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Influence of different pre-sowing treatments on seed germination and seedling growth parameters of Custard apple (*Annona squamosa* L.)

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Abstract
The present investigation entitled "Influence of different pre-sowing treatments on seed germination and seedling growth parameters of Custard apple (*Annona squamosa* L.)" was carried out during the year 2022-2023 at Centre of Excellence on Protected Cultivation and Precision Farming, Department of Fruit Science, College of Agriculture, IGKV, Raipur (C.G.). The experiment was employed in Completely Randomized Design having thirteen different treatments, which replicated thrice. The different pre-soaking agents were *i.e.* cow dung, cow urine and GA_3 with their different concentrations. The seeds treated with GA_3 @ 200 ppm took minimum days to start germination (23.33 days), 50% germination (46.66 days) and the germination percentage (83.33%) of custard apple was found maximum under the same treatment. The plant growth parameters *viz.* plant height (15.68 cm), number of leaves per seedling (13.66) and girth of stem (3.71 mm) at 120 days after sowing influenced significantly under the seeds treated with gibberellic acid @ 200 ppm, which was closely followed by cow dung (100%).

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

Introduction
Custard apple (*Annona squamosa* L.) is also known as Sitaphal, Sugar apple, Sweet soap etc, which is grown in tropical and subtropical climates. It belongs to the Annonaceae family and is a native of the West Indies but it has long been cultivated in Central America and Southern Mexico.

Custard apples provide 1.8 g of protein, 0.57 g of fat, 20.82 g of carbs, 54 g of calcium, 0.3 mg of iron, 0.10 g of thiamine, 0.06 g of riboflavin and 35.9 g of ascorbic acid (Food value per 100 g of edible portion).

The subtropical fruit Custard apple prefers a warm, humid region with mild winters for maximum production. It can withstand temperatures down to several degrees below freezing, but in northern India, temperatures above 40 °C produce profuse flower abscission. It can be grown commercially well in regions with a 125-250 cm annual rainfall. The ideal temperature range is between 15 and 25 °C. It can be effectively grown up to 1000 metres above sea level and has a wide range of adaptation (Venkatratnam and Satyanaryana Swamy, 1956, Joshi *et al.*, 1999, Joshi *et al.*, 2000 and Bose *et al.*, 2002) [20, 11, 12, 5].

There are more than 100 species in the genus, five of which have edible fruits. Commercially significant species include *Annona squamosa* L. (Custard Apple), *Annona reticulata* L. (Bullock Heart, Ramphal) and *Annona cherimola* (Hanu-manphal). Among all the species Custard apple is the most popular monoecious fruit in India and is also known as Sitaphal, Sugar Apple and Sweet Sop.

Custard apples are typically reproduced by seed, however because of their hard, thick seed coats, they take 35 to 50 days to germinate. To achieve optimal and greater germination and strong seedling growth under nursery, seed requires pre-treatments that aid in the promotion of early and higher germination rates with robust and healthy seedlings (Chadha, 2010) [6].

Seed priming is a seed treatment, in which seeds are hydrated with bio-active chemical to initiate the pre-germinative metabolism in embryo, which accelerate the rapid germination and growth of the seedling.

The use of plant growth regulators in proper concentration with scarification can regulate growth behavior in most of the fruit crops and pre-sowing treatment of growth regulators could lead to increase in seed germination and strengthening of seedling growth. Without the

usage of growth regulators, seeds exhibited poor germination and development. Plant growth regulators, such as GA_3, IBA, and IAA, improve seedling germination and survival. Gibberellins (GA_3) mobilise the energy reserves from the endosperm, activate the vegetative growth of the embryo and weaken the endosperm layer that surrounds the embryo and limits its expansion.

The prices of growth regulators have gone sky high so to overcome this crisis some alternatives for growth regulators are easy to access and cheap. This has diverted the focus to shift in that the organics, today's cow dung and urine are employed as a growing medium. The germination of Custard apple seeds are also accelerated by soaking in 10% cow urine or cow dung solution for 24 hours. Using cow urine could lead to a breakthrough in the current situation since it is easily available. Cow urine contains iron, urea, uric acid, estrogen and progesterone has very good impact on seeds germination, seedling growth parameters and vigour of plants.

Materials and Methods

The present experiment was conducted at Centre of Excellence on Protected Cultivation and Precision Farming, Department of Fruit Science, College of Agriculture, IGKV, Raipur (C.G.) during the year 2022-23. The combinations of different treatments were *viz.* T_0 : Control (Soaking of seeds for 24 hours in Distilled water), T_1 : Soaking of seeds for 24 hours in GA_3 @ 200 ppm, T_2 : Soaking of seeds for 24 hours in Cow dung (100%), T_3 : Soaking of seeds for 24 hours in Cow urine (100%), T_4 : Soaking of seeds for 24 hours in Cow dung (25%) + Cow urine (75%), T_5 : Soaking of seeds for 24 hours in Cow dung (50%) + Cow urine (50%), T_6 : Soaking of seeds for 24 hours in Cow dung (75%) + Cow urine (25%), T_7 : Soaking of seeds for 24 hours in Cow dung (25%) + water (75%), T_8 : Soaking of seeds for 24 hours in Cow dung (50%) + water (50%), T_9 : Soaking of seeds for 24 hours in Cow dung (75%) + water (25%), T_{10} : Soaking of seeds for 24 hours in Cow urine (25%) + water (75%), T_{11} : Soaking of seeds for 24 hours in Cow urine (50%) + water (50%) and T_{12} : Soaking of seeds for 24 hours in Cow urine (75%) + water (25%). The experiment was employed in completely randomized design with three replications.

Custard apple fruits of uniform size and full ripeness were gathered for seed extraction. The extracted seeds were rinsed under running water and dried for an hour in the shade. Seeds were soaked in water before drying to eliminate the floating, dead seeds. The required amount of GA_3 was weighed with the help of an electronic balance. After being weighed, GA_3 was placed into a glass beaker using a gentle brush and then 1000 ml of distilled water was added to create a solution of 200 ppm concentration. In a glass beaker, fresh cow urine and fresh cow dung were measured one at a time. Distilled water was then added to create the 25, 50, 75 and 100 per cent solutions for the various treatments. The extracted seeds were placed in a 250 ml glass beaker for 24 hours of seed soaking. Each glass beaker was filled with a freshly made solution of GA_3, cow dung and cow urine in desired concentrations according to the treatment separately. Black poly bags with dimensions of 8" × 5" and a thickness of 200 gauge were used for sowing of seeds. The media, which consisted of soil, sand and FYM in the proportions of 3:1:1, were placed inside the poly bags. Treated custard apple seeds were sown after 24 hours in polythene bags. The observations regarding germination parameters *viz.* days taken to start germination, days taken to 50% germination, germination percentage, growth parameters *viz.* plant height (cm), number of leaves per seedling and girth of stem (mm) were recorded.

Result and Discussion

Seed germination parameters

Days taken to start germination

As per the data displayed in Table 1, it is clear that the minimum days taken to start gemination (17.20 days) was confirmed under the treatment T_1 (soaking of seeds for 24 hours in GA_3 @ 200 ppm), which was found non-significant differences with the treatments T_2, T_3 & T_4 having respective days taken to start germination of 18.30, 18.40 & 18.40 days under the present investigation. However the treatments T_2, T_3, T_4, T_5, T_6, T_9 & T_8 and T_5, T_6, T_9, T_8, T_7 & T_{12} and T_6, T_9, T_8, T_7, T_{12} & T_{11} having the number of days taken to start germination of 18.30, 18.40, 18.40, 18.66, 19.00, 19.33 & 19.66 and 18.66, 19.00, 19.33, 19.66, 19.86 & 20.00 and 19.00, 19.33, 19.66, 19.86, 20.00 & 20.33 days, respectively were recorded statistically at par with each other at 5% level of significance under the study. Similarly the treatments T_{10}, T_{11}, T_{12}, T_7, T_8 & T_9 having respective days taken to start germination of 20.66, 20.33, 20.00, 19.86, 19.66 & 19.33 days were also registered statistically equivalent with each other under the present experiment. The maximum number of days taken to start germination (23.33 days) was enrolled under the treatment T_0 (control).

The decrease in number of days taken to start germination of custard apple seedlings might be due to the fact that GA_3 plays an important role in two stages of germination one at initial enzyme induction and other in activation of reverse food mobilizing system, which helps in enhancement of germination. The above results are conformity with the results observed by Suryakanth *et al.* (2005) [19] in guava, Anburani and Shakila (2010) [1], Babu *et al.* (2010) [3] and Barche *et al.* (2010) [4] in papaya and Yadav *et al*. (2018) [22] in custard apple.

Days taken to 50% germination

As per the data displayed in Table 1, it is clear that the minimum days taken to 50% gemination (33 days) was registered under the treatment T_1 (soaking of seeds for 24 hours in GA_3 @ 200 ppm), which was found non-significant differences with the treatments T_2 & T_3 having respective days taken to 50% germination of 34.66 & 35.00 days under the present investigation. However the treatments T_2, T_3, T_4, T_5 & T_6 and T_4, T_5, T_6, T_9, T_8 & T_7 and T_8, T_7 & T_{12} having the number of days taken to 50% germination of 34.66, 35.00, 36.33, 37.00 & 37.33 and 36.33, 37.00, 37.33, 38.00, 38.33 & 39.00 and 38.33, 39.00 & 41.00 days, respectively were recorded statistically at par with each other at 5% level of significance under the study. The maximum number of days taken to 50% germination (46.66 days) was marked under the treatment T_0 (control).

The decrease in number of days taken to 50% germination of custard apple seedlings might be due to the fact that GA_3 plays an important role in the activity of alpha-amylase, which catalyzes the breakdown of starch into simple carbohydrates and releases chemical energy that is needed to activate embryonic stem cells, explaining the hopeful effect on seed germination (Anjanawe *et al*., 2013) [2]. The present results are closely supported with the results observed by Palanisamy *et al.* (1987) [15] in papaya and Martinez *et al.* (2016) [13] in custard apple.

Germination percentage

It is apparent from the Table 1, that the maximum gemination percentage (83.33%) was noticed under the treatment T_1 (soaking of seeds for 24 hours in GA_3 @ 200 ppm), which was found non-significant differences with the treatments T_2, T_3, T_4 & T_5 having respective gemination percentage of 80.00, 79.33, 76.33 & 75.00 under the present investigation. However the treatments T_2, T_3, T_4, T_5, T_6, T_9, T_8, T_7 & T_{12} having the gemination percentage of 80.00, 79.33, 76.33, 75.00, 74.33, 74.00, 73.66, 72.66 & 72.00 and 38.33, 39.00 & 41.00, respectively were recorded statistically at par with each other at 5% level of significance under the study. Similarly the treatments T_{10}, T_{11}, T_{12}, T_7, T_8, T_9, T_6, T_5 & T_4 having respective gemination percentage of 69.33, 70.00, 72.00, 72.66, 73.66, 74.00, 74.33, 75.00 & 76.33 were also registered statistically equivalent with each other under the present experiment. The minimum gemination percentage (53.33%) was registered under the treatment T_0 (control).

The increase in germination percentage of custard apple seedlings might be due to the fact that GA_3 participates in the activity of alpha-amylase, which catalyzes the starch conversion into simple carbohydrates and chemical energy is liberated, which is used in the activation of embryo. This result is in close conformity with the findings observed by Babu *et al.* (2010) [3], Barche *et al.* (2010) [4] and Deb *et al.* (2010) [7] in papaya and Garge *et al.* (2011) [9] in custard apple.

Growth parameters

Plant height (cm)

The observations on plant height of custard apple seedlings recorded at 30, 60, 90 and 120 days after sowing was significantly influenced by cow dung, cow urine and GA_3 treatments tested under the present investigation, which are presented in Table 2.

At 30 DAS, the plant height of custard apple seedlings were significantly influenced under the different pre-soaking agents. The maximum plant height (8.01 cm) was recorded under the treatment T_1 (soaking of seeds for 24 hours in GA_3 @ 200 ppm), which was found significantly superior among rest of the other treatments tested under the present investigation. However the treatments T_2, T_3, T_4, T_5, T_6, T_9, T_8, T_{12}, T_{11} & T_{10} with their average plant height of 7.72, 7.65, 7.55, 7.45, 7.38, 7.20, 6.98, 6.70 & 6.60 cm, respectively were showed significant differences with each other at 5% level of significance. The minimum plant height (4.32 cm) was perceived under the treatment T_0 (control).

At 60 DAS, the maximum plant height (9.68 cm) was noticed under the superiority of treatment T_1 (soaking of seeds for 24 hours in GA_3 @ 200 ppm), which was found non- significant differences with the treatments T_2 & T_3 having respective plant height of 9.39 & 9.32 cm under the present investigation. Similarly the treatments T_2, T_3, T_4, T_5 & T_6 and T_3, T_4, T_5, T_6 & T_9 and T_6, T_9 & T_8 and T_9, T_8, T_7 & T_{12} having plant height of 9.39, 9.32, 9.22, 9.12 & 9.05 and 9.32, 9.22, 9.12, 9.05 & 8.87 and 9.05, 8.87 & 8.65 and 8.87, 8.65, 8.51 & 8.46 cm, respectively were recorded statistically at par with each other at 5% level of significance under the present study. The minimum plant height (5.82 cm) was obtained under treatment T_0 (control).

At 90 DAS, the maximum plant height (12.18 cm) was demonstrated under the treatment T_1 (soaking of seeds for 24 hours in GA_3 @ 200 ppm), which was found non- significant differences with the treatments T_2, T_3 & T_4 having respective plant height of 11.89, 11.82 & 11.72 cm under the present investigation. The minimum plant height (8.32 cm) was enrolled under treatment T_0 (control).

At 120 DAS, the excellency of treatment T_1 (soaking of seeds for 24 hours in GA_3 @ 200 ppm) recorded maximum plant height of custard apple seedlings (15.68 cm), which was seen non-significant differences with the treatments T_2, T_3 & T_4 having respective plant heights of 15.39, 15.32 & 15.22 cm under the present investigation. Moreover the treatments T_2, T_3, T_4, T_5 & T_6 and T_3, T_4, T_5, T_6 & T_9 and T_5, T_6, T_9 & T_8 and T_9, T_8, T_7 & T_{12} having plant height of 15.39, 15.32, 15.22, 15.12 & 15.05 and 15.32, 15.22, 15.12, 15.05 & 14.87 and 15.12, 15.05, 14.87 & 14.65 and 14.87, 14.65, 14.51 & 14.46 cm, respectively were observed statistically at par with each other at 5% level of significance under the present study. The minimum plant height (10.79 cm) was obtained under treatment T_0 (control).

The increase in plant height of custard apple seedlings might be due to the result of GA_3's ability to increase nutrient intake by osmosis, which leads to cell elongation, increases internodal length, which ultimately leads to plant height. The present findings are closely resemble with the results observed by Wagh *et al.* (1998) [21] in aonla, Pampanna and Sulikeri (2001) [16] in sapota and Rajput *et al.* (2020) [17] in custard apple.

Number of leaves per seedling

The data referring to number of leaves per seedlings observed at 30, 60, 90 and 120 days after sowing showed significant variations among different treatments tested under the present investigation. The results are presented in Table 3.

It is apparent from the data gathered in Table 3, at 30 DAS the significant variations were observed among the treatments in respect to number of leaves per seedling under the present study having maximum number of leaves per seedling (7.86) was recorded under the treatment T_1 (soaking of seeds for 24 hours in GA_3 @ 200 ppm), which was found non- significant differences with the treatment T_2 having number of leaves per seedling of 7.46 under the present investigation. However the treatments T_2 & T_3 and T_3 & T_4 and T_4, T_5 & T_6 and T_5, T_6 & T_9 and T_9 & T_8 and T_8, T_7 & T_{12} and T_7, T_{12} & T_{11} having number of leaves per seedling 7.46 & 7.20 and 7.20 & 6.86 and 6.86, 6.54 & 6.46 and 6.54, 6.46 & 6.26 and 6.26 & 5.86 and 5.86, 5.66 & 5.66 and 5.66, 5.66 & 5.26, respectively were recorded statistically at par with each other at 5% level of significance. The minimum number of leaves per seedling (3.55) was obtained under treatment T_0 (control).

At 60 DAS, the maximum number of leaves per seedling (8.01 cm) was recorded under the supremacy of treatment T_1 (soaking of seeds for 24 hours in GA_3 @ 200 ppm), which was found significantly superior among all other treatments tested under the present trial. The minimum number of leaves per seedling (4.94) was recorded under the treatment T_0 (control).

Similarly at 90 DAS, the maximum number of leaves per seedling (12.66) was perceived under the treatment T_1 (soaking of seeds for 24 hours in GA_3 @ 200 ppm), which was found significantly superior among all other treatments. However the treatments T_2 & T_3 and T_4, T_5 & T_6 and T_5, T_6 & T_9 and T_9 & T_8 and T_8, T_7 & T_{12} and T_7, T_{12} & T_{11} having number of leaves per seedling of 11.86 & 11.66 and 10.86, 10.73 & 10.46 and 10.73, 10.46 & 10.26 and 10.26 & 9.86 and 9.86, 9.66 & 9.66 and 9.66, 9.66 & 9.26, respectively were observed statistically at par with each other at 5% level of significance. The minimum number of leaves per seedling (7.40) was marked

under treatment T_0 (control).

At 120 DAS, almost similar trends of results were observed in respect to number of leaves per seedling. The maximum number of leaves per seedling (13.66) was inspected under the superiority of treatment T_1 (soaking of seeds for 24 hours in GA_3 @ 200 ppm), which was found significantly superior among all other treatments. Furthermore the treatments T_2 & T_3 and T_4, T_5 & T_6 and T_5, T_6 & T_9 and T_9 & T_8 and T_8, T_7 & T_{12} and T_7, T_{12} & T_{11} having number of leaves per seedling of 12.86 & 12.66 and 11.86, 11.66 & 11.46 and 11.66, 11.46 & 11.26 and 11.26 & 10.86 and 10.86, 10.66 & 10.46 and 10.66, 10.46 & 10.26, respectively were claimed statistically at par with each other at 5% level of significance. The minimum number of leaves per seedling (8.40) was obtained under treatment T_0 (control).

The increase in number of leaves per seedling of custard apple might be due to the result of activity of GA_3 in the apical meristem, which causes more of the nucleoprotein responsible for increasing leaf initiation to be synthesised, may be the likely cause of the increase in the number of leaves. This findings are close agreements with the results observed by Jadhav *et al.* (2015) [10] in custard apple and Shinde and Malshe (2015) [18] in khirni.

Girth of stem

The data related to girth of stem of custard apple seedlings observed at 30, 60, 90 and 120 days after sowing was found to be significant different due to cow dung, cow urine and GA_3 treatments tested under the present investigation, which are demonstrated in Table 4.

At 30 DAS, the significant variations were noticed among the treatments in respect to girth of stem under the present study. The maximum girth of stem (7.86 mm) was detected under the treatment T_1 (soaking of seeds for 24 hours in GA_3 @ 200 ppm), which was found non-significant differences with the treatment T_2, T_3, T_4, T_5, T_6, T_9, T_8, T_{10} & T_7 having girth of stem of 1.78, 1.72, 1.66, 1.64, 1.60, 1.56, 1.55, 1.54 & 1.52 mm, respectively under the present investigation. The minimum girth of stem (0.86 mm) was obtained under the treatment T_0 (control).

At 60 DAS, the maximum girth of stem (2.66 mm) was recorded under the superiority of treatment T_1 (soaking of seeds for 24 hours in GA_3 @ 200 ppm), which was found statistically at par with the treatments T_2, T_3, T_4, T_5, T_6, T_9, T_8, T_{10} & T_7 having girth of stem of 2.53, 2.47, 2.39, 2.39, 2.35, 2.31, 2.29, 2.29 & 2.27 mm under the present investigation. The treatment T_0 (control) recorded minimum girth of stem (1.45 mm) under the present experiment.

Similarly at 90 DAS, the maximum girth of stem (3.41 mm) was confirmed under the treatment T_1 (soaking of seeds for 24 hours in GA_3 @ 200 ppm), which was found non- significant differences with the treatment T_2, T_3, T_4, T_5, T_6, T_9, T_8, T_{10} & T_7 having girth of stem of 3.28, 3.22, 3.14, 3.12, 3.10, 3.06, 3.04, 3.04 & 3.02 mm under the present investigation. The minimum girth of stem (2.20 mm) was monitored under treatment T_0 (control).

As per the data flashed in Table 4, at 120 DAS the girth of stem (3.71 mm) was recorded maximum under the excellency of treatment T_1 (soaking of seeds for 24 hours in GA_3 @ 200 ppm), which was found non-significant differences with the treatment T_2, T_3, T_4, T_5, T_6, T_9, T_8, T_{10} & T_7 having girth of stem of 3.58, 3.52, 3.44, 3.42, 3.40, 3.36, 3.34, 3.34 & 3.32 mm, respectively under the present investigation. Additionally the treatments T_2, T_3, T_4, T_5, T_6, T_9, T_8, T_{10}, T_7 & T_{11} and T_3, T_4, T_5, T_6, T_9, T_8, T_{10}, T_7, T_{11} & T_{12} having girth of stem of 3.58, 3.52, 3.44, 3.42, 3.40, 3.36, 3.34, 3.34, 3.32 & 3.22 and 3.52, 3.44, 3.42, 3.40, 3.36, 3.34, 3.34, 3.32, 3.22 & 3.12 mm, respectively were examined statistically at par with each other at 5% level of significance. The minimum girth of stem (2.50 mm) was obtained under the treatment T_0 (control).

The increase in girth of stem of custard apple seedlings might be due to the fact that GA_3 application enhanced the rate of cell division and elongation of stem portion. Increase in stem girth may be possible due to stimulation of cambium and its immediate cell progeny as observed by Dhankar and Singh (1996) [8] in aonla. The present results are closely associated with the findings observed by Dhankar and Singh (1996) [8] in aonla and Barche *et al.* (2010) [4], Meena and Jain (2012) [14], Deb *et al.* (2010) [7], Anjanwe *et al.* (2013) [2] in papaya.

Table 1: Effect of Cow dung, Cow urine and GA_3 on days taken to start germination, days taken to 50% germination and germination percentage of custard apple seedlings

Notations	Treatment details	Days taken to start germination	Days taken to 50% germination	Germination percentage
T_0	Soaking of seeds for 24 hours in Distilled water (Control)	23.33^{f}	46.66^{f}	53.33^{a}
T_1	Soaking of seeds for 24 hours in GA_3 @ 200 ppm	17.20^{a}	33.00^{a}	83.33^{d}
T_2	Soaking of seeds for 24 hours in Cow dung (100%)	18.30^{ab}	34.66^{ab}	80.00^{cd}
T_3	Soaking of seeds for 24 hours in Cow urine (100%)	18.40^{ab}	35.00^{ab}	79.33^{cd}
T_4	Soaking of seeds for 24 hours in Cow dung (25%) + Cow urine (75%)	18.40^{ab}	36.33^{bc}	76.33^{bcd}
T_5	Soaking of seeds for 24 hours in Cow dung (50%) + Cow urine (50%)	18.66^{bc}	37.00^{bc}	75.00^{bcd}
T_6	Soaking of seeds for 24 hours in Cow dung (75%) + Cow urine (25%)	19.00^{bcd}	37.33^{bc}	74.33^{bc}
T_7	Soaking of seeds for 24 hours in Cow dung (25%) + water (75%)	19.86^{cde}	39.00^{cde}	72.66^{bc}
T_8	Soaking of seeds for 24 hours in Cow dung (50%) + water (50%)	19.66^{bcde}	38.33^{cd}	73.66^{bc}
T_9	Soaking of seeds for 24 hours in Cow dung (75%) + water (25%)	19.33^{bcde}	38.00^{c}	74.00^{bc}
T_{10}	Soaking of seeds for 24 hours in Cow urine (25%) + water (75%)	20.66^{e}	41.66^{e}	69.33^{b}
T_{11}	Soaking of seeds for 24 hours in Cow urine (50%) + water (50%)	20.33^{de}	41.33^{e}	70.00^{b}
T_{12}	Soaking of seeds for 24 hours in Cow urine (75%) + water (25%)	20.00^{cde}	41.00^{de}	72.00^{bc}
	SE (m) ±	0.48	0.95	2.90
	C.D. at 5%	1.44	2.76	8.44

The superscript letter indicates that the treatment means with the same letters are at par at 5% level of significance, while the means with different letters are significantly different at 5% level of significance. These letters have been affixed based on CD-value comparison of treatment means.

Table 2: Effect of Cow dung, Cow urine and GA_3 on plant height (cm) of custard apple seedlings

Notations	Treatment details	Plant height (cm)			
		30 DAS	60 DAS	90 DAS	120 DAS
T_0	Soaking of seeds for 24 hours in Distilled water (Control)	4.32^{a}	5.82^{a}	8.32^{a}	10.79^{a}
T_1	Soaking of seeds for 24 hours in GA_3 @ 200 ppm	8.01^{m}	9.68^{g}	12.18^{g}	15.68^{g}
T_2	Soaking of seeds for 24 hours in Cow dung (100%)	7.72^{l}	9.39^{fg}	11.89^{fg}	15.39^{fg}
T_3	Soaking of seeds for 24 hours in Cow urine (100%)	7.65^{k}	9.32^{efg}	11.82^{efg}	15.32^{efg}
T_4	Soaking of seeds for 24 hours in Cow dung (25%) + Cow urine (75%)	7.55^{j}	9.22^{ef}	11.72^{efg}	15.22^{efg}
T_5	Soaking of seeds for 24 hours in Cow dung (50%) + Cow urine (50%)	7.45^{i}	9.12^{ef}	11.62^{ef}	15.12^{def}
T_6	Soaking of seeds for 24 hours in Cow dung (75%) + Cow urine (25%)	7.38^{h}	9.05^{def}	11.55^{def}	15.05^{def}
T_7	Soaking of seeds for 24 hours in Cow dung (25%) + water (75%)	6.84^{de}	8.51^{bc}	11.01^{bc}	14.51^{bc}
T_8	Soaking of seeds for 24 hours in Cow dung (50%) + water (50%)	6.98^{f}	8.65^{bcd}	11.15^{bcd}	14.65^{bcd}
T_9	Soaking of seeds for 24 hours in Cow dung (75%) + water (25%)	7.20^{g}	8.87^{cde}	11.37^{cde}	14.87^{cde}
T_{10}	Soaking of seeds for 24 hours in Cow urine (25%) + water (75%)	6.60^{b}	8.26^{b}	10.76^{b}	14.26^{b}
T_{11}	Soaking of seeds for 24 hours in Cow urine (50%) + water (50%)	6.70^{c}	8.36^{b}	10.86^{b}	14.36^{b}
T_{12}	Soaking of seeds for 24 hours in Cow urine (75%) + water (25%)	6.80^{d}	8.46^{bc}	10.96^{bc}	14.46^{bc}
	SE (m) ±	0.02	0.15	0.16	0.17
	C.D. at 5%	0.06	0.45	0.46	0.47

Table 3: Effect of Cow dung, Cow urine and GA_3 on number of leaves per seedling of custard apple

Notations	Treatment details	Number of leaves per seedling			
		30 DAS	60 DAS	90 DAS	120 DAS
T_0	Soaking of seeds for 24 hours in Distilled water (Control)	3.55^{a}	4.94^{a}	7.40^{a}	8.40^{a}
T_1	Soaking of seeds for 24 hours in GA_3 @ 200 ppm	7.86^{j}	9.90^{k}	12.66^{j}	13.66^{j}
T_2	Soaking of seeds for 24 hours in Cow dung (100%)	7.46^{ij}	8.76^{j}	11.86^{i}	12.86^{i}
T_3	Soaking of seeds for 24 hours in Cow urine (100%)	7.20^{hi}	8.50^{hi}	11.66^{i}	12.66^{i}
T_4	Soaking of seeds for 24 hours in Cow dung (25%) + Cow urine (75%)	6.86^{gh}	8.34^{gh}	10.86^{gh}	11.86^{gh}
T_5	Soaking of seeds for 24 hours in Cow dung (50%) + Cow urine (50%)	6.54^{fg}	8.34^{gh}	10.73^{fg}	11.66^{fg}
T_6	Soaking of seeds for 24 hours in Cow dung (75%) + Cow urine (25%)	6.46^{fg}	8.20^{fg}	10.46^{fg}	11.46^{fg}
T_7	Soaking of seeds for 24 hours in Cow dung (25%) + water (75%)	5.66^{cd}	7.70^{d}	9.66^{cd}	10.66^{cd}
T_8	Soaking of seeds for 24 hours in Cow dung (50%) + water (50%)	5.86^{de}	7.90^{e}	9.86^{de}	10.86^{de}
T_9	Soaking of seeds for 24 hours in Cow dung (75%) + water (25%)	6.26^{ef}	8.30^{g}	10.26^{ef}	11.26^{ef}
T_{10}	Soaking of seeds for 24 hours in Cow urine (25%) + water (75%)	5.04^{b}	7.04^{b}	9.06^{b}	10.06^{b}
T_{11}	Soaking of seeds for 24 hours in Cow urine (50%) + water (50%)	5.26^{bc}	7.30^{c}	9.26^{bc}	10.26^{bc}
T_{12}	Soaking of seeds for 24 hours in Cow urine (75%) + water (25%)	5.66^{cd}	8.10^{f}	9.66^{cd}	10.46^{bcd}
	SE (m) ±	0.17	0.05	0.17	0.17
	C.D. at 5%	0.51	0.16	0.51	0.50

Table 4: Effect of Cow dung, Cow urine and GA_3 on girth of stem (mm) of custard apple seedlings

Notations	Treatment details	Girth of stem (mm)			
		30 DAS	60 DAS	90 DAS	120 DAS
T_0	Soaking of seeds for 24 hours in Distilled water (Control)	0.86^{a}	1.45^{a}	2.20^{a}	2.50^{a}
T_1	Soaking of seeds for 24 hours in GA_3 @ 200 ppm	1.92^{d}	2.66^{d}	3.41^{d}	3.71^{d}
T_2	Soaking of seeds for 24 hours in Cow dung (100%)	1.78^{cd}	2.53^{cd}	3.28^{cd}	3.58^{cd}
T_3	Soaking of seeds for 24 hours in Cow urine (100%)	1.72^{bcd}	2.47^{bcd}	3.22^{bcd}	3.52^{bcd}
T_4	Soaking of seeds for 24 hours in Cow dung (25%) + Cow urine (75%)	1.66^{bcd}	2.39^{bcd}	3.14^{bcd}	3.44^{bcd}
T_5	Soaking of seeds for 24 hours in Cow dung (50%) + Cow urine (50%)	1.64^{bcd}	2.39^{bcd}	3.12^{bcd}	3.42^{bcd}
T_6	Soaking of seeds for 24 hours in Cow dung (75%) + Cow urine (25%)	1.60^{bcd}	2.35^{bcd}	3.10^{bcd}	3.40^{bcd}
T_7	Soaking of seeds for 24 hours in Cow dung (25%) + water (75%)	1.52^{bcd}	2.27^{bcd}	3.02^{bcd}	3.32^{bcd}
T_8	Soaking of seeds for 24 hours in Cow dung (50%) + water (50%)	1.55^{bcd}	2.29^{bcd}	3.04^{bcd}	3.34^{bcd}
T_9	Soaking of seeds for 24 hours in Cow dung (75%) + water (25%)	1.56^{bcd}	2.31^{bcd}	3.06^{bcd}	3.36^{bcd}
T_{10}	Soaking of seeds for 24 hours in Cow urine (25%) + water (75%)	1.54^{bcd}	2.29^{bcd}	3.04^{bcd}	3.34^{bcd}
T_{11}	Soaking of seeds for 24 hours in Cow urine (50%) + water (50%)	1.42^{bc}	2.17^{bc}	2.92^{bc}	3.22^{bc}
T_{12}	Soaking of seeds for 24 hours in Cow urine (75%) + water (25%)	1.32^{b}	2.07^{b}	2.82^{b}	3.12^{b}
	SE (m) ±	0.14	0.15	0.15	0.15
	C.D. at 5%	0.42	0.44	0.44	0.45

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