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Effect of GA₃ and cow urine on growth and physiology of custard apple 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 maximum fresh and dry weight (3.58 and 0.76 g) of shoots and roots (0.98 and 0.46 g) respectively were obtained at 150 days after sowing under treatment T₃. The maximum LAI (1.07) and LAD (2975.00 cm² days) and minimum LTR 33.75 at 150 days after sowing was noted under treatment T₃ (GA₃ 400 ppm), and maximum LTR 59.50 was recorded under T₁₀ control. The maximum mean survival percentage of seedlings (83.50%), seedling vigour index I (1966.75 cm) and seedling vigour index II (91.40 g) was recorded under treatment T₃.

Keywords: Fresh weight, dry weight, LAI, LAD, LTR

1. Introduction

Custard apple (*Annona squamosa* L.) belongs to family Annonaceae and is one of the finest fruits gifted to India by tropical America. It is commonly found in India and cultivated an area of 22 thousand ha. With production of 174 MT (Anonymous, 2014) [2]. Custard apple, popularly known as "Sitaphal" is grown mainly in the states of Andhra Pradesh, Assam, Tamil Nadu and Madhya Pradesh, it is grows wild in Deccan plateau and some parts of central India. Custard apple is generally classified as semi wild fruit by virtue of its spontaneous spread in forests, wastelands and other uncultivated places. It is hardy, tolerant to drought, salinity and saline irrigation water to certain extent. 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.

It is generally propagated by seed since there is little variability among seedlings. Maximum germination can be obtained by sowing of freshly extracted seed upto 20-30 days. The seeds of Annonaceae are albuminous ellipsoids and their length varies between 5 and 30 mm. They have a ruminant endosperm (Corner, 1976) [5]. The embryo is small, straight, with moderately developed embryonic axis, rudimentary plumule and a flat and thin cotyledon; which develops after the seed is formed (Corner, 1976) [5]. Setten and Koek-Noorman (1992) [9] observed that Annonaceae seeds undergoing dispersal have a small embryo that is considered underdeveloped and immature; immaturity requires time to complete embryo growth after seed dispersion. Meanwhile, Hayat (1963) [7] reported that the seeds of *A. squamosa* have a small embryo with two foliaceous, thin cotyledons that take one to three months to germinate. Seed germination is the resumption of active growth of embryo that results in the emergence of the young plant. Seeds of many fruit crops remain ungerminated even under favourable conditions. Such kind of dormancy in seeds may be due to presence of hard and impermeable seed coat, germination inhibitors and improper development of embryo. Such seeds may require special treatments like scarification, soaking in water, growth regulators etc. to overcome dormancy. Gibberellins (GA₃) activate the embryonic vegetative growth, weakens the endosperm layer that involves the embryo and restricts its growth, and mobilizes the energetic reserves from the endosperm of cereals (Bewley, 1997 [3]; Taiz and Zeiger, 2006 [10]). After germination, the response of the young seedling to various inputs make it fruitful or unfruitful at alter stage. So, present investigation was done to see the growth and physiology of young plant.

2. Material and Methods

The ten treatments were plotted with four replications under poly house condition to examine seed germination and growth behaviour of custard apple. The experiment was carried out at Fruit Research Station, Imalia, JNKVV, Jabalpur during the year 2016-2017. Jabalpur is situated in "Kymore Plateau and Satpura Hills" Agro-climatic zone of Madhya Pradesh at 23.9°N latitude and 79.58° east longitudes and an altitude of 411.78 meters above the mean sea level. The climate of Jabalpur region is semi-arid and subtropical having warm and

dry spring summer and cool winter as main characteristics feature, in general the highest temperature reaches above 45°C and below 5°C respectively. The relative humidity varies from 70-80%. The average annual rainfall of about 1375, mm, which is mainly distributed from mid-June to first week of October from south-west monsoon with occasional rain during winter.

2.1 Treatment Details

Notation	Concentration	Remark
T ₁	GA ₃ - 200ppm	Seed soaking for 24hrs
T ₂	GA ₃ -300 ppm	Seed soaking for 24hrs
T ₃	GA ₃ -400 ppm	Seed soaking for 24hrs
T ₄	GA ₃ -500 ppm	Seed soaking for 24hrs
T ₅	Cow urine 10%	Seed soaking for 24hrs
T ₆	Cow urine 20%	Seed soaking for 24hrs
T ₇	Cow urine 30%	Seed soaking for 24hrs
T ₈	Cow urine 40%	Seed soaking for 24hrs
T ₉	Water 100%	Seed soaking for 24hrs
T ₁₀	Control	Without soaking

3. Result and Discussion

3.1 Fresh and dry weight of shoots and roots

The result of present study indicated (Table 1) that in seed treated with different dose of GA₃ and cow urine for 24hrs. The maximum fresh and dry weight (3.58 and 0.76 g) of shoots and roots (0.98 and 0.46 g) respectively were obtained

at 150 days after sowing under treatment T₃. The minimum fresh and dry weight of shoots (2.68 and 0.59 g) and roots (0.69 and 0.27g) obtained at 150 days after sowing. The results are supported with the findings of Choudhary and Chakrawar (1982)^[4].

Table 1: Influence of gibberellic acid and cow urine on fresh and dry weight of shoots and roots at 150 DAS

Treatment	Fresh weight of shoots (g) at 150 DAS	Dry weight of shoots (g) at 150 DAS	Fresh weight of roots (g) at 150 DAS	Dry weight of roots (g) at 150 DAS
T ₁ (200 ppm GA ₃)	3.30	0.59	0.82	0.31
T ₂ (300 ppm GA ₃)	3.25	0.61	0.85	0.40
T ₃ (400 ppm GA ₃)	3.58	0.76	0.98	0.46
T ₄ (500 ppm GA ₃)	3.11	0.57	0.74	0.35
T ₅ (10% cow urine)	3.06	0.56	0.77	0.29
T ₆ (20% cow urine)	3.05	0.55	0.77	0.29
T ₇ (30% cow urine)	2.96	0.59	0.71	0.28
T ₈ (40% cow urine)	2.99	0.55	0.75	0.30
T ₉ (100% water)	4.00	0.55	0.72	0.28
T ₁₀ (Control)	2.68	0.54	0.69	0.27
SEm±	0.14	0.03	0.06	0.02
CD at 5%	0.42	0.09	0.18	0.09

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

The result of present study indicated (Table 2) 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)^[11]. The effect of gibberellic acid showed significant effect on Leaf Area Index and Leaf Area Duration. The maximum LAI (1.07) and LAD (2975.00 cm² days) were noted under treatment T₃ (GA₃ 400 ppm). Whereas, the minimum LAI (0.78) and LAD (1300.75 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].

3.3 Light Transmission Ratio (LTR)

The result of present study indicated (Table 2) that in seed treated with different dose of GA₃ and cow urine for 24hrs. In the present study, significantly minimum LTR 33.75 at 150

days after sowing was computed when GA₃ at 400 ppm and maximum LTR 59.50 was recorded under T₁₀ control. The finding was supported by Munde and Gajbhiye (2010)^[8]. The results were significantly correlated with LAI which exhibited the lowest and highest transmission through the crop canopy.

3.4 Survival per cent of seedlings

The present results demonstrated (Table 2) that the effect of gibberellic acid showed significant effect on seedling survival per cent at 150 days after sowing. The maximum mean survival percentage of seedlings (83.50%) was recorded under treatment T₃ i.e. 400 ppm GA₃ whereas, minimum survival percentage of seedlings (70.75 %) was recorded under T₁₀ i.e. control. The result have been reported by Ambadkar and Jadhav (2007)^[11] revealed that by treating with GA₃ at 300 and 400 ppm are well known for better germination, seedling growth and vigour are highly suitable for commercial cultivation and their germination and seedling health can be improved.

Table 2: Influence of gibberellic acid and cow urine on Leaf area duration at 150 DAS, LAI, light transmission ratio and survival per cent of seedling

Treatment details	Leaf area duration at 150 DAS	Leaf Area Index (LAI) at interval of 120 and 150 days after sowing	Light Transmission Ratio at 150 DAS	Survival percent of seedling at 150 DAS
T ₁ (200 ppm GA ₃)	2227.00	0.84	50.50	73.00
T ₂ (300 ppm GA ₃)	2511.75	0.91	49.00	74.50
T ₃ (400 ppm GA ₃)	2975.00	1.07	33.75	83.50
T ₄ (500 ppm GA ₃)	2098.00	0.79	39.15	73.75
T ₅ (10% cow urine)	2396.50	0.81	45.25	79.25
T ₆ (20% cow urine)	2279.75	0.83	47.75	72.50
T ₇ (30% cow urine)	1893.50	0.84	37.36	73.25
T ₈ (40% cow urine)	2005.00	0.80	49.65	72.25
T ₉ (100% water)	1448.00	0.79	56.25	72.00
T ₁₀ (Control)	1300.75	0.78	59.50	70.75
SEm±	286.42	0.04	4.53	1.38
CD at 5%	800.83	0.13	16.46	5.03

3.5 Seedling vigour index I

The result of present study indicated (Table 3) 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 (1966.75cm) was recorded under T₃ and minimum (633.00cm) was recorded under T₁₀ i.e. control.

3.6 Seedling vigour index II

The result of present study indicated (Table 3) that in seed treated with different dose of GA₃ and cow urine for 24hrs. In the present study, significantly maximum seedling vigour index II (91.40 g) was computed under T₃ (GA₃ 400 ppm) and minimum seedling vigour index II (27.30g) was recorded under T₁₀. The results are in conformity with the results of Gurung *et al.* (2014)^[6].

Table 3: Influence of gibberellic acid and cow urine on Seedling vigor index (cm) and Seedling vigor index II (g) at 150 DAS

Treatment details	Seedling vigor index I (cm) at 150 DAS	Seedling vigor index II (g) at 150 DAS
T ₁ (200 ppm GA ₃)	1000	67
T ₂ (300 ppm GA ₃)	927.87	44.95
T ₃ (400 ppm GA ₃)	1,966.75	91.40
T ₄ (500 ppm GA ₃)	885.75	32.90
T ₅ (10% cow urine)	830.25	32.55
T ₆ (20% cow urine)	813.25	31.92
T ₇ (30% cow urine)	776.00	31.65
T ₈ (40% cow urine)	795.12	31.67
T ₉ (100% water)	809.00	31.90
T ₁₀ (Control)	663.00	27.30
SEm±	87.44	28.90
CD at 5%	251.83	30.45

4. Conclusion

It Can be concluded that treatment T₃ (400 ppm GA₃ and cow urine for 24hrs) was the best among the all for all the parameters.

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