

Effect Of Seed Treatments on Seed Germination Studies in Ramphal (*Annona reticulata* L.)

ABSTRACT

Annona reticulata L., commonly known as bullock's heart, is a tropical fruit-bearing tree belonging to the Annonaceae family. It is prized for its flavourful and nutritious fruit. The plants are used for anti-inflammatory, stress reliever, antimutagenic, curing wounds, anti-anxiety, and spasmolytic properties and have all been used. In this fruit, the seeds are poor due to seed dormancy, and viability is easily lost. To overcome this problem in bullock's heart, an experiment was laid out in the Floriculture unit, Department of Horticulture, Faculty of Agriculture, Annamalai University, Tamil Nadu on seed germination studies in Ramphal (*Annona reticulata* L.). Amongst the different pre-sowing seed treatments, treatment with Gibberellic Acid @ 1000 ppm significantly improved the germination percentage (90.63%) and reduced the number of days taken for initiation of seed germination (17.02 days), days taken for 50 percent of seed germination (22.44 days), span of seed germination (25.09 days) as compared to control. This experiment concluded that Gibberellic Acid @ 1000 ppm treated seeds have better seed germination characteristics.

Keywords: *Bullock's heart, Annona reticulata, Gibberellic acid, seed treatment, seed germination.*

INTRODUCTION

Annona reticulata, commonly known as bullock's heart, is a tropical fruit-bearing tree belonging to the Annonaceae family. This species is native to the tropical regions of the Americas, with its origins traced back to the West Indies, Central America, and Northern South America. Over time, *Annona reticulata* has spread and naturalized across various parts of the world including Southeast Asia, Africa, and India, where it thrives in warm, tropical climates. *Annona reticulata* is prized for its flavourful and nutritious fruit. It is commonly consumed fresh, either scooped out of the skin with a spoon or blended into smoothies and desserts. *Annona reticulata* is a small, glabrous tree that grows in tropical conditions. It has many lateral branches and grows 6.0-7.5 m in height. The stems are cylindrical with shorter and brown-colored hairs and lenticels. Leaves are acute, oblong, lanceolate, rounded, cusped, or obtuse leaf-based. The upper surface of the leaves is glabrous and the lower surfaces have a few spreading hairs. *Annona reticulata* is heart-shaped with the surface rough and the ripening time color changed from yellow to yellowish red. Fruits are delicious and used for blood issues. The seeds are dark-colored with a smooth surface (Basappa *et al.*, 2024). The nutritional composition of 100 grams of bullock's heart fruit is as follows: 101 kcal, 25.2 g of carbohydrates, 2.4 g of fiber, 0.6 g of fat, 0.2 g of saturated fat, 1.7 g of protein, 33 IU of vitamin A, 19.2 mg of vitamin C, 0.1 mg of thiamine, 0.1 mg of riboflavin, 0.5 mg of niacin, 0.2 mg of vitamin B₆, 0.1 mg of pantothenic acid, 30 mg of calcium, 0.7 mg of iron, 18 mg of magnesium, 21 mg of phosphorus, and 382 mg of potassium (Karande *et al.*,

Commented [d1]: It should be in Italics

Commented [d2]: Use specific disease term.

2023). *Annona spp* are commonly propagated through seeds and the seeds are poor due to seed dormancy, and viability is easily lost. To overcome this problem in ramphal, the study must improve germination characteristics.

MATERIALS AND METHODS

The experiment was conducted in the Floriculture unit, Department of Horticulture, Faculty of Agriculture, Annamalai University, Cuddalore, Tamil Nadu during the year 2024 (January - June). Selecting the seeds from uniform-sized quality and disease-free Ramphal fruits. The seeds are extracted after being washed in water and selected as good-quality seeds. The experiment is laid out in Completely Randomized Design (CRD) with 16 treatments and 3 replications. The different treatments like T₁ - Jeevamirtham @ 5%, T₂ - Jeevamirtham @ 10%, T₃ - Jeevamirtham @ 15%, T₄ - GA₃ @ 500 ppm, T₅ - GA₃ @ 1000 ppm, T₆ - GA₃ @ 1500 ppm, T₇ - KNO₃ @ 1000 ppm, T₈ - KNO₃ @ 2000 ppm, T₉ - KNO₃ @ 3000 ppm, T₁₀ - H₂SO₄ @ 1%, T₁₁ - H₂SO₄ @ 2%, T₁₂ - H₂SO₄ @ 3%, T₁₃ - Thiourea @ 1%, T₁₄ - Thiourea @ 2%, T₁₅ - Thiourea @ 3% and T₁₆ - Control. After the treated seeds were sowed in a 2-3 cm depth in polybags filled with media comprising red soil, sand, and FYM (2:1:1). The observations about seed germination characteristics were recorded daily up to 150 days after sowing i.e. germination percentage, days taken for initiation of seed germination, days taken for 50 percent of seed germination and span of seed germination. The experimental data recorded on various characteristics during the investigation were analyzed statistically using the method of analysis of variance (ANOVA) for Complete Randomized Design (CRD) by Fisher and Yates (1963). Analysis of variance (one-way classified data) for each characteristic was performed using 'WASP 2.0' software. The significance of various treatments was judged with the help of the "F" value (test) at a 5% level of significance. To elucidate the nature and the magnitude of effects, S.Ed and C.D. at a 5 per cent level of significance were included in the summary table.

RESULTS AND DISCUSSION

The data relating to germination percentage, days taken for initiation of seed germination, days taken for 50 percent of seed germination, and span of seed germination in Ramphal as influenced by the different pre-sowing treatments are given in Table 1. The highest germination percentage (90.63) is registered in T₅ (GA₃ @ 1000 ppm) followed by T₈ (KNO₃ @ 2000 ppm) which showed 87.68 and the lowest germination percentage (50.18) was recorded in T₁₆ (control). Gibberellic acid's antagonistic impact on germination may be the cause of the increase in germination (Brain and Hemming, 1958; Wareing *et al.*, 1968) and GA₃ has a role in the cytological enzyme activation process that triggers the α-amylase enzyme which transforms insoluble starch into soluble sugars. Energy from these sugars is needed for several metabolic and physiological processes connected to germination. The results conform with the earlier reports by Hazarika *et al.* (2023) in papaya, Hossain *et al.* (2023) in papaya, Sabarad *et al.* (2023) in wood apple, Anagha *et al.* (2024) in dragon fruit, Bahadure *et al.* (2024) in lime and Deshi *et al.* (2024) in apple.

Commented [d3]: Add plant authentication number of your research product.

Commented [d4]: Full form of abbreviation

Commented [d5]: Full form of abbreviation

Commented [d6]: Add few picture of your research work

The minimum days taken for initiation of seed germination is registered in T₅ (GA₃ @ 1000 ppm) followed by T₈ (KNO₃ @ 2000 ppm) which showed 17.02 days and 17.85 days respectively to T₁₆ control (33.98 days). GA₃ synthesized by the enlarged embryo acts on the living cells and causes de nova synthesis of hydrolyzing enzymes particularly α-amylase and protease which converts the starch into simple sugars during germination (Paleg, 1965). The enzymes that weaken the seed coat and permit the axis to break through are the other enzymes that GA₃ activates. For the radicle to break through the endosperm and seed coat that limits its growth, GA₃ also increases cell elongation (Hartmann and Kester, 1979). The results conform with the earlier reports by Garg and Bahadur (2023) in guava, Hossain *et al.* (2023) in papaya, Anagha *et al.* (2024) in dragon fruit, Bahadure *et al.* (2024) in lime and Deshi *et al.* (2024) in apple.

T₅ (GA₃ @ 1000 ppm) registered the minimum days taken for 50 percent of seed germination (22.44) whereas control recorded the maximum number of days taken for 50 percent of seed germination (46.90). The reduction in the number of days required for 50% of germination may be due to the synergistic effects of these two inputs combined (GA₃ and soaking period) which enhance protoplasmic physio-chemical properties, respiration, nucleic acid metabolism, and other aspects of combined growth. GA₃ is thought to have enhanced the de novo synthesis of hydrolyzing enzymes, specifically protease and amylase. The food that had been hydrolyzed was then used to develop the embryo, which improved germination. Findings similar to the present study were reported by Hakimi *et al.* (2020) in avocado, Singh and Kaur (2021) in aonla, Harshita *et al.* (2021) in Indian blackberry, and Bahadure *et al.* (2024) in lime.

The minimum days taken for a span of seed germination observed in T₅ (GA₃ @ 1000 ppm) followed by T₈ (KNO₃ @ 2000 ppm) which showed 25.09 days and 26.74 days respectively than T₁₆ control (50.71 days). The shortest number of days required for seed germination in seeds treated with GA₃ may be attributed to the fact that GA₃ initiates starch hydrolysis, whose translocation enables the completion of seed germination. Findings similar to the present study were reported by Harshita *et al.* (2021) in Indian blackberry, Singh and Kaur (2021) in aonla, and Bahadure *et al.* (2024) in lime.

Commented [d7]: Full form of abbreviation in List of abbreviation

Table 1. Effect of seed treatments on germination characteristics of Ramphal seeds at 150 DAS

Treatments	Germination percentage (%)	Days taken for initiation of seed germination	Days taken for 50 percent of seed germination	Span of seed germination (days)
T ₁ -Jeevamirtham @ 5%	57.94 (49.57)	29.32	42.13	45.37
T ₂ - Jeevamirtham @ 10%	55.33 (48.06)	30.00	43.44	46.88
T ₃ - Jeevamirtham @ 15%	52.84 (46.63)	31.48	45.35	48.74
T ₄ - GA ₃ @ 500 ppm	79.75 (63.26)	22.01	28.98	31.83

T ₅ - GA ₃ @ 1000 ppm	90.63 (72.25)	17.02	22.44	25.09
T ₆ - GA ₃ @ 1500 ppm	82.40 (65.20)	20.92	27.36	30.13
T ₇ - KNO ₃ @ 1000 ppm	77.43 (61.64)	23.06	30.58	33.51
T ₈ - KNO ₃ @ 2000 ppm	87.68 (69.46)	17.85	24.14	26.74
T ₉ - KNO ₃ @ 3000 ppm	74.80 (59.87)	24.19	32.29	35.21
T ₁₀ - H ₂ SO ₄ @ 1 %	66.63 (54.72)	26.94	37.18	40.22
T ₁₁ - H ₂ SO ₄ @ 2 %	63.67 (52.94)	27.88	38.78	41.92
T ₁₂ - H ₂ SO ₄ @ 3 %	60.85 (51.27)	28.61	40.68	43.87
T ₁₃ - Thiourea @ 1 %	71.96 (58.03)	25.11	33.92	36.90
T ₁₄ - Thiourea @ 2 %	85.10 (67.29)	19.64	25.75	28.44
T ₁₅ - Thiourea @ 3 %	69.65 (56.58)	26.11	35.60	38.55
T ₁₆ – Control	50.18 (45.10)	33.98	46.90	50.71
S.Ed	1.00 (0.70)	0.26	0.58	0.63
CD at 5 % (p = 0.05)	2.05 (1.43)	0.54	1.18	1.28

Note: Figures in parenthesis are arc sin transformation values

CONCLUSION

The findings from the present study, titled Seed Germination Studies in Ramphal (*Annona reticulata* L.), indicate that treating seeds with GA₃ at 1000 ppm significantly enhances germination parameters such as germination percentage, time to initiate germination, time to achieve 50% germination, and the overall germination period. Ramphal, also known as Bullock's heart, suffers from physical dormancy due to its hard seed coat, leading to poor germination rates. Treatment with KNO₃ at 2000 ppm also yielded favorable results, but GA₃ at 1000 ppm proved superior. It is recommended that farmers aiming for successful Ramphal cultivation adopt gibberellic acid at 1000 ppm as a pre-sowing treatment. This approach can improve both seed germination and early growth performance. This study confirms that gibberellic acid is the most effective solution for breaking dormancy and enhancing seed germination in Ramphal. These results demonstrate the potential of GA₃ as a reliable strategy to boost germination success.

REFERENCES

- Anagha, P., Prakasha, D., Kulapati, H., Mallikarjun, A., Vijay, M., and Anand, N. (2024). Improving seed germination and seedling growth of dragon fruit (*Hylocereus undatus*) by PGRs. *Indian Journal of Agricultural Sciences*, 94(2), 187-191.
- Bahadure, A. B., Nagre, P. K., Paithankar, D. H., Ingle, Y. V., and Bharad, S. G. (2024). Assessment of various plant growth substances on germination rates and seedling vigor in acid lime seedlings (*Citrus aurantifolia* Swingle) cv. PDKV lime. *International Journal of Advanced*

Biochemistry Research, 8(3), 753-756.

- Basappa, K. S., Raghava, S., and Umesha, S. (2024). Prevalence of phytochemical and pharmacological properties; furthermore, a miraculous healing plant in the contemporary time, *Anonna reticulata*. *Pharmacognosy Communications*, 14(1), 2-12.
- Brain, P. W., and Hemming, H. G. (1958). Complementary action of gibberellic acid and auxin in pea internode extension. *Annals of Botany*, 22, 1-7.
- Deshi, K. E., Ogbuka, G. I., Nanbol, K. K., and Satdom, S. M. (2024). The effect of varying concentrations of gibberellic acid (GA₃) under refrigeration on the breaking of dormancy and seedling growth of apple (*Malus domestica* Borkh.) seeds in Jos Plateau State, Nigeria. *IOSR Journal of Agriculture and Veterinary Science*, 17(1), 23-27.
- Fisher, R. A., and Yates, F. (1963). Statistical tables for Biological, Medical and Agricultural Research. Oliver and Boyd Edinburgh, 86.
- Garg, K., and Bahadur, V. (2023). Influence of potting media and GA₃ on seed germination and seedling growth of guava (*Psidium guajava*) cv. Allahabad Safeda under shade net condition. *International Journal of Plant and Soil Science*, 35(16), 393-403.
- Hakimi, N., Shivakumar, B. S., Lakshmana, D., Ganapathi, M., and Adivappar, N. (2020). Effect of plant growth regulators and chemicals on seed germination, vigour index and mortality of avocado (*Persea americana* Mill.). *International Journal of Current Microbiology and Applied Sciences*, 9(8), 3640-3645.
- Harshita Mali, Mool Chand Jain, Rakesh Kumar Yadav, Pooja Sharma and Kuldeep Singh. (2021). Germination of Indian blackberry [*Syzygium cuminii* (L.) Skeels] as affected by pre-sowing seed treatment. *International Journal of Current Microbiology and Applied Sciences*, 10(1), 3392-3400.
- Hartmann, H. T., and Kester, D. E. (1979). Plant Propagation: Principles and practices. Fourth Edition, Prentice Hall of India. Ltd. 407.
- Hazarika, B., Gogoi, S., Das, R. T., and Bordoloi, A. (2023). Studies on seed germination, growth and vigour of papaya seedlings cv. 'Sapna' as influenced by growth regulators and propagation media. *The Pharma Innovation Journal*, 12(11), 2387-2391.
- Hossain, F., Islam, N., Ali, S., Kayes, A., and Choudhury, S. (2023). GA₃ and growing medium influence papaya seed germination and seedling growth. *Trends in Horticulture*, 6(2), 3263.

- Karande, P. S., Haldankar, P. M., Khandekar, R. G., Malshe, K. V., and Mane, A. V. (2023). Effect of seed treatment on germination and growth of bullock's heart (*Annona reticulata* L.) seedling. *The Pharma Innovation Journal*, 12(12), 1379-1382.
- Paleg, L. (1965). Physiological effects of gibberellins. *Annuals Reviews of Plant Physiology*, 16, 291-322.
- Sabarad, S. R., Manu Kumar, H. R., Sabarad, A. I., and Chandan, K. (2023). Influence of seed priming on germination and seedling growth of wood apple (*Limonia acidissima* L.). *The Pharma Innovation Journal*, 12(3), 2120-2124.
- Singh, S. and Kaur, A. (2021). Effect of various treatments on seed germination and seedling vigour of aonla cv. Chakaiya. *Indian Journal of Agricultural Research*, 55(5), 614-618.
- Wareing, C., Brewbaker, B., and Crawford, D. J. (1968). The activity of endogenous growth regulators in lettuce in relation to seed germination. *American Journal Botany*, 54, 314-317.