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Role of Plant Growth Regulators on Seed Germination of Papaya – A Review

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ABSTRACT

Papaya is botanically known as *Carica papaya* L. It belongs to Caricaceae family and it has chromosome number is 2n=18. Papaya is native to Tropical America. It was introduced in the 16th century in India. The term 'Plant Growth Regulators' is relatively new in use. In previous literature, these were revealed as Hormones. "Hormone" is a Greek word derived from "hormao" which means to stimulate. Thimonn (1948) optional the use of the term phytohormons in place of hormone of plants. He defined phytohormons as the organic substances which are formed naturally in plants, synthesized in one part and usually trans-located to other part of plants where in every small quantity effect on the growth and other physiological activates of the plants. The term growth regulator is used for the materials which work similar to phytohormons but synthetic in nature.

Key word : *Papaya, Plant growth Regulator, Growth, Quality, Yield*

Introduction

Papaya botanically known as *Carica papaya* L. It belongs to Caricaceae family and it has chromosome number is 2n=18. Papaya is native to Tropical America. It was introduced in the 16th century in India (Kumar and Abraham, 1983). It is grown in tropical and sub-tropical climatic conditions. Papaya was originated from Central America and recently introduced in Australia, Hawaii, the Philippines, Sri Lanka, South Africa, and India (Morton, 1987).

Papaya is commercially grown in many states of India such as higher production in Andhra Pradesh, Madhya Pradesh, Gujarat, Uttar Pradesh, Maharashtra, Haryana, Tamil Nadu, Karnataka, and some parts of Rajasthan. It covers the maximum area in Gujarat followed by Andhra Pradesh and Kerala. The total production of papaya in India is 6.01 MT from an area of 0.14 Mh with the productivity of 42.92 Metric tonnes/ha (Anon., 2020). In Gujarat, papaya covers 0.02 Mh area with total production of 1.25 MT (Anon., 2018).

Papaya is a sweet, healthy, and refreshing fruit it is good for digestion system (Ram, 2005). Papaya has high nutritional value such as moisture (90.8%), fat (0.1%), fibre (0.8%), protein (0.6%), carbohydrate (7.2%), mineral matter (0.5%), calories (32 KCal), phosphorus (13 mg), potassium (69 mg), calcium (17 mg), magnesium (11 mg), iron (0.5 mg), sodium (7.2 mg), copper (0.2 mg), sulphur (13 mg), chlorine (11 mg), vitaminsA (666 mg) and vitamin C (57 mg) in 100g of papaya fruit (Ram, 2005). Every part of the plant can be used for nutritional and health purposes at a low cost (Nwofia *et al.,* 2012). Leaf extract of papaya also useful for many diseases such as

malaria and dengue fever (Deshpande *et al.*, 2021). The milky latex papain found in the fruit and other plant parts which have been utilised as beer clarifying agents and meat tenderizers (Ayoola and Adeyeye, 2010). Papain is mostly found inunripen fruits rather than mature fruits. Papaya fruit is usually consumed as a dessert, but it is also useful for making different processed products such as jam, candy, puree, juice, preserves, and pickles (Chaudhary *et al.*, 2019).

Under controlled environmental condition, proper seed germination and seedling growth are the most important considerations for optimal papaya seedling production. Different pre-sowing seed treatments of papaya have an impact on germination rate and seedling growth. Several fruit crops use a variety of pre-sowing seed treatments, including plant growth regulators and growing media, to improve seed germination and seedling growth (Lanjhiyana *et al.*, 2020).

Red lady is the most popular papaya variety among growers because to its hermaphrodite character and long shelf life. However, the cost of seeds for this variety is extremely high. As a result, papaya growers face a difficulty in increasing germination rates and creating healthier seedlings. Because papaya is commercially propagated by seed, the most crucial aspect for the production of papaya fruits is strong and healthy seedling production. Proper seed germination and seedling growth are critical aspects for optimal seedling output in the nursery (Lanjhiyana *et al.*, 2020).

What is Plant Growth Regulators

He phytohormons are defined as the organic substances which are formed naturally in plants, synthesized in one part and usually trans-located to other part of plants where in every small quantity effecton the growth and other physiological activates of the plants. The term growth regulator is used for the materials which work similar to phytohormons but synthetic in nature. The various types of growth regulating substances are: Auxins; Cytokines; Gibberellinas; ABA; Ethylene.

Plant growth regulators have become an important feature of modern crop cultivation for enhancing germination, growth, yield and quality. Plant growth regulators are organic compounds (other than nutrients) that promote, inhibit, or otherwise affect any physiological function in plants when used in low quantities. The use of such regulators to enhance germination is normal practice. Plant growth regulators like GA3, NAA, and others have been shown to increase the number of seedlings during germination. (Chaudhary *et al.*, 2020) observed that the seeds are treated with GA_3 resulting improved seed germination and seedling growth in papaya. As a result, gibberellins are key germination

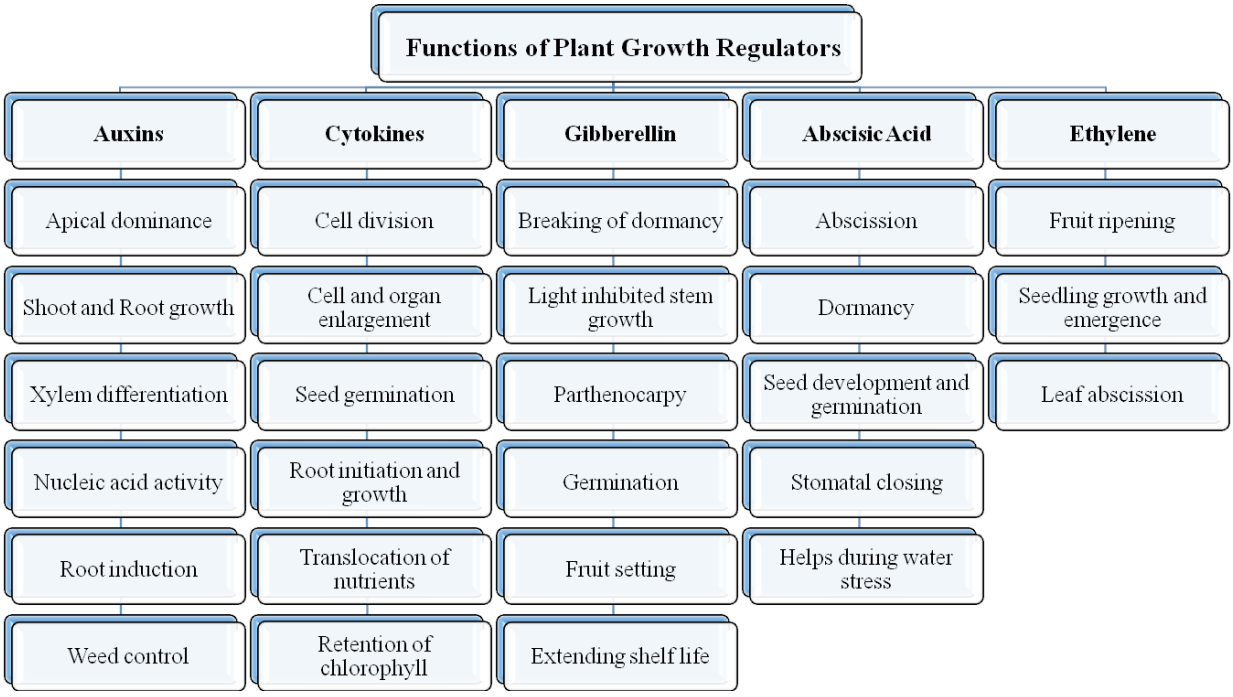

Table 1. Effect of different plant growth regulators on papaya seed germination**.**

Plant Growth Regulators	Concentration	Effect of PGRs on Seed Germination	References
GA_3	500 PPM	15 days required for completion of germination, Highest number of leaves	(Barche *et al.,* 2008)
GA_3	50 PPM	Improve the germination.	(Zhao Chun Xiang *et al.,* 2004)
GA_3	100 PPM	Highest seed germination.	(Anjanawe *et al.* 2013)
GA_3	100 PPM	Maximum seedling height, Stem girth.	(Meena and Jain, 2012)
NAA	100 PPM	Enhanced germination, Reduced the time required to attain 50 per cent germination.	(Helail and Salama, 1999)
GA_3, NAA & BA	200 PPM50 PPM	Maximum seed germination, seedling height, stem diameter, length of longest root.	(Anjanawe *et al.,* 2013)
GA_3	150 PPM	Early as well as higher germination percentage, better shoot and tap root growth, secondary root production and chlorophyll content.	(Kumawat *et al.,* 2014)
GA_3	150 PPM	Seed germination (72.2%), maximum seedling growth (seedling height and seedling girth).	(Deb *et al.,* 2008)
NAA	200 PPM	Maximum height of the seedlings.	(Rana *et al.,*2020)
NAA	2000 PPM	Highest seed germination.	(Soyler and Khawar, 2007)
GA_3	100 PPM	Maximum root and shoot length, seedling height and germination percentage.	Vyas *et al.* (2009)

promoters that increase the performance of papaya seeds by increasing seed germination and uniformity (Zanotti and Barros, 2014).

Effect of plant growth regulators on papaya seed germination

The promising effect of GA_3 as a seed pre-sowing treatment replaced the seeds dormancy mechanism, resulting in early germination (Khan, 1980). Gibberellic acid works on the embryo, causing the production of hydrolyzing enzymes such as amylase and protease. This hydrolyzed food is then used for embryo growth, resulting in improved germination (Choudhary *et al.,* 2020). GA_3 @150 mg/l treatment considerably reduced the number of days required for initial germination and 50% germination (Desai *et al.,* 2017). It could be because GA_3 aided in physically breaching, so reducing physiological barriers associated with the impermeable seed coverings that cause seed dormancy (Mayer and mayber, 1963). The experiment clearly shows that gibberellic acid has a major impact on the various germination characteristics of papaya seeds. The treatment GA_3 @ 150 ppm had the shortest germination time (Lanjhiyana *et al.,* 2020). The treatment in which the seedlings were treated with GA_3 200 ppm had the highest germination rate (Anburani and Shakila, 2008). The increased germination percentage in the GA_3 treatment could be attributed to GA_3's role in the activation of cytological enzymes, as well as an increase in cell wall flexibility and greater water absorption. Another reason could be that GA_3 promotes seed germination by forming the a-amylase enzyme, which transforms insoluble starch into soluble sugars, and it also promotes radical development by reducing metabolic blocks as previously suggested (Gillard and Walton, 1973).

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