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A review of plant growth regulators and its effect on rose flower

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Abstract

One of the most lucrative agricultural sectors globally is the floral industry. The study examined how plant growth regulators affect roses. After analysing the findings of previous studies in this area, PGRs. These compounds, which are endogenously produced by plant tissues, promote the growth and development of the plants. They work by altering, regulating, or managing the processes involved in plant growth, such as the development of leaves and flowers, the lengthening of stems, and quality improvement. Artificial chemical substances possessing physiological activity akin to substances that promote plant growth and the capacity to alter the growth and development of plants. The PGRs are used commercially in agriculture. The method of using PGRs in horticulture yields positive outcomes. Nevertheless, additional research and discussion on the topic are required in order to draw the conclusion that presents favourable prospects and real-world benefits for application in the future.

Keywords: Auxins, abscisic acid, benzyladenine, cytokinins, gibberellins and triiodobenzoic acid

Introduction

Rosa hybrida, the modern rose, is a member of the *Rosaceae* family. The word "rose" comes from the Greek "Rhodon," which signifies scent. It is referred to as the "Queen of Flowers" and is one of nature's most exquisite creations. Roses are commonly used as symbols of love, sympathy, or grief all throughout the world. Breeders have been drawn to it since ancient times by its beauty and attractiveness, which inspires them to develop new varieties and colours. Rose is the most popular ornamental flower all over the world, which is used as garden plants and cut flowers (Hong *et al.* 2021) ^[15].

Rose flowers are used in huge quantities for adornment. Beside it has been growing for countries for the extraction of its essence. Rose hips have high in vitamin C, and their petals are used to make gulkand and pankhuri. (Singh, 2006) ^[37].

The rose flower has the highest commercial value among cut flowers and is the world's leading producer of cut flowers. Plant quality, vase life, and beauty are all influenced by cultivation conditions, timing of harvest and postharvest handling. Hybrid tea and floribunda roses are regarded as modern roses that is Popular in Australia (Ibrahim *et al.* 2017) ^[17].

The word hormone is derived from Greek, meaning set in motion. The term "Phytohormone" was coined by Thimann in 1948. Plant hormones influence transcriptional levels, gene expression, and the division and development of cells. The integration of developmental activities is greatly aided by PGRs. The induction of hormone changes in metabolism and distribution within plants is a common way that environmental variables elicit inductive effects. In addition, they control the expression of plants' innate genetic potential (Sathyanarayana and Divya, 2021) ^[35]. PGRs, are essential to the life cycles of plants and can be created artificially by chemists or naturally by plants. (Davies, 2013) ^[8]. Auxins and cytokinins are examples of PGRs; these are tiny molecules that, in minute amounts, control the processes involved in plant development. (Fu, J. 2011) ^[10].

Application Methods

PGRs can be applied to plants using a variety of techniques, the majority of which involve foliar application. Commercial growers most commonly employ two techniques: drenching, foliar spraying and soil drenching (Sajjad, *et al.*, 2014) ^[32], seed priming (Pill and Gunter, 2001) ^[27], pasting (Saniewski, *et al.*, 2010) ^[34], capillary string (Carswell, *et al.*, 1996) ^[6],

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pre-plant sowing (Currey and Lopez, 2010) [7] and injection (de Vries and Dubois, 1988) [9]. The three most often used commercial techniques for ornamental plants are pre-planting, foliar spraying, and drenching. The study on PGR application techniques found that early applications, such as dipping prior to planting and substrate drenching during planting time, boost the effective use of these chemicals and assist achieve desired results. (Ranwala, *et al.*, 2005) [30].

The plant growth regulators are used in horticulture

Auxins, Abscisic Acid, BA, Cytokinins, Cycocel, Ethylene, Gibberellins, Salicylic acid and Triiodobenzoic Acid etc.

Auxins

In 1880, Charles Darwin was the first to hypothesise that auxin existed. The Greek term Auxin, which meaning "to grow," is the source of the English word Auxin. It was originally discovered in human urine. Tryptophan is a precursor to auxin and is produced at the tips of shoots and roots, in young, expanding leaves and seeds.

In rose, chrysanthemum, carnation and gerbera, auxins (IBA, NAA, and IAA) are commonly utilised to aid in the rooting of cuttings. IBA is the auxin that is most frequently and extensively utilised to encourage roots, followed by NAA and IAA. Combinations of two or more auxins have a synergistic effect and are more effective. (Sathyanarayana and Divya, 2021) [35]. Stem cuttings are well recognised to initiate and accelerate roots when exposed to auxins (Hartmann *et al.*, 2002) [12]. Numerous growth and behavioural processes in the life cycles of plants are coordinated by auxins like NAA. Moreover, NAA promotes flower production, plays a crucial part in the development of shoots, and causes cell division and elongation (Fu, J. 2011) [10]. According to a study on *Rosa damascena*, or damask rose, applying NAA to rose plants at a dose of 25 mg/L boosted the length, height, yield, and oil content of the flowers (Saffari *et al.* 2004) [31].

Gibberellins

In 1926, Japanese scientist E. KuRosawa made the discovery of gibberellin while examining the ailment known as stupid seedling (bakanae). It was caused by a fungus *Gibberella fujikuroi*. Precursor is terpenoids (Terpenes, Diterpenes and Sesquiterpenes), site of production is Embryos, roots and young leaves. It promotes cell division (Singh *et al.* 2021) [38]. With foliar gibberellic acid spray, the rose blossom "Iceberg" exhibited the longest stem length and intercellular length (Prashanth, 2003) [28]. Treatment with GA₃ @ 250 ppm, 10 DAP improves the fruit set and potential seed yield. The number of branches, plant height, stem diameter, and number of blooms per plant in the rose flower were all markedly boosted by gibberellic acid (Kusumawati *et al.*, 2015) [23]. By lengthening the internal length, increasing the number of nodes, and promoting growth, it lengthens the shoots. (Rajesh, 2012) [29]. The induction of parthenocarpic development of fruits in roses is possible by application of GA₃. It was also found useful for the prevention of bull-head malformation of flowers in Baccara rose (Singh, 2006) [37]. The optimal blend of compounds, such as salicylic acid and gibberellic acid (Goszynask and Rudnick, 1990) [11].

Cytokinins: In the 1950s, F. Skoog, C. Miller, and others identified cytokinins as agents that stimulate cell division

(cytokinesis). The role of cytokinins Cytokinins promote apical dominance, lateral bud development, and cell division. It repeatedly encourages tobacco roots' cortical cells to elongate. Exogenous administration of it stimulates the formation of chloroplasts in the callus tissues of excised cotyledons. Senescence is avoided because it stops the breakdown of metabolites such proteins, lipids, nucleic acids and chlorophylls in leaves (Singh *et al.* 2021) [38].

Banzyl adenine

Cut flowers are treated with cytokinins, such BA, to enhance their quality and prolong their vase life. Additionally, BA boosts flower production, reduces flower drop, and encourages cell elongation and division (Krug, *et al.* 2006) [22]. BA alongwith adenine (each 0.5%) applied with lanoline paste resulted in growth promotion of flower axillary buds and the development of renewal canes for revitalising cultivators of roses in greenhouses, such as Nordia, Happiness, and Golden Rapture. Many ornamental plant species benzyladenine and naphthalene acetic acid have both been applied pre and post-harvest. By applying BA in lanolin paste to lower buds—which is delivered into the tissue by scarring the bark—one can increase the output of cut flowers. Aromatic plant development and growth have also been enhanced by the application of BA (Affonso *et al.* 2007) [2].

Ethylene

This gaseous hormone is crucial for all fruit ripening processes, as well as for inhibiting root growth, abscission, and other growth processes (Singh, *et al.* 2021) [38].

Naturally occurring, ethylene was one of the first substances to be identified as a plant growth regulator and effectively applied to increase pineapple flower production. Its toxicity to humans is minimal. Since the creation of synthetic compounds that imitate these naturally occurring plant hormones, the usage of plant growth regulators has increased dramatically and is now a vital aspect of contemporary agriculture.

Abscisic Acid (ABA)

Another name for it is stress hormones. The ABA at higher concentrations located, in the pericarp inhibits the seed germination which is a major problem in rose breeding. ABA is a naturally occurring hormone that has been found in almost all plants and regulates plant growth and metabolism in a variety of ways (Singh, *et al.* 2021) [38].

Salicylic acid

Salicylic acid applied before to rose harvest enhances both rose quality and quantity (Tabebzadeh *et al.*, 2015) [40]. Due to its significant function in controlling plant metabolism, including growth regulation and stress response, salicylic acid has been demonstrated to be an important hormone. Additionally seen in the rate of photosynthesis, transpiration, stomatal conduction, and ion uptake and transport (Tehranifar *et al.* 2013) [41]. Before harvest, salicylic acid spraying produced the longest vase life (Hashemabadi and Zarchini, 2010) [13]. Salicylic acid can enhance the activity of oxidative enzymes, flower vase life, and water absorption (Alaey *et al.*, 2011) [1].

Cycocel: Some of growth retardant also influence the growth and flowering of roses. Plants Cv. Gabriele private

limited with CCC produce greater number of buds without any blind shoots, compared to the untreated plants. Treatment with 3% CCC solution in soil of potted rose plants caused dwarfing and improved flowering. (Singh A. K. 2006) [37].

Triiodobenzoic Acid

The rose treatment with TIBA (4000 ppm) is found to significantly increase the number of basal shoots per plant and at higher concentrations it leads to shorter shoots but with increased number of branches and flowers in *Rosa borboniana* by Singh A. K. (2006) [37].

Mohammed *et al.* (2019). The effect of plant growth regulators on the blossoms of two contemporary rose types was the main focus of the investigation. Using the quick and solvent-free SPME method, this study demonstrated how BA and NAA treatments can significantly increase the volatile organic compound (VOC) content of the flowers of two different rose kinds, Hybrid Tea and Floribunda, thus increasing the aromatic value of the flowers.

Zahid, *et al.* (2021) [44]. Examine how using various plant growth regulators as a foliar spray can improve the growth and vase life of greenhouse roses, specifically cultivar *Rosa hybrida*. Salicylic acid demonstrated the maximum plant height and days to the first bloom harvest despite different treatments. The results showed that applying growth regulators topically to plants raised the amounts of chlorophyll a, chlorophyll b, and total chlorophyll. Furthermore, plants sprayed with salicylic acid and humic acid at a dosage of 60 mg/L showed a substantial increase in flowering parameters such as flower stalk length, fresh weight of flower, dried weight of flower, flower diameter, number of flowers per plant, floral quality, and vase life.

Hong, *et al.* (2021) [15]. In the case of *Rosa hybrida* L. 'Red Rose', This study examined the morphological and physiological changes that occur during the formation of a rose's flower, as well as the effects of PGRs on the *in vitro* vegetative shoots of the rose's ability to flower. Auxins, gibberellins, and cytokinin levels rose when the meristem moved from the shoot apical meristem to the flower meristem stage. Plant growth regulators have a significant role in flowering and shoot apical meristem cell division.

Yaquby *et al.* (2022). Examine the effects of salicylic and gibberellic acids on the quantity, quality, and vase life of the "Avalanche" variety of roses. Through further absorption of the solution, the results of this experiment demonstrated that the spray of growth regulators can significantly increase the vase-life of roses compared to the control (Water spray), and can increase traits like flower diameter, stem diameter, flower length and the number of flowers per plant.

Conclusion

Plant Growth Regulators these naturally occurring compounds are created by plant tissues and aid in the growth and development of the plants themselves. They work by altering, regulating, or managing the processes involved in plant growth, such as the development of leaves and flowers, the lengthening of stems, and quality improvement. Synthetic substances with physiological properties similar to agents that stimulate plant growth and the ability to change the growth and development of plants. In horticulture crops yields positive outcomes. PGRs are employed in agriculture on a commercial basis.

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Conflicts of Interest

The author's shows interest on effect of plants growth regulators on different flower crops.

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