.17	5.57	9.51	5.93	4.42	6.37	7.43	6.90	6.24	4.75	7.51	9.57
Interaction G × M	Sig.	Sig.	NS	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.

**Table 2:** Interaction studies on seedling growth of papaya (*Carica papaya* L.) cv. Madhubindu influenced by media, GA<sub>3</sub> and cow urine under net house condition at 30 and 45 DAS

Treatment combination	Height of seedling (cm)		Length of root (cm)		Stem diameter (mm)		Leaf area (cm <sup>2</sup> )		Fresh weight of shoot (g)		Fresh weight of root (g)	
	30 DAS	45 DAS	30 DAS	45 DAS	30 DAS	45 DAS	30 DAS	45 DAS	30 DAS	45 DAS	30 DAS	45 DAS
G <sub>1</sub> M <sub>1</sub>	17.88	30.22	6.50	9.61	3.38	4.18	50.08	157.40	5.04	12.5	1.28	1.63
G <sub>1</sub> M <sub>2</sub>	11.64	30.90	5.84	9.28	2.93	3.70	33.92	163.01	4.10	11.0	1.15	1.30
G <sub>1</sub> M <sub>3</sub>	15.17	32.66	6.26	9.52	3.20	3.95	38.26	168.62	4.28	10.2	1.19	1.50
G <sub>2</sub> M <sub>1</sub>	19.30	28.46	5.70	9.12	3.49	4.06	48.84	184.34	5.01	11.9	1.22	1.60
G <sub>2</sub> M <sub>2</sub>	14.67	28.75	5.33	9.53	3.45	3.83	35.92	145.89	4.78	11.7	1.20	1.36
G <sub>2</sub> M <sub>3</sub>	15.26	32.16	5.64	8.62	3.38	4.17	43.27	142.09	5.57	11.6	1.27	2.00
G <sub>3</sub> M <sub>1</sub>	17.49	28.78	7.23	11.0	3.46	4.00	49.33	181.04	5.46	13.7	1.24	2.40
G <sub>3</sub> M <sub>2</sub>	12.93	28.22	5.67	8.63	3.19	3.88	43.98	170.46	4.16	13.7	1.18	1.56
G <sub>3</sub> M <sub>3</sub>	19.46	31.83	6.37	9.83	3.49	4.55	45.09	184.31	5.79	14.3	1.54	2.16
G <sub>4</sub> M <sub>1</sub>	17.71	32.28	5.26	10.2	3.35	4.53	49.18	137.32	4.25	15.9	1.25	2.33
G <sub>4</sub> M <sub>2</sub>	13.07	22.20	4.90	7.56	3.08	3.60	31.87	142.39	3.59	10.8	1.16	1.43
G <sub>4</sub> M <sub>3</sub>	16.30	31.24	6.33	10.2	3.43	4.02	50.93	164.02	5.40	13.8	1.25	2.10
G <sub>5</sub> M <sub>1</sub>	19.96	38.19	5.76	9.42	3.52	4.50	77.25	199.75	7.49	16.1	1.75	2.63
G <sub>5</sub> M <sub>2</sub>	15.53	30.21	5.10	9.62	3.43	4.25	58.35	159.16	6.36	15.0	1.25	2.06
G <sub>5</sub> M <sub>3</sub>	17.33	32.01	5.53	9.74	3.41	4.05	56.81	159.64	6.17	18.8	1.67	2.13
G <sub>6</sub> M <sub>1</sub>	22.00	42.02	5.76	9.15	4.13	5.11	70.23	210.28	6.41	17.6	1.80	2.75
G <sub>6</sub> M <sub>2</sub>	15.86	31.80	5.68	8.52	3.48	4.14	60.50	181.94	6.12	15.7	1.73	2.10
G <sub>6</sub> M <sub>3</sub>	17.70	31.19	5.46	8.54	3.45	4.44	54.47	174.05	6.21	15.9	1.66	2.20
S. Em. ±	0.88	1.00	0.31	0.32	0.08	0.15	2.14	6.70	0.19	0.37	0.06	0.10
C.D. at 5%	2.52	2.87	NS	0.91	0.25	0.44	6.15	19.24	0.55	1.08	0.17	0.31

## Conclusion

From the foregoing discussion it can be concluded that among the different treatment combination G<sub>6</sub>M<sub>1</sub> [cow urine 10% dipping for 18 hours and soil + cocopeat (1:1)] is found superior and most effective for better growth of papaya seedlings over the rest of the treatment combinations.

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