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Effect of seed treatment on germination and physiology of custard apple (*Annona squamosa* L.) at seedling stage

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Abstract

An investigation was conducted to see the effect of GA3 and cow urine on growth and physiology of custard apple. The result evinced that the gibberellic acid at 200 ppm (T3) recorded minimum days taken to germination (15.75), days taken to 50% germination (10.50) germination percentage (86.67%), Significantly maximum length of seedling (25.17cm) where recorded in treatment T3, maximum fresh and dry weight (4.43 and 0.81 g) of shoots respectively were obtained at 150 days after sowing under treatment T3, The highest number of roots per seedling where found in treatment T3 i.e (55.75), The maximum LAI (1.29) and LAD (3701.38 cm² days) was noted under treatment T3 (GA3 200 ppm), The maximum mean survival percentage of seedlings (83.82%), seedling vigour index I (0.81cm) and seedling vigour index II (77.03g) was recorded under treatment T3.

Keywords: Seed germination Fresh weight, dry weight, LAI, LAD, Length of seedling, Number of leaves per seedling, Seedling vigour index I and II, Survival percentage

1. Introduction

Custard Apple (*Annona squamosa* L.) belongs to the family Annonaceae and 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. In Bengal and Assam it is known as ‘Ata’, ‘Anusa’ in Gujarat, ‘Seetapandu’ in Telugu, ‘Sitapalam’ in Tamil and ‘Sirpha’ in Malayalam. In India, Custard Apple occupies an area of 29.87 thousand ha with production of 228.37 MT and the productivity is 12 TH (Horticulture Statistics at a Glance-2018). In M.P., custard apple occupies an area of 2.74 thousand ha with production of 37.00 MT. its productivity is about 23.91 MT (Horticulture Statistics at a Glance-2018),

It is found growing almost in all the tropical and sub tropical regions mostly in wild form. It grows very well even on a shallow soil. It also sheds off leaves during stress period to minimize the moisture loss from plant tissues through transpiration and thus a most appropriate fruit crop for rainfed region. It is considered as beneficial for cardiac disease, diabetes, hyperthyroidism and cancer. It contains about 28-55% of edible portion consisting of 73.30% moisture, 1.60% protein, 0.30% fat, 0.70% mineral matter, 23.90% carbohydrates, 0.20% calcium, 0.40%

phosphorus, 1.0% iron, 12.40-18.15% sugar and 0.26-0.65% acidity with caloric value of 105 K cal/100g.

Setten and Koek-Noorman (1992) [13] observed that Annonaceae seeds undergoing dispersal have a small embryo that is considered underdeveloped and immature. Seed germination of custard apple is uneven and irregular making sexual propagation difficult. Much experimental evidences support the concepts that specific endogenous growth promoting and inhibiting compounds are involved directly in the control of seed development, dormancy and germination (Black, 1980). Custard apple requires 35-50 days for potential germination (Hernandez, 1983). 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 from 150-500ppm and chemicals for

getting better germination of custard apple seeds (Banker, 1987; Stino *et al.*, 1996, Pawshe *et al.*, 1997; Ratan and Reddy, 2004) [3, 8, 12]. Therefore, pre treatment of custard apple seed with water, different organics and chemicals is very important to improve germination. Considering the above problem the investigation was conducted to find out effect of water soaking, PGR and chemicals on seed germination and survivability of custard apple.

2. Material and Method

The present experiment entailed "Effect of seed treatment on germination and growth of custard apple at seedling stage" was carried out at Shed net House, Department of Horticulture G.H Rasoni University Saikheda M.P during September, 2018 to March, 2019. It was laid out in completely Randomized Design (CRD). The experiment was done to find out the influence of gibberellic acid on germination, growth and survival of custard apple. The experiment consist of ten treatment which replicate four time i.e. T1 (GA3 125 ppm), T2 (GA3 150 ppm), T3 (GA3 200 ppm) and T4 (GA3 250 ppm), T5 (Cow urine 10 %), T6 (Cow urine 20%), T7 (Cow urine 30%), T8 (Cow urine 40%), T9 (Water 100%) and T10 (Control). Fresh seed of Custard apple was collected,

extracted and soaked in 125 ppm, 150 ppm and 200 ppm, 250 ppm, of gibberellic acid solution and cow urine of 10%, 20%, 30%, 40%, respectively was weighed in an electrical weighing balance and conical flask for preparation of solution. The seeds were soaked in water and as well as in GA3 and Cow urine for 24 hours and grown in polybags under the polyhouse. Polybags having a length of 15 cm and diameter of 10 cm with 200 gauge thickness were used and filled with the soil and FYM was added for manure purposed. Treated seed of Custard apple were sown in polythene bags of 15 X 10 cm size filled One seed per poly bag was sown at 2-2.5 cm depth on 17th July 2018. Watering was done using rose can regularly Necessary plant protection measures were taken. The growth parameters were recorded at 60, 90, 120 and 150 days after sowing. Five plants were randomly selected for observations and mean value was computed. The data were analyzed using standard statistical methods. (Panse and Sukhatme, 1985). The length was measured with meter scale, width was with vernier calipers and weight with electronic weighing machine. The germination in each treatment was recorded at 60 days after sowing. Number of seedlings were counted and expressed as germination percentage

Treatment details

Notation	Concentration	Remark
T1	GA3- 125ppm	Seed soaking for 24hrs
T2	GA3-150ppm	Seed soaking for 24hrs
T3	GA3-200ppm	Seed soaking for 24hrs
T4	GA3-250ppm	Seed soaking for 24hrs
T5	Cow urine 10%	Seed soaking for 24hrs
T6	Cow urine 20%	Seed soaking for 24hrs
T7	Cow urine 30%	Seed soaking for 24hrs
T8	Cow urine 40%	Seed soaking for 24hrs
T9	Water 100%	Seed soaking for 24hrs
T10	Control	Without soaking

3. Result and Discussion

3.1 Days taken to start germination

The data pertaining to days taken to start germination revealed that almost all the treatments showed significant

effect on days taken to start germination of seed over treatment T10 (control). The minimum days (15.75) were taken to germinate the seed of custard apple under treatment T3 which was found statistically at par with treatment T1 (17.50), T2 (21.25), T4 (20.75). The maximum days (36.00) were taken to start germination under treatment T10 (control). The increase in germination was due to GA3. These findings are supported by Dhankhar (1996) [3].

3.2 Days taken to 50% germination

The data pertaining to days taken to 50% germination clearly showed that all the treatments significantly affected the days taken to 50% germination of seed over treatment T10 (control). GA3 concentration of 200 ppm in T3 recorded minimum days (10.50) for 50% germination which was statistically at par with treatment T1 (11.75), T2 (15.50). The maximum days (27.75) to achieve 50% germination were noted under treatment T10 (control). Similar results have been reported by Meena *et al.* (2003) [6] in papaya seed treated with GA3 for germination and found maximum percentage of germination. The findings of Venkatrao *et al.* (2005) [15] are also close to the conformity with the present findings

3.2.1 Percentage of germination in each treatment at 60 days

Data revealed that almost all the treatments showed significant effect on percentage of germination of seed at 60 DAS over treatment T10 (control). The maximum percentage of seeds germination (86.67%) was noted at 60 days after sowing under treatment T3 (GA3 200 ppm) which was found statistically at par with treatment T2 (73.59), T5 (68.96), T6 (66.86), T7 (67.80), T8 (67.26), T9 (67.03). Whereas, the minimum percentage of seeds germination (62.83%) was under noted treatment T10 (control). These findings may be due to GA3, which would have triggered the activity of specific enzymes that promoted early germination, such as α -amylase, which have brought an increase in availability of starch assimilation. Similar findings were reported by Wagh *et al.* (1998) [16]. And Plant growth regulators and some chemicals are widely used in increasing the seed germination percentage and for healthy growth. Similar findings were reported by Parmar *et al.* (2016) [7].

3.2.2 Leaf Area Index (LAI) and Leaf Area Duration (LAD)

The result of present study indicated that in seed treated with different dose of GA3 and cow urine for 24hrs. Leaf Area is an important input in physiological and agronomic studies such as in various transpiration models, characterization of crop growth, LAI etc. (Thakur and Kaur, 2001) [14]. The effect of gibberellic acid showed significant effect on Leaf Area Index and Leaf Area Duration. The maximum LAI (1.29) and LAD (3701.38 cm² days) were noted under treatment T3 (GA3 200 ppm). Whereas, the minimum LAI (0.46) and LAD (2128.35 cm² days) were obtained under treatment T10. This was higher ascribed to higher magnitude increases in parameter associated with the LA. The finding was supported by Setten and Koek-Noorman (1992) [9].

3.2.3 Length of seedling (cm)

That various treatments showed significant effect on length of seedling over control treatment (T10) at 150 days after sowing. The maximum seedling height of (25.17cm) were recorded when seeds soaked in 200 ppm concentration of

GA3 treatment (T3), whereas, minimum height of seedlings (13.09 cm) was recorded under control treatment (T10). Gibberellins are well known for inter-nodal cell elongation, thereby leading to increase in seedling length. These findings are supported by Ratan and Reddy (2004) [12].

3.3 Fresh and dry weight of shoot and roots (g)

A perusal of data indicated that the fresh weight of shoots was significantly affected by different treatments over treatment T10 (control). The maximum fresh weight of shoots (4.43g) was recorded under treatment T3 and found significantly at par with rest of the treatment, while the minimum fresh weight of shoots (2.06 g) was noted under treatment T10 (control). It is also clear that dry weight of shoots was significantly affected by the various treatments. The maximum dry weight of shoots was (0.81g) was recorded under treatment T3 which was found statistically at par with T6 (0.69), T1 (0.68), T2 (0.63), T4 (0.60), while minimum (0.51g) in treatment T10. It is evident from data that all the treatments significantly affected the fresh weight of shoots over treatment T10 (control). The maximum fresh weight of shoots (4.43g) was recorded under treatment T3 which was significantly superior over rest of the treatments and minimum fresh weight of shoots (2.06g) was noted under treatment T10 (control). The various treatments also showed great influence on dry weight of shoots over treatment T10 (control) at 150 days after sowing. The maximum dry weight of shoot (0.81 g) was recorded under treatment T3 which was found to be significantly superior over rest of the treatments and minimum dry weight of shoot (0.51 g) was noted in treatment T10. Increase in fresh weight of shoots is due to the influence of GA3 on different plant parts, which could be due to its effect in stimulating cell division, cell elongation, auxin metabolism, cell wall plasticity and permeability of cell membrane leading to enhanced growth. Increase in the dry weight of different plant parts due to improved mobilization of nutrients due to the application of GA3, which promotes plant growth and development. The findings are agreement with the findings of Rahemi and Baninasab (2000) [10]. A part from that at 400 ppm maximum polyembryony is observed which gives rise to maximum biomass per plant. This result is in agreement with the findings of Hore and Sen (1995) in which he reported that at 400 ppm maximum polyembryony is found in acid lime. Plant growth regulators and some chemicals are widely used in increasing fresh and dry weight of shoot. Similar findings were reported by Parmar *et al.* (2016) [7].

3.4 Number of roots per seedling

The data revealed that various treatments showed significant effect on number of roots over treatment T10 (control) after 150 days. The maximum number of (55.75) roots per seedling was recorded under treatment T3 which was at par with treatment T4 (47.28), T5 (49.50), T6 (51.25) and T7 (55.50cm) while minimum number of root was recorded under treatment T10 (29.75). Vigorous root growth due to GA3 might have resulted in more production of photosynthates and their translocation through phloem to the root zone, which might be responsible for improving the root growth. Similar findings were reported by Wagh *et al.* (1998) [16].

3.5 Seedling vigour index I

The result of present study indicated that in seed treated with different dose of GA3 and cow urine for 24hrs. The present

research reveals that the effect of gibberellic acid showed significant effect on seedling vigour index I. The maximum seedling vigour index I (1816.55cm) was recorded under treatment T3 and minimum (522.21cm) was recorded under treatment T10 i.e. control. which was at par with treatment T1 (850.00), T2 (799.20), T8 (706.64)

3.6 Seedling vigour index II

The result of present study indicated that in seed treated with different dose of GA3 and cow urine for 24 hrs. In the present study, significantly maximum seedling vigour index II (77.03g) was computed under treatment T3 (GA3 200 ppm) and minimum seedling vigour index II (26.14g) was recorded under treatment T10. The results are in conformity with the results of Gurung *et al.* (2014) [6].

3.7 Survival percentage of seedlings

The data revealed that various treatments have great influence on survival percentage of seedling over treatment T10 (control) at 150 DAS. Data indicates that maximum survival percentage (83.82) was recorded under treatment T3 which was found statistically at par with rest of the treatment whereas minimum survival percentage of (63.59) under treatment T10 (control) at 150 days after sowing. The finding was supported by Meena *et al.* (2003) [6]. Survival percentage in aonla 100 days old seedlings were significantly highest in the 1% KNO3 treatment. The finding was supported by Purbey and Meghwal (2005) [9].

Table 1: Influence of gibberellic acid and cow urine on days taken to start germination (days) and Days taken to 50% germination

Treatment	Treatment details	Days taken to start germination	Days taken to start 50% germination
T1	125 PPM GA3	17.50	11.75
T2	150 PPM GA3	21.25	15.50
T3	200 PPM GA3	15.75	10.50
T4	250 PPM GA3	20.75	16.50
T5	10 % Cow urine	22.00	17.25
T6	20 % Cow urine	22.50	19.25
T7	30 % Cow urine	20.50	15.00
T8	40 % Cow urine	22.50	15.50
T9	100 % Water	29.50	22.50
T10	Control	36.00	27.75
SEm±		0.69	0.68
CD at 1%		1.99	1.97

Table 2: Influence of gibberellic acid and cow urine on Percentage of germination in each treatment at 60DAS.

Treatment	Treatment details	Percentage of germination in each treatment at 60 DAS
T1	125 PPM GA3	65.84
T2	150 PPM GA3	73.59
T3	200 PPM GA3	78.63
T4	250 PPM GA3	73.20
T5	10 % Cow urine	68.96
T6	20 % Cow urine	66.86
T7	30 % Cow urine	67.80
T8	40 % Cow urine	67.26
T9	100 % Water	67.03
T10	Control	62.83
SEm±		0.95
CD at 1%		2.73

Table 3: Influence of gibberellic acid and cow urine on leaf area duration at 150 DAS

Treatment	Treatment details	Leaf area duration at 150DAS
T1	125 PPM GA3	3206.60
T2	150 PPM GA3	3318.92
T3	200 PPM GA3	3701.38
T4	250 PPM GA3	3345.83
T5	10 % Cow urine	2975.55
T6	20 % Cow urine	3076.62
T7	30 % Cow urine	3490.93
T8	40 % Cow urine	3017.82
T9	100 % Water	2509.05
T10	Control	2128.35
SEm±		119.60
CD at 1%		345.43

Table 4: Influence of gibberellic acid and cow urine on Leaf area index at interval of 120 & 150 days after sowing

Treatment	Treatment details	Leaf area index at interval of 120 & 150 days after sowing
T1	125 PPM GA3	0.51
T2	150 PPM GA3	0.83
T3	200 PPM GA3	1.29
T4	250 PPM GA3	0.79
T5	10 % Cow urine	0.62
T6	20 % Cow urine	0.80
T7	30 % Cow urine	1.11
T8	40 % Cow urine	0.81
T9	100 % Water	0.59
T10	Control	0.46
SEm±		0.07
CD at 1%		0.21

Table 5: Influence of gibberellic acid and cow urine on length of seedling(cm) at 150 days after sowing

Treatment	Treatment details	length of seedling(cm) at 150 days after sowing
T1	125 PPM GA3	13.16
T2	150 PPM GA3	17.73
T3	200 PPM GA3	25.17
T4	250 PPM GA3	17.74
T5	10 % Cow urine	24.33
T6	20 % Cow urine	24.24
T7	30 % Cow urine	20.88
T8	40 % Cow urine	20.22
T9	100 % Water	17.75
T10	Control	13.09
SEm±		1.43
CD at 1%		4.13

Table 6: Influence of gibberellic acid and cow urine on number of roots per seedling at 150 DAS

Treatment	Treatment details	Number of roots per seedling at 150 days
T1	125 PPM GA3	42.00
T2	150 PPM GA3	46.15
T3	200 PPM GA3	55.75
T4	250 PPM GA3	47.28
T5	10 % Cow urine	49.50
T6	20 % Cow urine	51.25
T7	30 % Cow urine	55.50
T8	40 % Cow urine	41.69
T9	100 % Water	31.00
T10	Control	29.75
SEm±		2.05
CD at 1%		5.91

Table 7: Influence of gibberellic acid and cow urine on fresh weight of shoot dry weight of shoot (g) 150 DAS

Treatment	Treatment details	Fresh weight of shoot at 150 DAS (gm)	Dry weight of shoot at 150 DAS (gm)
T1	125 PPM GA3	4.13	0.68
T2	150 PPM GA3	3.82	0.63
T3	200 PPM GA3	4.43	0.81
T4	250 PPM GA3	3.28	0.60
T5	10 % Cow urine	3.31	0.59
T6	20 % Cow urine	3.32	0.69
T7	30 % Cow urine	3.82	0.59
T8	40 % Cow urine	2.71	0.54
T9	100 % Water	2.72	0.53
T10	Control	2.06	0.51
SEm±		0.31	0.03
CD at 1%		0.89	0.09

Table 8: Influence of gibberellic acid and cow urine on Seedling vigour index(cm) and Seedling vigour index II (g) at 150 DAS

Treatment	Treatment details	Seedling vigour Index I (cm)	Seedling vigour index II (g) at 150 DAS
T1	125 PPM GA3	850.00	68.47
T2	150 PPM GA3	799.20	49.10
T3	200 PPM GA3	1816.55	77.03
T4	250 PPM GA3	697.89	37.94
T5	10 % Cow urine	705.12	37.39
T6	20 % Cow urine	680.57	32.30
T7	30 % Cow urine	607.24	33.59
T8	40 % Cow urine	706.64	30.21
T9	100 % Water	698.58	29.41
T10	Control	522.21	26.14
SEm±		60.80	2.19
CD at 1%		175.61	6.32

Table 9: Influence of gibberellic acid and cow urine on Survival percent of seedling at 150 DAS

Treatment	Treatment details	Survival percent of seedling at 150 DAS
T1	125 PPM GA3	74.57
T2	150 PPM GA3	69.43
T3	200 PPM GA3	83.82
T4	250 PPM GA3	70.61
T5	10 % Cow urine	70.61
T6	20 % Cow urine	75.75
T7	30 % Cow urine	78.40
T8	40 % Cow urine	75.24
T9	100 % Water	66.22
T10	Control	63.59
SEm±		3.78
CD at 1%		10.91

4. Conclusion

It Can be concluded that treatment T3 (200 ppm GA3 and cow urine for 24hrs) was the best among the all for all the parameters.

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