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Effect of different seed treatment on seed germination of custard apple (*Annona squamosa* L.)

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Abstract

The present investigation entitled “Effect of different seed treatment on seed germination of Custard apple (*Annona squamosa* L.)” was carried out during the year 2023-24 in the shed net of Horticulture Research farm at Pt. Kishori Lal Shukla College of Horticulture and Research Station, Rajnandgaon, (C.G.). The investigation was framed in Completely Randomized Design and replicated thrice with eleven treatments. Among the different pre-sowing seed treatments, T₅ (GA₃ 400 ppm soaking for 24 hours) showed significant impact on minimum days to germination (17.60 days) and maximum germination percentage (87.44%), length of shoot (7.54, 15.00 and 24.64 cm), number of leaves per seedling (9.95, 12.75 and 14.60), girth of stem (2.60, 3.54 and 3.86 mm) at 60, 90 and 120 DAS respectively, length of seedling (39.64 cm) at 120 DAS, respectively as compared to rest of the other treatments. While T₀ Control (Distilled water) gave the minimum values for all the parameters measured.

Keywords: Custard apple, cow dung, cow urine, GA₃, germination

Introduction

Custard apple (*Annona squamosa* L.) is commonly known as Sugar apple or Sweetsoap in English while in hindi Sitaphal and Sharifa. Custard apple is considered as one of the most delicious and nutritionally valuable fruit. It contains moisture (70.5%), carbohydrate (25.2 g), total dietary fiber (2.4 g), protein (1.7 g), mineral (0.9 g), calcium (30 mg), magnesium (18 mg), phosphorus (21 mg), potassium (382 mg), sodium (4 mg), iron (0.71 mg) vitamin-A (33 IU) and vitamin-C (19.2 mg) per 100 g fruit pulp (USDA/Anon, 2019) ^[1].

In India, the total cultivated area under Custard apple is 47 thousand hectares with a production volume of 402 MT with a productivity of 8.71 MT (Anon., 2022) ^[2, 3]. The leading custard apple growing states are Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Orissa and Assam as well as some humid areas of Rajasthan. In Chhattisgarh, the total area under custard apple is 9.690 thousand hectares with an annual production of 53.715 thousand MT with a productivity of 5.44 MT (Anon., 2022) ^[2, 3].

Custard apples are mainly propagated by budding method and grafting method through using of rootstock. However the germination of custard apple is very poor and takes long time (generally take 35 to 50 days to germinate). Such seeds may require special treatments like scarification, soaking in water, growth regulators and chemicals etc. to overcome dormancy. Use of plant growth regulator may improve the germination of the seed and overcoming dormancy and causing rapid germination of seeds. For enhancing seed germination and growth of seedling, chemicals like concentrated H₂SO₄, concentrated HCL, hot water as well as cow dung and cow urine were also used.

Materials and Methods

The study was conducted experiment was carried out during the year 2023-2024 under Department of Fruit Science at Pt. Kishori Lal Shukla College of Horticulture and Research Station, Rajnandgaon (C.G.). The present experiment was carried out to study the effect different seed treatment on seed germination of Custard apple (*Annona squamosa* L.). The experimental design was CRD and there were eleven treatments which are replicated thrice. The treatment details are T₀ Control (Distilled water), T₁ Hot water treatment 50 to 60 °C

soaking for 24 hours, T₂ Cow urine (100%) soaking for 24 hours, T₃ Cow dung (100%) soaking for 24 hours, T₄ GA₃ (200 ppm) soaking for 24 hours, T₅ GA₃ (400 ppm) soaking for 24 hours, T₆ KNO₃ (1%) soaking for 12 hours, T₇ KNO₃ (2%) soaking for 12 hours, T₈ H₂SO₄ (0.1%) soaking for 2 minutes, T₉ HCL (0.1%) soaking for 2 minutes, T₁₀ Thiourea (1%) soaking for 12 hours.

The seeds of *annona* were soaked with these chemicals as per treatments concentrations and time according to the treatment separately. The seeds were removed from respective solutions and dried in shade on tissue paper for 15 minutes and then immediately used for sowing. Treated Custard apple seeds were sown on On 14th of August 2023 in polythene bags of 8" x 5" size containing media mixture of Soil, Sand and FYM media (3:1:1), one seed per poly bag was sown at a depth of 3-4 cm. After sowing seed light irrigation was given and poly bags were arranged as per treatments. Germination percentage was calculated based on the below mentioned formula:-

$$\text{Germination (\%)} = \frac{\text{Total no. of seed germinated}}{\text{Total no. of seeds sown}} \times 100$$

The observations were recorded for germination parameters viz. Days taken to germination, germination percentage and seedling growth parameters viz. Length of shoot (cm), Number of leaves per seedling, Girth of stem (mm), Length of seedling (cm). The experimental data collected relating to different parameters were statistically analyzed by Completely Randomized Design (CRD) and results were analyzed as per the guide lines suggested by Fisher and Yates (1963). The mean values of several parameters make up the data in the thesis and the crucial difference is used to compare the significance level. The OPSTAT portal, which is accessible on the CCS HAU website, was used to do statistical analysis.

Results and Discussion

Days taken to germination

The days taken to germination of different treatments varied from 17.60 days to 32.67 days. Among different treatment T₅ (GA₃ 400 ppm soaking for 24 hours) gave significantly minimum days taken to germination (17.60 days). While treatment T₀ (Control) recorded maximum days taken to germination (32.67 days).

GA₃ was effective treatment and it was recorded minimum days taken to germination might be due to GA₃ enhancing α -amylase hydrolyzing enzyme activity during the initial germination phase. Consequently, starch is converted into readily available carbohydrates and energy which facilitated embryo activation and expending the germination process. The above results are conformity with the results observed by Palepad *et al.* (2016) ^[11], Yadav *et al.* (2018) ^[22] in custard apple.

Germination percentage

The germination percentage of different treatments varied from 63.60% to 87.44%. Among different treatment T₅ (GA₃ 400 ppm soaking for 24 hours) gave significantly maximum Germination percentage (87.44%). While treatment T₀ (Control) recorded minimum germination percentage (63.60%).

It might be due to GA₃ regulates enzyme activity increasing alfa amylase and hydrolyzing enzymes to converts starch into simple carbohydrates which providing energy for germination. Additionally GA₃ improves water uptake, facilitating seedling emergence and counteracts the inhibitory effects of abscisic acid. GA₃ also increases RNA and protein synthesis, antioxidant activity and seedling establishment which lead to seedling establishment. The present results are closely supported with the results observed by Shirol *et al.* (2003) ^[20] in khirnee, Palepad *et al.* (2016) ^[11], Martinez *et al.* (2023) ^[9] in custard apple.

Length of shoot (cm)

Among different treatments significantly maximum length of shoot (7.54 cm, 15.00 cm, 24.64 cm) T₅ (GA₃ 400 ppm soaking for 24 hours). While minimum length of shoot was recorded in treatment T₀ (Control distilled water) (3.90 cm, 8.80 cm, 15.00 cm) at 60, 90 and 120 DAS, respectively.

It might be due to the result of GA₃ ability to increase nutrient intake by osmosis, which induces to cell elongation and cell division in custard apple shoots. Additionally GA₃ stimulates the production of auxins and other plant hormones such as cytokinins to promote cell growth and differentiation which ultimately leads to shoot length. The present findings are closely resemble with the results observed by Dilip *et al.* (2017) ^[4] in rangpur lime, Panda *et al.* (2018) ^[12] in kagzi lime, Jadhav *et al.* (2016) ^[7], Parmar *et al.* (2016) ^[13], Rajput *et al.* (2020) ^[16] in custard apple.

Number of leaves per seedling

Among different treatments significantly maximum number of leaves per seedling (9.95, 12.75 and 14.60) was recorded in treatment T₅ (GA₃ 400 ppm soaking for 24 hours). While minimum number of leaves per seedling was recorded in treatment T₀ (Control) (5.00, 7.10 and 9.23) at 60, 90 and 120 DAS, respectively.

It might be due to GA₃ treatment induces cell division and elongation in the apical meristem, mediated by auxin and cytokinin signaling pathways. GA₃ up regulates gene involved in leaf initiation and expansion, leading to increased leaf primordial formation and nucleoprotein synthesis ultimately enhancing number of leaves per seedling. This findings are close agreements with the results observed by Jadhav *et al.* (2016) ^[7], Patel *et al.* (2016) ^[14], Palepad *et al.* (2017) ^[10], Pritee *et al.* (2019) ^[15] in custard apple and Shinde and Malshe (2015) ^[19] in khirni.

Girth of stem (mm)

Among different treatments significantly maximum girth of stem (mm) (2.60 mm, 3.54 mm and 3.86 mm) was recorded in treatment T₅ (GA₃ 400 ppm soaking for 24 hours). While minimum girth of stem (mm) was recorded in treatment T₀ (Control) (1.45 mm, 2.20 mm and 2.45 mm) at 60, 90 and 120 DAS, respectively.

It might be possible due to GA₃ treatment promoted stem girth expansion in custard apple seedlings by accelerating cell division and elongation rates. This growth response is likely mediated by GA₃ stimulation of cambial activity, resulting in enhanced secondary growth and increased stem girth. The present results are closely associated with the findings observed by Patel *et al.* (2016) ^[14], Mane *et al.* (2018) ^[8], Pritee *et al.* (2019) ^[15], and Rawat and Pandey (2019) ^[18] in custard apple.

Length of seedling (cm)

The statistical analysis revealed that the significantly maximum length of seedling (39.64 cm) was obtained in the treatment T₅ (GA₃ 400 ppm soaking for 24 hours). While treatment T₀ (Control) recorded minimum length of seedling (23.67 cm).

The maximum length of seedling observed in GA₃ might be

attributed to gibberellic acid enhanced and activated α -amylase levels. These factors facilitate the breakdown of complex carbohydrates into simple sugars which providing readily available energy and nutrients for rapid seedling growth and development. These results are in close agreement with the results observed by Patel *et al.* (2016)^[14], Raut and Kotecha (2020)^[17], in custard apple.

Table 1: Effect of different seed treatment on Days taken to germination, Germination percentage, Length of shoot (cm)

Notations	Treatment details	Days taken to germination	Germination percentage	Length of shoot (cm)		
				60 DAS	90 DAS	120 DAS
T ₀	Control (Distilled water) soaking for 24 hours	32.67	63.60 (8.037)	3.90	8.80	15.00
T ₁	Hot water treatment 50 to 60 °C soaking for 24 hours	28.70	69.00 (8.365)	4.10	9.00	15.20
T ₂	Cow urine (100%) soaking for 24 hours	25.60	73.30 (8.619)	4.94	9.67	16.18
T ₃	Cow dung (100%) soaking for 24 hours	26.66	72.77 (8.589)	4.67	9.57	15.80
T ₄	GA ₃ (200 ppm) soaking for 24 hours	18.40	84.20 (9.226)	6.90	14.12	23.40
T ₅	GA ₃ (400 ppm) soaking for 24 hours	17.60	87.44 (9.402)	7.54	15.00	24.64
T ₆	KNO ₃ (1%) soaking for 12 hours	20.20	81.00 (9.055)	6.30	11.37	19.20
T ₇	KNO ₃ (2%) soaking for 12 hours	19.19	82.68 (9.145)	6.55	11.65	19.46
T ₈	H ₂ SO ₄ (0.1%) soaking for 2 minutes	23.40	77.00 (8.831)	5.19	10.10	18.30
T ₉	HCL (0.1%) soaking for 2 minutes	24.00	75.33 (8.733)	5.14	10.00	18.00
T ₁₀	Thiourea (1%) soaking for 12 hours	22.33	80.60 (9.032)	5.60	10.30	18.65
SE(m) \pm		0.66	2.20	0.14	0.30	0.63
CD at 5%		1.93	6.45	0.42	0.89	1.84
CV (%)		4.83	4.95	4.46	4.85	5.85

Note: SQRT value depicted under brackets

Table 2: Effect of different seed treatment on Number of leaves per seedling, Girth of stem (mm), Length of seedling (cm)

Notations	Treatment details	Number of leaves per seedling			Girth of stem (mm)			Length of seedling (cm)
		60 DAS	90 DAS	120 DAS	60 DAS	90 DAS	120 DAS	
T ₀	Control (Distilled water) soaking for 24 hours	3.90	8.80	15.00	1.45	2.20	2.45	23.67
T ₁	Hot water treatment 50 to 60 °C soaking for 24 hours	4.10	9.00	15.20	1.80	2.52	2.74	26.40
T ₂	Cow urine (100%) soaking for 24 hours	4.94	9.67	16.18	2.00	2.70	2.92	27.28
T ₃	Cow dung (100%) soaking for 24 hours	4.67	9.57	15.80	1.95	2.64	2.84	26.74
T ₄	GA ₃ (200 ppm) soaking for 24 hours	6.90	14.12	23.40	2.50	3.38	3.65	38.40
T ₅	GA ₃ (400 ppm) soaking for 24 hours	7.54	15.00	24.64	2.60	3.54	3.86	39.64
T ₆	KNO ₃ (1%) soaking for 12 hours	6.30	11.37	19.20	2.23	3.00	3.20	33.26
T ₇	KNO ₃ (2%) soaking for 12 hours	6.55	11.65	19.46	2.30	3.10	3.28	33.46
T ₈	H ₂ SO ₄ (0.1%) soaking for 2 minutes	5.19	10.10	18.30	2.14	2.90	3.12	30.25
T ₉	HCL (0.1%) soaking for 2 minutes	7.10	9.00	11.20	2.10	2.85	3.07	29.10
T ₁₀	Thiourea (1%) soaking for 12 hours	7.90	10.10	12.30	2.17	2.96	3.17	30.65
SE(m)		0.20	0.30	0.39	0.05	0.07	0.07	1.13
C.D. at 5%		0.57	0.87	1.14	0.14	0.19	0.22	3.32
C.V. (%)		4.55	5.23	5.70	3.84	3.97	4.05	6.36

Conclusion

The following conclusions can be made: It can be concluded that in case of seed germination parameters *viz.*, days taken to germination, germination percentage seeds treatment with T₅ (GA₃ 400 ppm soaking for 24 hours) performed the best and resulted superior then rest of other treatment. In case of seedling growth parameters *viz.* Length of shoot (cm), Number of leaves per seedling, Girth of stem (mm), Length of seedlings (cm). Seeds treatment with T₅ (GA₃ 400 ppm soaking for 24 hours) performed the best and resulted superior then rest of other treatment.

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