The Pharma Innovation Journal 2022; 11(8): 450-454

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(8): 450-454

www.thepharmajournal.com
Received: 02-05-2022
Accepted: 09-06-2022

Dhorajiya NP
Department of Fruit Science, College of Horticulture, Junagadh Agricultural University, Junagadh, Gujarat, India

Butani AM
Department of Fruit Science, College of Horticulture, Junagadh Agricultural University, Junagadh, Gujarat, India

Chaudhari T
Department of Fruit Science, College of Horticulture, Junagadh Agricultural University, Junagadh, Gujarat, India

Chitroda RL
Department of Fruit Science, College of Horticulture, Junagadh Agricultural University, Junagadh, Gujarat, India

Corresponding Author:
Dhorajiya NP
Department of Fruit Science, College of Horticulture, Junagadh Agricultural University, Junagadh, Gujarat, India

Effect of pre-soaking treatments and various environmental conditions on growth parameters of custard apple (*Annona squamosa* L.) var. Sindhan

Dhorajiya NP, Butani AM, Chaudhari T and Chitroda RL

Abstract
The experiment was laid out in a Completely Randomized Design with Factorial concept by three repetitions. The treatments comprised of eight level of pre-soaking treatments (S) *viz.*, S_1 = GA_3 500 ppm, S_2 = Thiourea 1%, S_3 = Urea 0.1%, S_4 = KNO_3 0.1%, S_5 = Cow dung slurry: Water (1:10), S_6 = Cow urine: Water (1:10), S_7 = Soaking in hot water, S_8 = Control and three levels of environmental conditions (E) *viz.*, E_1 = Open field, E_2 = Net house, E_3 = Polyhouse. Among eight pre-soaking treatments, S_1 (GA_3 500 ppm) gave maximum height of seedling (33.41 cm), number of leaves per seedling (18.36), stem diameter (4.03 mm), internode length (2.18 cm), leaf area (43.30 cm^2), fresh weight of seedling (8.27 gm), dry weight of seedling (3.05 gm), fresh weight of shoot (5.64 gm), seedling vigour index (4801.80), length of root (16.19 cm), number of primary roots (20.71), number of secondary roots (45.18), fresh weight of root (2.29 gm), dry weight of root (1.06 gm) and root: shoot ratio (0.42) at 90 DAS. Among three environmental conditions, E_3 (Polyhouse) gave maximum height of seedling (30.62 cm), number of leaves per seedling (17.02), stem diameter (3.68 mm), length of internode (2.18 cm), leaf area (37.94 cm^2), fresh weight of seedling (8.25 gm), dry weight of seedling (3.00 gm), fresh weight of shoot (5.85 gm), seedling vigour index (4303.57), length of root (15.66 cm), number of primary roots (20.04), number of secondary roots (38.21), fresh weight of root (2.01 gm), dry weight of root (0.95 gm) and root: shoot ratio (0.43) at 90 DAS. Among different treatment combinations, maximum leaf area (46.19 cm^2) was recorded in S_1E_3 (GA_3 500 ppm + Polyhouse).

Keywords: Custard apple, pre-soaking treatments, environmental conditions

Introduction
Custard apple (*Annona squamosa* L.) is an important fruit crop which is cultivated in tropical and subtropical climate. It comes under family Annonaceae and native of the West Indies and cultivated since early times throughout Central America to Southern Mexico. The fruit is also popularly known as "Sugar apple", "Monkey fruit" and "Sweetsop".

Custard apple is an important dry land fruit of India. It is suitable to grow in dry climate and withstand mild frost. The root system is confined to relatively shallow layers and therefore, these do not require deep soils. Custard apple is free from pests and diseases except mealybugs.

The custard apple tree is not especially attractive. It is erect and deciduous tree, with a rounded or spreading crown and trunk 25-35 cm thick. Height ranges from 15 to 35 ft (4.5-10 m). The ill-smelling leaves are alternate, oblong or narrow-lanceolate. Flowers are in drooping clusters are fragrant and slender, light-green externally and pale-yellow with a dark-red or purple spot on the inside at the base. The compound fruit is 8-16 cm in diameter, may be symmetrically heart-shaped, lopsided or irregular or nearly round or oblate with a deep or shallow depression at the base.

Total area of custard apple fruit crop in India is about 42,000 ha with production of 3,49,000 MT (Anon. 2020) [2]. It is found growing almost in all the tropical and subtropical regions mostly in wild form. The custard apple orchards mostly occurred in the parts of Andhra Pradesh, Assam, Bihar, Karnataka, Maharashtra, Madhya Pradesh, Orissa, Rajasthan, and Tamil Nadu as a shrub or hedge plant. Now days, it has gained commercial significance and exclusive orchards are emerging in Andhra Pradesh and Maharashtra. In Gujarat, the area of custard apple fruit crop is about 6460 ha with production of 66,610 MT (Anon. 2017) [3].

Besides high nutritive value, it has also a high medicinal value (Pareek and Sharma, 1993). Custard apple appears to possess potent bioactive principles in most of it's plant parts (fruit, seed and leaves).

Custard apple is one of the most important fruit crop and its area is expanding at a faster rate in recent years. It is mainly propagated by budding and grafting by using rootstock. The seeds of custard apple have hard endocarp, due to this hard and thick seed coat, it requires about 35-50 days for germination (Torres and Sanchez, 1992) [17]. For enhancing seed germination and growth of seedling, seed priming chemicals like GA_3, Urea, Thiourea, KNO_3, hot water as well as cow dung slurry, cow urine and various growing conditions were used. The germination of the seeds and growth of the seedlings are much influenced by the climatic conditions of the region. Mostly, sowing of custard apple seeds is carried out on the onset of monsoon, thereby restricting the availability of planting material for that particular season.

Materials and methods

The present experiment was carried out at Hi-Tech Horticulture Park, College of Horticulture, Junagadh Agricultural University, Junagadh (Gujrat) during July 2021 to October 2021. The experiment comprised of eight level of pre-soaking treatments (S) *viz*., S_1 = GA_3 500 ppm, S_2 = Thiourea 1%, S_3 = Urea 0.1%, S_4 = KNO_3 0.1%, S_5 = Cow dung slurry: Water (1:10), S_6 = Cow urine: Water (1:10), S_7 = Soaking in hot water, S_8 = Control and three levels of environmental conditions (E) *viz*., E_1 = Open field, E_2 = Net house, E_3 = Polyhouse having 24 treatment combinations. The experiment was laid out in poly bags in Completely Randomized Design (factorial) with three repetitions. There were 20 bags per treatment per repetitions. Observations were recorded using standard procedure and statistically analysed.

Results and Discussion

The effect of pre-soaking treatments and various environmental conditions on growth parameters was found significant during the investigation. Whereas, the interaction effect was found non-significant in all growth parameters except leaf area.

Height of seedling (cm) and length of internode (cm)

Among pre-soaking treatments, maximum height of seedling (33.41 cm) and internode length (2.18 cm) was observed in S_1 (GA_3 500 ppm) (Table 1). This might be due to fact that this hormone increased osmotic uptake of nutrients, causing cell multiplication and elongation in the cambium tissue of the internodal region which ultimately increase height of seedling. This findings are in conformity with the results as found by Pundhir and Mohammed (1988) [14] in papaya and Parvin *et al.* (2015) [13] in black walnut seeds.

Among environmental conditions, maximum height of seedling (30.62 cm) and internodal length (2.18 cm) was found in E_3 (Polyhouse) (Table 1). This might be due to favourable microclimatic condition in polyhouse. This findings are in conformity with the results as found by Brijwal *et al.* (2013) [6] in guava and Verma *et al.* (2019) [19] in aonla.

Number of leaves per seedling and leaf area (cm^2)

Among pre-soaking treatments, maximum number of leaves (18.36) and leaf area (43.30 cm^2) was noted in S_1 (GA_3 500 ppm) (Table 1). This might be due to the activity of GA_3 at apical meristem resulting in more synthesis of nucleoprotein which is responsible for increasing leaf number and expansion. Similar findings were also reported by Meena and Jain (2012) [12] and Anjanwe *et al.* (2013) [4] in Papaya.

Among environmental conditions, maximum number of leaves (17.02) and leaf area (37.94 cm^2) was found in E_3 (Polyhouse) (Table 1). This might be due to the congenial day and night temperature, proper light and relative humidity in polyhouse. Same result were also found by Sharma and Dhaliwal (2013) [16] in citrus and Brijwal *et al.* (2013) [6] in guava.

Among different treatment combinations, maximum leaf area (46.19 cm^2) was recorded in S_1E_3 (GA_3 500 ppm + Polyhouse) (Table 5). This might be due to fact that the favourable microclimate in polyhouse may stimulate the activity of GA_3 at apical meristem resulting more synthesis of nucleoprotein which is responsible for increasing leaf expansion. The similar result was found by Brijwal *et al.* (2013) [6] in guava and Verma *et al.* (2019) [19] in aonla.

Stem diameter (mm)

Among pre-soaking treatments, maximum stem diameter (4.03 mm) was observed in S_1 (GA_3 500 ppm) (Table 2). This might be due to fact that the GA_3 caused greater cell division and elongation at the stem portion resulting into the greater stem diameter. The above results are conformity with Meena and Jain (2012) [12] and Anjanawe *et al.* (2013) in papaya, Parvin *et al.* (2015) [13] in black walnut seeds.

Among environmental conditions, maximum stem diameter (3.68 mm) was noted in E_3 (Polyhouse) (Table 2). This might be due to fact that polyhouse provided favourable condition which increased cell division result in higher stem diameter. Same result was reported by Sharma and Dhaliwal (2013) [16] in citrus and Joshi *et al.* (2016) [9] in guava.

Fresh and dry weight of seedling (gm), Fresh weight of shoot

Among pre-soaking treatments, maximum fresh weight of seedling (8.27 gm), dry weight of seedling (3.05 gm) and fresh weight of shoot (5.64 gm) was observed in S_1 (GA_3 500 ppm) (Table 2). This might be due to mobilization of water and nutrients transported at higher rate which might have promoted more production of photosynthetic product and translocated them to various plant parts resulted in better growth of seedlings. Similar findings were also reported by Anjanwe *et al.* (2013) [4] and Ramteke *et al.* (2015) [15] in papaya, Parvin *et al.* (2015) [13] in black walnut seeds.

Among environmental conditions, maximum fresh weight of seedling (8.25 gm), dry weight of seedling (3.00 gm) and fresh weight of shoot (5.85 gm) was noted in E_3 (Polyhouse) (Table 2). This might be due to fact that polyhouse provided favourable condition of CO_2 level, light intensity and humidity that promote photosynthesis resulted into rapid growth of seedling. The similar result was found by Verma *et al.* (2019) [19] in aonla.

Seedling vigour index

Among pre-soaking treatments, maximum seedling vigour index (4801.80) was found in S_1 (GA_3 500 ppm) (Table 3). The similar result was found by Anburani and Shakila (2010) [1] in papaya and Vasantha *et al.* (2014) [18] in aonla.

Among environmental conditions, maximum seedling vigour index (4303.57) was found in E_3 (Polyhouse) (Table 3). Same result found by Verma *et al.* (2019) [19] in aonla.

Root parameters

Among pre-soaking treatments, maximum length of root

(16.19 cm), number of primary roots (20.71), number of secondary roots (45.18), fresh weight of root (2.29 gm), dry weight of root (1.06 gm) and root: shoot ratio (0.42) was noted in S_1 (GA_3 500 ppm). This might be due to, GA_3 promote cell multiplication and elongation in the meristematic region of the roots. Similar findings were also reported by Anjanwe *et al.* (2013) [4] in papaya and Parvin *et al.* (2015) [13] in black walnut seeds.

Among environmental conditions, maximum length of root (15.66 cm), number of primary roots (20.04), number of secondary roots (38.21), fresh weight of root (2.01 gm), dry weight of root (0.95 gm) and root: shoot ratio (0.43) was found in E_3 (Polyhouse). This might be due to the favorable environmental conditions under polyhouse. Same result found by Verma *et al.* (2019) [19] in aonla.

Table 1: Effect of pre-soaking treatments and environmental conditions on growth parameters at 90 DAS in custard apple var. Sindhan

Treatments	Height of seedling (cm)	Length of internode (cm)	Number of leaves	Leaf area (cm^2)
Factor A: Pre-soaking treatments				
S_1: GA_3 500 ppm	33.41	2.18	18.36	43.30
S_2: Thiourea 1%	32.18	2.08	17.58	40.32
S_3: Urea 0.1%	23.13	1.60	14.88	26.86
S_4: KNO_3 0.1%	30.23	1.91	17.42	39.36
S_5: Cow dung slurry: Water (1:10)	28.44	1.82	16.48	36.90
S_6: Cow urine: Water (1:10)	26.79	1.73	15.84	32.59
S_7: Soaking in hot water	25.06	1.64	15.74	29.48
S_8: Control	21.34	1.44	12.27	24.34
S. Em.±	0.48	0.04	0.27	0.67
C. D. at 5%	1.37	0.11	0.76	1.91
Factor B: Environmental conditions				
E_1: Open field	23.93	1.33	14.73	31.02
E_2: Net house	28.17	1.88	16.46	33.48
E_3: Polyhouse	30.62	2.18	17.02	37.94
S. Em.±	0.29	0.02	0.16	0.41
C. D. at 5%	0.84	0.06	0.47	1.17
Interaction (S x E)				
S. Em.±	0.83	0.06	0.47	1.16
C. D. at 5%	NS	NS	NS	3.30
C. V. %	5.23	6.17	5.02	5.90

Table 2: Effect of pre-soaking treatments and environmental conditions on growth parameters at 90 DAS in custard apple var. Sindhan

Treatments	Stem diameter (mm)	Fresh weight of seedling (gm)	Dry weight of seedling (gm)	Fresh weight of shoot (gm)
Factor A: Pre-soaking treatments				
S_1: GA_3 500 ppm	4.03	8.27	3.05	5.64
S_2: Thiourea 1%	3.82	7.94	2.90	5.39
S_3: Urea 0.1%	3.04	5.89	1.94	4.36
S_4: KNO_3 0.1%	3.28	7.62	2.67	5.26
S_5: Cow dung slurry: Water (1:10)	3.22	7.41	2.49	5.08
S_6: Cow urine: Water (1:10)	3.14	7.03	2.27	4.92
S_7: Soaking in hot water	3.04	6.34	2.14	4.74
S_8: Control	2.81	5.63	1.63	3.68
S. Em.±	0.06	0.14	0.05	0.12
C. D. at 5%	0.18	0.39	0.16	0.33
Factor B: Environmental conditions				
E_1: Open field	2.94	5.58	1.56	3.87
E_2: Net house	3.28	7.21	2.60	4.95
E_3: Polyhouse	3.68	8.25	3.00	5.85
S. Em.±	0.04	0.08	0.03	0.07
C. D. at 5%	0.11	0.25	0.10	0.20
Interaction (S x E)				
S. Em.±	0.11	0.24	0.09	0.20
C. D. at 5%	NS	NS	NS	NS
C. V. %	5.78	5.84	6.88	7.13

Table 3: Effect of pre-soaking treatments and environmental conditions on root parameters at 90 DAS in custard apple var. Sindhan

Treatments	Seedling vigour index	Length of root (cm)	Number of primary roots	Number of secondary roots
Factor A: Pre-soaking treatments				
S_1: GA_3 500 ppm	4801.80	16.19	20.71	45.18
S_2: Thiourea 1%	4242.09	15.62	20.01	42.23
S_3: Urea 0.1%	2432.32	13.70	16.19	29.44
S_4: KNO_3 0.1%	3717.30	15.13	19.65	39.11
S_5: Cow dung slurry: Water (1:10)	/3272.20	14.80	18.97	35.86
S_6: Cow urine: Water (1:10)	2916.61	14.58	18.43	32.90
S_7: Soaking in hot water	2540.48	14.26	17.41	31.08
S_8: Control	1833.66	12.69	14.03	27.92
S. Em.±	71.37	0.25	0.30	0.57
C. D. at 5%	202.93	0.71	0.85	1.62
Factor B: Environmental conditions				
E_1: Open field	2053.02	13.73	16.19	32.31
E_2: Net house	3302.09	14.48	18.31	35.88
E_3: Polyhouse	4303.57	15.66	20.04	38.21
S. Em.±	43.70	0.15	0.18	0.35
C. D. at 5%	124.27	0.43	0.52	0.99
Interaction (S x E)				
S. Em.±	123.64	0.43	0.52	0.98
C. D. at 5%	NS	NS	NS	NS
C. V. %	6.65	5.12	4.95	4.81

Table 4: Effect of pre-soaking treatments and environmental conditions on root parameters at 90 DAS in custard apple var. Sindhan

Treatments	Fresh weight of root (gm)	Dry weight of root (gm)	Root: shoot ratio
S_1: GA_3 500 ppm	2.29	1.06	0.42
S_2: Thiourea 1%	2.17	0.91	0.40
S_3: Urea 0.1%	1.54	0.60	0.36
S_4: KNO_3 0.1%	2.05	0.84	0.39
S_5: Cow dung slurry: Water (1:10)	2.00	0.78	0.38
S_6: Cow urine: Water (1:10)	1.88	0.72	0.38
S_7: Soaking in hot water	1.76	0.65	0.37
S_8: Control	1.26	0.56	0.34
S. Em.±	0.04	0.02	0.01
C. D. at 5%	0.11	0.05	0.03
Factor B: Environmental conditions			
E_1: Open field	1.67	0.52	0.34
E_2: Net house	1.92	0.83	0.37
E_3: Polyhouse	2.01	0.95	0.43
S. Em.±	0.02	0.01	0.01
C. D. at 5%	0.07	0.03	0.02
Interaction (S x E)			
S. Em.±	0.07	0.03	0.02
C. D. at 5%	NS	NS	NS
C. V. %	6.36	6.64	7.10

Table 5: Interaction effect of pre-soaking treatments and environmental conditions on leaf area at 90 DAS in custard apple var. Sindhan.

Treatments	Leaf area (cm^2)		
	E_1	E_2	E_3
S_1	39.98	43.72	46.19
S_2	38.55	40.04	42.37
S_3	23.03	24.29	33.25
S_4	36.89	39.81	41.38
S_5	34.20	36.67	39.83
S_6	27.13	33.42	37.23
S_7	26.53	27.72	34.21
S_8	21.82	22.19	29.02
S. Em.±	1.16		
C. D. at 5%	3.30		
C. V. %	5.90		

Conclusion

From the results obtained in the present experiment, it is concluded that the pre-soaking treatment of custard apple seed with 500 ppm GA_3 for 24 hrs. during the month of July-

October and polyhouse condition was found suitable for improving seedling height, number of leaves per seedling, stem diameter, length of internode, leaf area, fresh and dry weight of seedling, fresh weight of shoot, seedling vigour index, length of root, number of primary and secondary roots, fresh and dry weight of root and root: shoot ratio of custard apple. Whereas, among different treatment combinations, S_1E_3 (GA_3 500 ppm + Polyhouse) was found suitable for improving leaf area.

References

1. Anburani, A. and Shakila, A. Influence of seed treatment on the enhancement of germination and seedling vigour of papaya. Acta Hort. 2010;851:295- 298.
2. Anonymous. Indian Horticulture Database. National Horticulture Board, Ministry of Agriculture, Government of India, 2020, http://www.nhb.gov.in/ accessed on 21st March, 2022.
3. Anonymous. Indian Horticulture Database. National Horticulture Board, Ministry of Agriculture, Government of India, 2017, http://www.nhb.gov.in/ accessed on 21st March, 2022.
4. Anjanwe SR, Kanpure RN, Kachouli BK, Mandloi DS. Effect of plant growth regulators and growth media on seed germination and growth vigour of papaya. Annals of Plant and Soil Res. 2013;15(1):31-34.
5. Asmita J, Shailesh T, Anjana K, Ajit K, Karishma K. Response of growing environment in propagation of different cultivars of aonla (*Emblica officinalis* Gaertn). J Pharmacognosy Phytochem. 2018;7(5):2267-2271.
6. Brijwal M, Kumar R. Studies on the seed germination and subsequent seedling growth of guava (*Psidium guajava* L.). Indian J Agric. Res. 2013;47(4):347-352.
7. Desai A, Panchal B, Trivedi A, Prajapati D. Studies on seed germination and seedling growth of papaya (*Carica papaya* L.) cv. Madhubindu as influenced by media, GA_3 and cow urine under net house condition. J Pharmacognosy Phytochem. 2017;6(4):1448-1451.
8. Dinesh A, Padmapriya S, Kavino M, Raja K, Sujatha KB. Effect of different physical and chemical methods of seed treatment on germination and seedling growth attributes of guava (*Psidium guajava* L.). J Pharmacognosy Phytochem. 2019;8(3):4373-4377.
9. Joshi M, Syamal MM, Singh SP. Propagation techniques of *Psidium guajava* L. under different growing conditions. Bangladesh J Botany. 2016;45(2):313-320.
10. Kalyani M, Bharad SG, Parameshwar P. Effect of growth regulators on seed germination in guava. Int. J on Bio. Sci. 2014;5(2):81-91.
11. Lay P, Basavaraju GV, Sarika G, Amrutha N. Effect of seed treatment to enhance seed quality of papaya (*Carica papaya* I.) cv. Surya. G.J.B.A.H.S. 2013;2(3):221-225.
12. Meena RR, Jain MC. Effect of seed treatment of gibberellic acid on growth parameters of papaya seedlings. Prog. Hort. 2012;44(2):248-250.
13. Parvin P, Khezri M, Tavosolian I, Hosseini H. The effect of gibberellic acid and chilling stratification on seed germination of eastern black walnut (*Juglans nigra* L.). J nuts. 2015;6(1):67-76.
14. Pundhir GS, Mohammad S. The effect of pre-sowing treatment of IAA, GA, BAP, hot and cold water on seed germination and seedling growth of papaya (*Carica papaya*) Cv. Honey dew. Thesis M.Sc. (ag.), submitted to RAU, Bikaner, 1988.
15. Ramteke V, Dhpaithankar, Mahantesh K, Murli MB, Jubin C, Vivek K. Seed germination and seedling growth of papaya as influenced by GA_3 and propagation media. Intel. J of Farm Sci. 2015;5(3):74-81.
16. Sharma LK, Dhaliwal HS. Germination and growth of rough lemon (*Citrus jambhiri* Lush.) seedlings under protected environment. J. Horti. Sci. 2013;8(1):91-94.
17. Torres, Sanchez. The filipinization of the order of poor clares, Philippine Quarterly of Culture and Soc. 1992;21:17-24.
18. Vasantha PT, Vijendrakumar RC, Guruprasad TR, Mahadevamma M, Santosh KV. Studies on effect of growth regulators and biofertilizers on tamarind (*Tamarindus indica* L.). Plant Archives 2014;14(1):155-160.
19. Verma R, Pandey CS, Pandey SK, Sahu K. Influence of Pre-Sowing Seed Treatment and Growing Conditions on Growth Performance of Indian Gooseberry Seedlings (*Emblica officinalis* Gaertn). Int. J Curr. Microbiol. App. Sci. 2019;8(3):1936-1948.