



An Investigation on Growth Performance of *Syzygium caryophyllatum* (L.) Alston Seeds on Pre-sowing Treatments

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ABSTRACT

Syzygium caryophyllatum (L.) Alston belongs to family Myrtaceae and it possess recalcitrant seeds. The present study is to evaluate the effect of Plant Growth Regulators at different concentrations and combinations in *Syzygium caryophyllatum* seeds. The seeds were treated with different combinations of hormones at 10 ppm, 50 ppm and 100 ppm. The Germination percentage, Shoot length, Root length, Leaf area and Vigour index were recorded. It was found that low ppm concentration of hormones increased the growth rate but was less compared to the control. Hormone treatment speed up germination than the control but the germination percentage was less. Low ppm concentration of hormones had given a better result.
Keywords: recalcitrant, plant growth hormones, vigour index

Received 11.03.2024

Revised 23.04.2024

Accepted 25.05.2024

INTRODUCTION

In 1973, Roberts coined the term recalcitrant [1], which has characteristic features such as desiccation intolerance, short life span and germinates soon after shedding. *Syzygium caryophyllatum* (L.) Alston belongs to family Myrtaceae [6]. The main aim of pretreatment with plant growth regulators is to promote the seedling growth. In United Kingdom plant hormones are referred as "plant growth substances"¹⁵. Hormones are chemicals and are not nutrients, which in lesser quantity may enhance the seed germination. The size of seed varies with species and the large sized can survive from unfavourable condition on their own but in the case of small seedling they may be sensitive to several diseases and pest. Hormone treatment of seeds may have some benefits [1]. In promoting the growth and yield of agricultural crops, several studies has paid attention on growth hormone. Studied on tree seedlings and had much scope on these studies [18]. Stimulatory effect of plant hormone was also reported [19, 13, 8]. External application of Growth regulators may also affect the plant growth other than the endogenous hormones level. Every hormone has its own unique nature of mode of action. Low concentration of hormone preparation can enhance seed germination and seedling growth.

MATERIALS AND METHODS

The plant materials were collected from Nanniyode, Palode, Thiruvananthapuram, Kerala. The plants were identified with the help of Flora of Presidency of Madra. The collected seed samples were dried, cleaned thoroughly to remove foreign materials and damaged seeds and stored in air tight containers. The seeds were treated with different combinations of Plant Growth Regulators which include Auxin, Gibberellin and Kinetin at different concentrations in 10 ppm, 50 ppm, 100 ppm varying concentrations at room temperature for around 6 hours. After that the seeds were washed well with distilled water in order to remove traces of the hormones on the seed coat.

The different combinations include

- IAA alone
- Kinetin alone
- Gibberellic acid alone
- IAA + Kinetin (50:50)
- IAA ↑ Kinetin ↓ (20:10)

- IAA ↓ Kinetin ↑ (10:20)
- IAA + Kinetin + GA
- Water

Samples were tested for seed germination following the standard germination methods.

Determination of Germination Percentage

Germination percentage is simply the proportion of seeds that germinate from all seeds subject to the right conditions for growth. Five seeds from each storage condition were sowed in field containing briquette. This process of germination was repeated continuously until the germination is completely stopped in all storage conditions.

Percentage of germination was calculated using the following formula:

$$\text{Percentage of germination} = \frac{\text{seeds germinated}}{\text{total seeds sowed}} \times 100$$

Determination of Seed Vigour Index

The seedling vigour index was calculated by following the formula. [20]

$$\text{Vigour index} = \text{Root length} + \text{Shoot length} \times \text{germination percent}$$

RESULTS

The control group's germination rate was 80 percent. It was discovered that when the seeds were exposed to various hormone concentrations, it had the least impact on germination when compared to the control. A better outcome was produced when that 10 ppm concentration was used. By 10 ppm IAA alone and 50 ppm IAA alone, 60% germination was provided. Additionally, water treatment contributed 60%. It had the least impact on germination when the hormone levels rose above 50 ppm. 30% of the seeds germinated on treatment with 100 ppm IAA alone (fig. 1). Therefore, the treatment had produced a better response in germination than the control with 10 ppm IAA alone. Fig. 2 displayed the impact of various concentrations on the length of the shoot. The shoot length was at its greatest in the 50 ppm IAA+Kinetin+ Gibberellin treatment (7.67 cm), lowest in the 100 ppm kinetin alone treatment (4.5 cm), and undetectable in the 100 ppm IAA + Kinetin, IAA↑Kinetin↓, and IAA↓Kinetin↑ treatments. Which suggests that treatment with a 50 ppm concentration had superior results. The maximum root length was seen at 50 ppm IAA+Kinetin (6.15) compared to the control (4.9), and there was no effect at 100 ppm IAA+Kinetin, IAA↑Kinetin↓, or IAA↓Kinetin↑. All of the treatments with a concentration of 10 ppm produced better results than the control. Additionally, they had produced substantially better results for IAA+Kinetin (6.15) and IAA alone in the instance of 50 ppm. A maximum leaf area of 1.49 is provided by 10 ppm IAA alone treatment. The control had a value of 1.45, hence IAA alone at a concentration of 10 ppm had produced a better result. However, in this instance as well, the 100 ppm treatment had the weakest effect, while 100 ppm IAA + Kinetin, IAA↑ Kinetin↓, and IAA↓ Kinetin↑ had no effect (fig. 4). When 100 ppm of the treatment was used, the smallest range of growth was seen. The control condition had the highest vigour index (992). Other than the control, the IAA alone treatment at 10 ppm and 50 ppm produced better results (fig. 5). The seeds grew up to a 50 ppm concentration rise, but at 100 ppm it was discovered that it had diminished. In particular, hormone combinations with a 100 ppm concentration had a negative impact on the germination rate. Under these circumstances, the seeds did not even begin to sprout. The results of hormone therapy at concentrations of 10 ppm, 50 ppm, and 100 ppm were no better than the control. In terms of growth performance, 10 ppm and 50 ppm had showed promising results. Based on the aforementioned findings, it can be deduced that hormone concentrations as low as these can produce the desired outcome.

DISCUSSION

Auxin may cause changes such as cell elongation [16, 10, 2, 7]. Abnormal morphological characters have been shown when auxins are directly applied at shoot apex. Seth and Mathanda (1959) [12] reported that through the application of Gibberellic acid plant height can be accelerated. GA3 is the most well-known one. Growth promoting properties of GA3 has been studied [17, 1]. different countries had conducted studies on function of Gibberellin and its effects [4, 3]. Decrease in seed viability might be one of the reasons for less germination rate [9]. The germination rate was found to be varying in different populations and variants of the same population of *Podophyllum hexandrum* [14].The prevalent conditions on seed germination and also the hereditary factors co ordinates the seed germination [21]. Due to the presence of natural inhibitors the applied hormones may give a poor response [5].

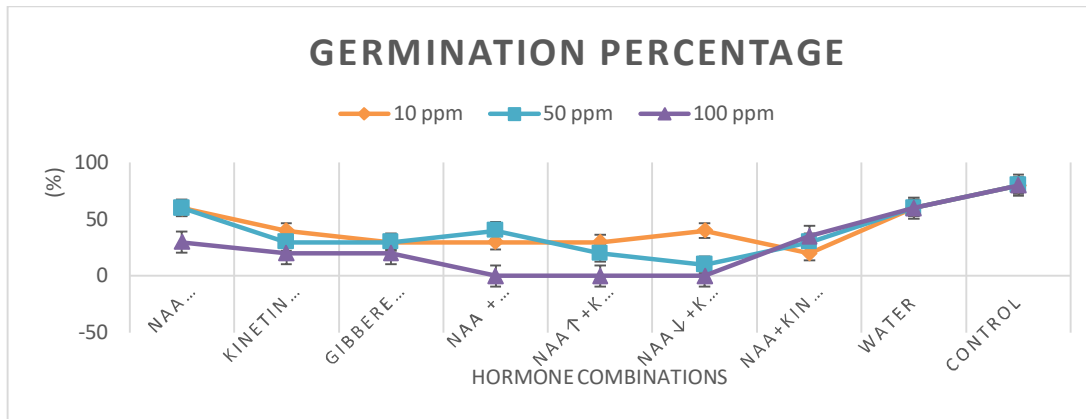


Fig 1: Germination Percentage

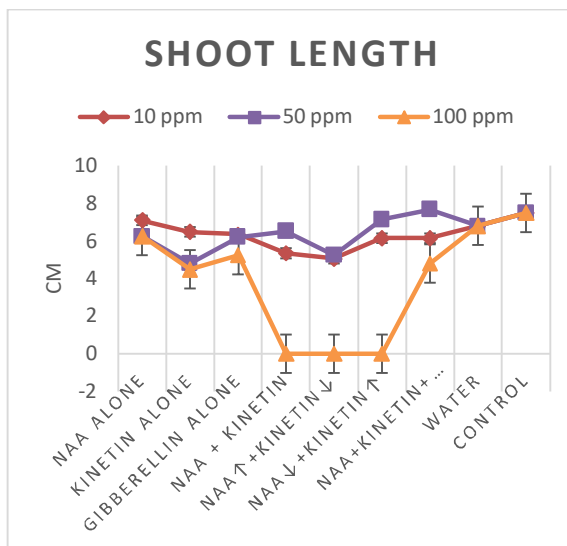


Fig 2: Shoot Length

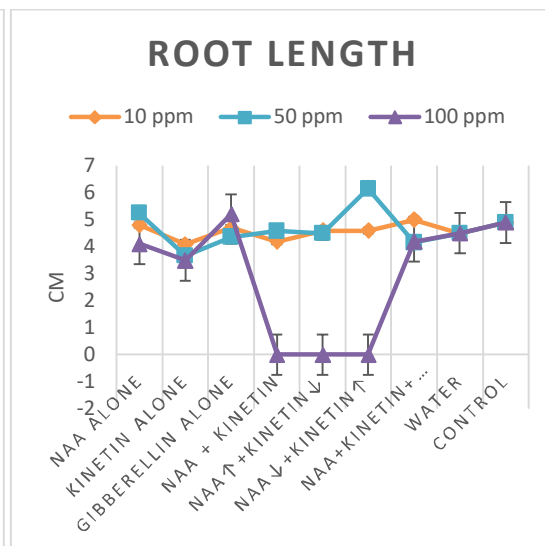


Fig 3: Root Length

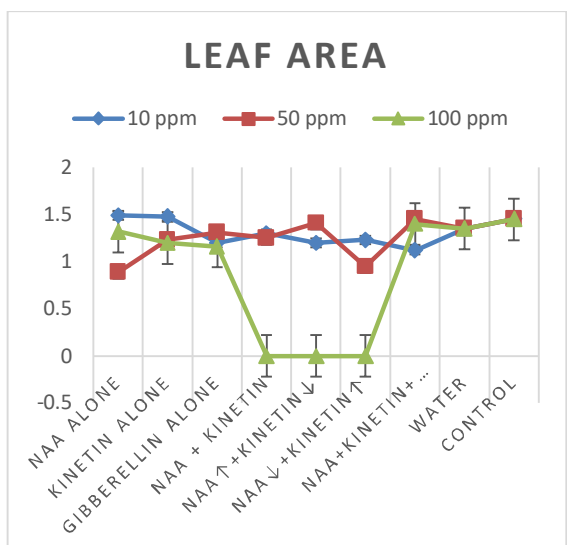


Fig 4: Leaf Area

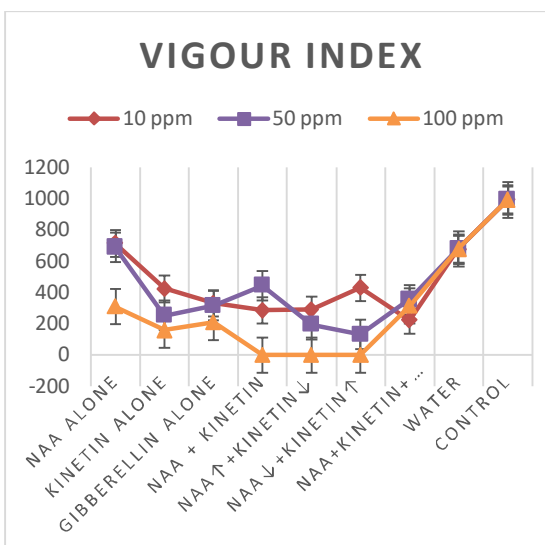


Fig5: Vigour Index

CONCLUSION

Several factors including plant hormones control seed germination and dormancy. The association between plant genes and hormones may also affect germination. Plant hormones play an important role in cell division, growth and differentiation and also in increasing the rate of germination. It is mentioned that exogenous hormones regulate seed germination and seedling growth is reported to have a stimulatory effect. Depending on the species, plant development stages and incubation period each treatment has varying effect. And appropriate concentration of hormone should be applied to get the desired positive result.

ACKNOWLEDGEMENTS

The authors are thankful to the Head, Department of Botany, Mahatma Gandhi College, Thiruvananthapuram, Kerala for providing the facilities to conduct the research work

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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CITATION OF THIS ARTICLE

Chithra S G, Neethu S Kumar, Santhoshkumar R. An Investigation on Growth Performance of *Syzygium Caryophyllatum* (L.) Alston Seeds on Presowing Treatments. Bull. Env.Pharmacol. Life Sci., Vol 13 [5] May 2024: 16-19