

Research Article

Effect of Time of Sowing and Chemical Treatments on Seedling Growth of Custard Apple (*Annona squamosa* L.) cv. Sindhan

D. B. Dadhaniya*, D. R. Kanzaria, B. Sejal, T. Dhara and P. Varuti

Department of horticulture, college of Agriculture, JAU, Junagadh, Gujarat, India

Abstract

An experiment was conducted at Lalbaug, Fruit Research Station, Department of Horticulture, College of Agriculture, Junagadh Agriculture University, Junagadh during the year of 2018. The experiment laid out in Completely Randomized Design with three replications. The treatments comprised of three different levels of time of sowing (S) viz., S₁ - 15th April, S₂ - 15th May; S₃ - 15th June and six different levels of chemicals (M) viz., M₁ - Control, M₂ - GA₃ 200 ppm soaking for 24 hours, M₃ - Concentrated H₂SO₄ 0.1% soaking for 2 minutes, M₄ - Concentrated HCl 0.1% soaking for 2 minutes, M₅ - Cow dung and Cow urine slurry (1:2 ratio) soaking for 24 hours and M₆ - Hot water (50 to 60°C) soaking for 24 hours. The maximum height of seedling, stem girth, number of leaves, shoot length, root length, number of roots and fresh weight of shoot individually in 15th April sowing as well as in GA₃ 200 ppm treatment.

That among different time of sowing dates, 15th April sowing treated along with GA₃ 200 ppm seed soaking for 24 hours found to be the most effective for higher leaf area, dry weight of shoot, fresh and dry weight of root.

Keywords: Custard apple, Time of sowing, Chemicals, Seedling growth

*Correspondence

Author: Dadhaniya

Email: dishadadhaniya07@gmail.com

Introduction

Custard apple (*Annona squamosa* L.) is one of the delicious fruits relished by many for table purpose. Pleasant flavor, mild aroma and sweet taste have a universal acceptance. Custard Apple (*Annona squamosa* L.) belongs to the family Annonaceae and is one of the finest fruits introduced in India from tropical America. It is also found in wild form in many parts of India. It is also known as “sugar apple” or “sweetsop” in English while in Hindi “Sharifa” and “Sitaphal” are its common name. The custard apple (*Annona squamosa* L.) is the most widely distributed species of the *Annona* genus in the world. Due to hard and thick seed coat, it requires about 35-50 days for germination [1]. Irregular germination, in custard apple seeds may be due to dormancy or due to hard seed coat. Very limited work has been carried out on this aspect in India and in different parts of the world indicating, the utility of GA₃ and chemicals for getting better germination of custard apple seeds [2]. The date of sowing has its own importance in seed germination and seedling growth. For enhancing better, synchronized seed germination and growth of seedlings, seed scarification chemicals like GA₃, hot water, concentrated H₂SO₄, HCl as well as cow dung + cow urine slurry were used.

Materials and Methods

The experiment entitled “Effect of time of sowing and chemical treatments on seed germination and seedling growth of custard apple (*Annona squamosa* L.) cv. Sindhan” under protected condition during the year 2018 Lalbaug, Fruit Research Station, at Department of Horticulture, College of Agriculture, Junagadh Agricultural University, Junagadh (Gujarat). The trial laid out in Factorial Completely Randomized Design (FCRD), consisting two factors with three replication and eighteen treatment combinations. The treatments comprised of three different levels of time of sowing (S) viz., S₁ - 15th April, S₂ - 15th May; S₃ - 15th June and six different levels of chemicals (M) viz., M₁ - Control, M₂ - GA₃ 200 ppm soaking for 24 hours, M₃ - Concentrated H₂SO₄ 0.1% soaking for 2 minutes, M₄ - Concentrated HCl 0.1% soaking for 2 minutes, M₅ - Cow dung and Cow urine slurry (1:2 ratio) soaking for 24 hours and M₆ - Hot water (50 to 60°C) soaking for 24 hours.

Results and Discussion

Effect of time of sowing

Maximum seedling length (20.2, 39.01 and 50.01 cm) (Figure 1), seedling girth (2.39, 3.20 and 4.10 mm) and number

of leaves per seedling (5.26, 11.32 and 17.51) at 60, 90 and 120 DAS, respectively whereas maximum root length (16.70 cm) and shoot length (33.31 cm) at 120 DAS was recorded in S₁. Whereas the minimum seedling length (18.55, 37.77 and 46.56 cm), seedling girth (2.10, 2.92 and 3.82 mm) and number of leaves per seedling (4.98, 10.75 and 16.94), minimum root length (16.02 cm) and shoot length (30.54 cm) was found in S₃. Significantly, maximum no. of roots per seedling (11.02) was obtained with S₁, while minimum no. of roots per seedling (10.36) was observed with S₃. Significantly, the highest fresh weight of shoot (5.90 g) was obtained with S₁ while lowest fresh weight of shoot (5.54 g) was observed with S₃. This might be due to favourable temperature which enhances physiological activities of the entire shoot and root cells with good relative humidity which perhaps increased the seedling height, stem girth, no. of leaves. Similar results were obtained by [3] in Aonla [4] in custard apple.

Effect of chemical treatments

Significantly maximum seedling length (22.53, 45.00 and 53.82 cm), stem girth (2.48, 3.58 and 4.49 mm) (Table 1) and number of leaves (6.94, 12.90 and 19.10) (Figure 2) (Table 2) respectively at 60, 90 and 120 DAS, where maximum root length (16.99 cm) and significantly highest shoot length (36.83 cm) at 120 DAS recorded in M₂ (Table 2). Significantly the minimum seedling length (15.51, 31.17 and 36.94 cm), stem girth (2.04, 2.50 and 3.35 mm) and number of leaves (3.21, 9.35 and 15.36) respectively at 60, 90 and 120 DAS, were minimum root length (15.52 cm) and significantly lowest shoot length (21.25 cm) was found in treatment M₁. Maximum number of roots (11.57) was recorded in M₂ at 120 DAS, while minimum number of roots (9.54) at 120 DAS was found in M₁ (Table 2). The maximum fresh weight of shoot (6.55 g) was recorded in M₂ whereas the minimum fresh weight of shoot (4.95 g) (Table 2). GA₃ treatment might be due to reason that shoot growth result in production of photosynthates which is translocated through phloem to the root zone might be responsible for increase in root length. Exogenous application of GA₃ induced the activity of gluconeogenic enzymes during early stages of seed germination and this could be the reason for improved germination and vigour characteristics that is reflected in terms of increase in root length. Increase in shoot height due to GA₃ has also been reported by [2]. These results are in conformity with [5-10] in custard apple.

Table 1 Effect of time of sowing and chemical treatments on height of seedling and stem girth of custard apple cv. Sindhan

Treatments	Height of seedling (cm)			Stem girth (mm)		
	60 DAS	90 DAS	120 DAS	60 DAS	90 DAS	120 DAS
Time of sowing (S)						
S ₁ - 15 th April	20.02	39.01	50.01	2.39	3.20	4.10
S ₂ - 15 th May	18.84	38.27	49.26	2.22	3.03	3.91
S ₃ - 15 th June	18.55	37.77	46.64	2.10	2.96	3.82
S.Em±	0.137	0.274	0.451	0.026	0.049	0.042
C.D. at 5%	0.39	0.79	1.29	0.07	0.14	0.12
Chemical treatments (M)						
M ₁ - Control	15.51	31.17	36.94	2.04	2.64	3.35
M ₂ - GA ₃ 200 ppm soaking for 24 hours	22.53	45.00	53.82	2.48	3.58	4.49
M ₃ -Concentrated H ₂ SO ₄ 0.1% soaking for 2 min.	19.57	40.56	49.98	2.21	3.00	4.19
M ₄ - Concentrated HCl 0.1% soaking for 2 min.	21.15	43.33	52.35	2.39	3.37	4.39
M ₅ - Cow dung + Cow urine slurry (1:2 ratio) soaking for 24 hours	18.46	36.04	49.74	2.18	3.08	3.77
M ₆ - Hot water (50 to 60 °C) soaking for 24 hours	17.60	33.99	48.99	2.11	2.70	3.46
S.Em±	0.194	0.388	0.638	0.037	0.070	0.060
C.D. at 5%	0.56	1.11	1.83	0.11	0.20	0.17
Interaction (S x M)						
S.Em±	0.336	0.671	1.105	0.064	0.121	0.104
C.D. at 5%	NS	NS	NS	NS	NS	NS
C.V.%	3.04	3.03	3.93	4.93	6.83	4.56

The highest leaf area (13.03 cm²), maximum dry weight of shoot (3.93 g), dry weight of root (0.29 g) and fresh weight of root (1.60 g) was recorded in S₁M₂. While, the lowest leaf area (9.72 cm²), lowest dry weight of shoot (2.54 g), lowest dry weight of root (0.13 g) and lowest fresh weight of root (0.93 g) was recorded in S₃M₁ (Table 3 & 4). This may be attributed to optimum availability of temperature and light intensities required for maximizing the assimilatory surface area development resulted in higher leaf area. And GA₃ accumulation of nucleoprotein

responsible for increasing leaf initiation and leaf expansion. Similar effect of GA₃ on leaf area was noticed by [11] in papaya, [10] in custard apple. During this time of sowing gave favorable temperature and relative humidity for growth and development. That maximum shoot and root dry weight and maximum fresh weight of root might be due to the increase in shoot and root length and more translocation of carbohydrates to roots increases the shoot and root dry weight due to GA₃.

Table 2 Effect of time of sowing and chemical treatments on no. of roots, root length, shoot length, fresh weight of shoot and number of leaves of custard apple cv. Sindhan

Treatments	No. of roots	Root length cm	Shoot length cm	Fresh weight of shoot	No. of leaves		
					60 DAS	90 DAS	120 DAS
Time of sowing (S)							
S ₁ - 15 th April	11.02	16.70	33.31	5.90	5.26	11.32	17.51
S ₂ - 15 th May	10.53	16.35	31.87	5.65	5.16	10.89	16.99
S ₃ - 15 th June	10.36	16.02	30.54	5.54	4.98	10.75	16.94
S.Em±	0.111	0.143	0.667	0.076	0.036	0.086	0.122
C.D. at 5%	0.32	0.41	1.92	0.22	0.10	0.25	0.35
Chemical treatments (M)							
M ₁ - Control	9.54	15.52	21.25	4.95	3.21	9.35	15.36
M ₂ - GA ₃ 200 ppm soaking for 24 hours	11.57	16.99	36.83	6.55	6.94	12.90	19.10
M ₃ - Concentrated H ₂ SO ₄ 0.1% soaking for 2 min.	9.91	16.47	33.51	5.80	5.23	11.23	17.29
M ₄ - Concentrated HCl 0.1% soaking for 2 min.	11.44	16.92	35.43	6.42	6.15	12.42	18.15
M ₅ - Cow dung + Cow urine slurry (1:2 ratio) soaking for 24 hours	10.70	16.33	33.42	5.20	5.18	10.52	17.19
M ₆ - Hot water (50 to 60 °C) soaking for 24 hours	10.65	15.92	31.00	5.26	4.08	9.50	15.78
S.Em±	0.157	0.202	0.944	0.107	0.051	0.122	0.173
C.D. at 5%	0.45	0.58	2.71	0.31	0.15	0.35	0.50
Interaction (S x M)							
S.Em±	0.271	0.350	1.634	0.186	0.089	0.211	0.299
C.D. at 5%	NS	NS	NS	NS	NS	NS	NS
C.V. %	4.42	3.71	8.87	5.64	3.00	3.33	3.02

Table 3 Effect of time of sowing and chemical treatments on leaf area and dry weight of shoot of custard apple cv. Sindhan

	Leaf area (cm ²)				Dry weight of shoot (g)			
	S ₁	S ₂	S ₃	Mean (M)	S ₁	S ₂	S ₃	Mean (M)
M ₁	10.98	10.20	9.72	10.30	3.01	3.03	2.54	2.86
M ₂	13.03	12.58	12.24	12.62	3.93	3.64	3.98	3.85
M ₃	11.94	11.55	11.49	11.66	3.25	3.54	3.33	3.38
M ₄	12.57	12.55	12.29	12.47	3.84	3.69	3.58	3.70
M ₅	11.83	11.06	11.52	11.47	3.08	2.97	2.92	2.99
M ₆	12.03	10.78	10.52	11.11	3.19	3.12	2.84	3.05
Mean (S)	12.06	11.45	11.30		3.39	3.33	3.20	
	S	M	S X M		S	M	S X M	
S.Em±	0.08	0.11	0.20		0.02	0.03	0.12	
C.D.at 5%	0.24	0.33	0.58		0.07	0.10	0.34	
C.V. %	3.01				3.55			

Table 4 Effect of time of sowing and chemical treatments on fresh weight of root and dry weight of root of custard apple cv. Sindhan

	Fresh weight of root				Dry weight of root			
	S ₁	S ₂	S ₃	Mean (M)	S ₁	S ₂	S ₃	Mean (M)
M ₁	1.06	0.97	0.93	0.99	0.18	0.16	0.13	0.16

M ₂	1.60	1.59	1.58	1.59	0.29	0.27	0.23	0.26
M ₃	1.47	1.48	1.48	1.48	0.19	0.19	0.14	0.17
M ₄	1.51	1.50	1.53	1.52	0.25	0.27	0.16	0.23
M ₅	1.32	1.28	1.09	1.23	0.22	0.21	0.22	0.22
M ₆	1.04	1.07	0.94	1.02	0.20	0.17	0.14	0.17
Mean (S)	1.34	1.32	1.26		0.22	0.21	0.17	
	S	M	S X M		S	M	S X M	
S.Em±	0.01	0.02	0.03		0.003	0.005	0.01	
C.D.at5%	0.04	0.06	0.10		0.01	0.01	0.02	
C.V. %	4.54				7.10			



T₂ - S₁M₂ : (15th April + GA₃ 200 ppm soaking for 24 hours)
Height of seedling (cm)

Figure 1. Representative photos of the experiments conducted on the effects on the height of seedling in this study.



T₂ - S₁M₂ : (15th April + GA₃ 200 ppm soaking for 24 hours)
Number of leaves

Figure 2. Representative photos of the experiments conducted on the effects on the leaves in this study.

Conclusion

Height of seedling, stem girth, number of leaves, shoot length, root length, number of roots and fresh weight of shoot were observed, individually in 15th April sowing as well as in GA₃ 200 ppm treatment. 15th April seed sowing, treated with GA₃ 200 ppm seed soaking for 24 hours found to be the most effective for leaf area, fresh and dry weight of root. To raise custard apple seedling in net house, it should be sown on 15th April with soaking the seed in GA₃ 200 ppm for 24 hours to attain better seedling growth of custard apple cv. Sindhan.

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