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A Review on Effect of Different Growing Media and GA_3 on Germination and Growth on Papaya

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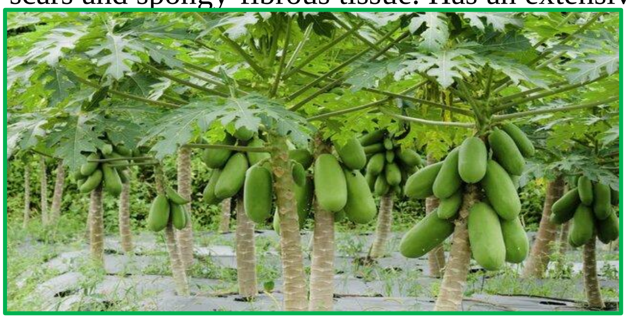
Papaya (*Carica papaya* L.) An important tropical commercial fruit crop of India. It is native to the tropics of the Americas. It is 7th important fruit crop of the country after Mango, Citrus, Banana, Apple, Guava and Sapota. According to National Horticulture Board (2015), Papaya occupies 1.8 % of total fruit crop area and 6.3 % of total fruit production in India. It occupies a cultivated area of 133.4 (000 ha) with an annual production of 5699.00 (000 MT/ha) productivity of 42.3 (MT/) Gujarat holds 2nd position with 21 % shares in papaya production of the country next to Andhra Pradesh, which has 27.4 % share. Among the various varieties of papaya pusa Dwarf, Taiwan, Pusa Delicious have attained the commercial status throughout the country. Gibberellic acid (also called Gibberellin A_3, GA, and GA_3) is a hormone found in plants and fungi. GA_3 appears mainly to induce the activity of the gluconeogenic enzymes during early stages of seed germination. Media is a substrate that provides the required elements and physical support to the growing plants. Propagation media used in raising horticultural plants in the nursery are mostly organic or inorganic in nature. Papaya is normally propagated by seed and it is interested by researchers due to the presence of gelatinous sarcotesta preventing germination. The effect of media on seed germination and seedling growth has been workout by various workers However, no information is available on as organic seeds priming and its combination effect with media on germination and growth of the seedlings. Therefore, the present study was initiated to find out seed germination and seedling growth of papaya in GA_3 with different media filled in plug trays.

Before sowing of seeds is soaking in water soluble endogenous hormones has been reported to promote the germination. The objective of the study was to increase the seed germination and physiological development of papaya seedlings through applying the growth regulator with different growing media.

Botanical Description of Papaya

Carica papaya is an evergreen, tree-like herb, 2-10 m tall, usually unbranched, although sometimes branched due to injury, containing white latex in all parts. Stem cylindrical, 10-30 cm in diameter, hollow with prominent leaf scars and spongy-fibrous tissue. Has an extensive rooting system. Leaves spirally arranged, clustered near apex of trunk; petiole up to 1 m long, hollow, greenish or purplish-green; lamina orbicular, 25-75 cm in diameter, palmate, deeply 7-lobed, glabrous, prominently veined; lobes deeply and broadly toothed. Flowers tiny, yellow, funnel-shaped, solitary or



clustered in the leaf axils, of 3 types; female flowers 3-5 cm long, large functional pistil, no stamens, ovoid-shaped ovary; male flowers on long hanging panicles, with 10 stamens in 2 rows, gynoecium absent except for a pistillode; hermaphrodite flowers larger than males, 5-carpellate ovary; occurrence depends on the season or age of the tree. Fruits large, cylindrical, with fleshy orange pulp, hollow berry, thin yellowish skin when ripe, varied. Fruits formed from female flowers are oblong, spherical, pear-shaped; from hermaphrodite flowers, long, obovoid or pyriform. Seeds numerous, small, black, round, covered with gelatinous aril. Small latex vessels extend throughout the tree and are particularly abundant in fruit that has reached full size but has not yet begun to ripen. The generic name is from the Latin 'carica', meaning 'edible fig', on account of the similarity of the leaves.

Origin

The papaya is believed to be native to southern Mexico and neighboring Central America. It is currently cultivated in Florida, Hawaii, Eastern British Africa, South Africa, Sri-Lanka, India, Canary Islands, Malaysia and Australia. It is now present in every tropical and subtropical country. Papaya was first described in 1526 by the Spanish chronicler Oviedo, who found it first on Panamanian and Colombian coasts. The fruit was rapidly propagated in the tropics, most likely due to the abundant and highly viable seeds. The crop has adapted quite well to tropical areas with fertile soils and abundant rainfall.

Climate

Papaya is essentially a tropical fruit crop and grows best in sunny places. It is very sensitive to frost but withstands extremes of temperature. Temperatures below 10OC will affect the growth and fruit set. It grows well in regions where summer temperature does not exceed 38OC but it can stand up to 48OC.It also flourishes well in regions up to an elevation of 1100m. It is adapted to a wide range of rainfall conditions ranging from 35cm to 250cm annually; however, excessive moisture adversely affects the crop as well as fruit quality. It does not stand strong (80Km/Hour) or hot winds. Dry climate during flowering often causes sterility while the same conditions during fruit maturity add to the sweetness of the fruit.

Soil

It can be grown on a variety of soils provided the soils are well drained. Under water stagnated conditions and in soils with poor drainage foot rot disease may cause heavy mortality. Hence, heavy soils should be avoided as papayas cannot withstand water stagnation for more than 48 hours. A loamy soil with a pH of 6.5 to 7.2 is considered ideal. It can be grown in poor soils also provided with heavy manuring and irrigation.

Economic Significance

Fruit is a rich source of vitamin A and C. It has a high nutritive and medicinal value. Papain prepared from dried latex of its immature fruits is used in meat tenderizing, manufacture of chewing gum, cosmetics, for degumming natural silk and to give shrink resistance to wool. It is also used in pharmaceutical industries, textile and garment cleaning paper and adhesive manufacture, sewage disposal etc. Major papaya producers are Brazil, Indonesia and India that export the fruit to many countries, including the United

Kingdom.

Effect Of GA_3 on Germination and Growth

Early germination (15.70 days) was recorded in seeds treated with 200 ppm GA3 (G2) followed by GA3 100 ppm (G1) and GA3 300 ppm (G3). Similarly higher germination percentage (95.71%) was recorded in seeds treated with 200 ppm GA3 (G2) followed by G3 and G1. While the maximum time for germination (16.49 days) and minimum germination percentage (87.14%) were recorded in control; water (G0). The increased germination percentage in seeds treated with GA3 200 ppm might be because of GA3 involvement in activation of cytological enzymes and also increases cell wall plasticity and water absorption. This helps to loosen the seed coat and increases the germination. GA3 is involved in two phases of germination: initial enzyme induction and activation of the reserve food mobilization mechanism, both of which boost germination.

In case of growth regulator GA3 100 ppm (G1) was found to be most effective for most of the seedling parameters like seedling height (12.46 cm), stem girth (5.71 mm), no. of leaves (18.22), leaf area (27.46 cm^2), fresh weight of seedling (7.69 g), dry weight of seedling (1.32 g), root length (30.25 cm), vigour index-I (4005.03 cm), vigour index-II (125.98 g). The maximum survival percentage (94.76%) was noted in G1, which was at par with G2 and G3. While the minimum value of all seedling parameters were recorded in control water (G0) viz. seedling height (10.66 cm), stem girth (5.16 mm), no. of leaves (16.39), leaf area (17.86 cm^2), fresh weight of seedling (4.65 g), dry weight of seedling (0.77 g), root length (22.44 cm), vigour index-I (2909.78 cm), vigour index-II (67.95 g), and survival percentage (82.22%). The positive effect of GA3 emphasised by the fact that the papaya seedling's endogenous levels of GA3 were insufficient, and external treatment of GA3 improved growth by promoting cell multiplication and cell elongation, leading to greater plant development GA3 may have aided in the invigoration of plant physiological processes and the stimulatory action of chemicals to develop new leaves at a faster rate, resulting in an increase in the number of leaves. The influence of GA3 on different plant parts leads to an increase in the fresh weight of shoots, which might be owing to its effect on promoting cell division, cellular and auxin metabolism, cell wall plasticity, and cell membrane permeability, all of which contribute to increased growth.

Effect of Growing Media on Germination and Growth

Among different combinations of growing media and GA3, the minimum time required for germination (13.98 days) was noted in soil: sand: vermicompost; 1:1:1 ratio with GA3 300 ppm (M2G3). While the maximum time required for germination (18.43 days) was noted in soil: sand: rice husk; 1:1:1 ratio along with GA3 100 ppm (M3G1). In the case of germination percentage the interaction between growing media and GA3 was observed to be non-significant. The reason behind minimum time required for papaya seed germination in sand: soil: vermicompost; 1:1:1 along with GA3 300 ppm (M2G3) might be that vermicompost contains a high amount of organic matter, which provides the media with a sufficient amount of water and nutrients. It also contains bioactive principles which are beneficial for root growth, root initiation, germination and plant growth (Kaur, 2017) [9]. Gibberellic acid weakens the mechanical barriers of the endosperm cells and helps in radical protrusion. This facilitates the early germination.

The combination of the growing media and GA3 resulted in a significant increase in seedling parameters. The greater values in respect to seedling height (21.85 cm), stem girth (8.16 mm), no. of leaves (28.13), fresh weight of seedling (14.79 g) and dry weight of seedling (2.09 g), were noted in soil: sand: rice husk: vermicompost; 1:1:1:1 ratio with GA3 100 ppm (M5G1). M5G1 was statistically at par with M5G3 (soil: sand: rice husk: vermicompost; 1:1:1:1 ratio with GA3 100 ppm) in case of stem girth, and in case of the dry weight of shoot it was statistically equal to M1G1 (soil: sand: FYM; 1:1:1 ratio with GA3 100 ppm). Increase in seedling parameters might be due to the combination containing many macro and micro nutrients, humic acid, which maintaining proper aeration and porosity and GA3, which increases cell division and uptake of nutrients, thus increasing the growth of seedling. The increase in fresh weight and dry weight might be because the combination of GA3 and media increases the water and nutrient transportation to aerial parts, which leads to production of photosynthetic product and translocation of various plant parts, resulting in a higher fresh and dry weight of shoot.

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