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Effect of light, CO_2 and GA_3 on germination of Purple Passion Fruit (*Passiflora edulis sims)* seeds

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Introduction

Purple Passion fruit (***Passiflora edulis Sims***.), a native of tropical America (Brazil), belongs to the family Passifloraceae is a high value and export oriented crop (**Dupriez and De Leener, 1989**). Passion fruit stands out not only for its exotic and unique flavour and aroma but also for its amazing nutritional and medicinal properties. It is cultivated in countries like Kenya, Australia, New Zealand, Hawaii, South Africa and Srilanka. India, too, has its place in passion fruit history. For several years, India has enjoyed a moderate harvest of purple passion fruit in the Nilgiris, Wynad, Kodaikanal, Shevroys, Coorg and Malabar in the South and in various parts of Northern India, especially Himachal and North East states like Manipur, Nagaland, Mizoram and Meghalaya.

Within the fruit of the passion fruit berry there are numerous number of approximately 250 black seeds. The length of passion fruit seeds varies from 2.4mm to 3mm. Each seed is covered by a thick membranous sac which contains fleshy juice. The flavor of passion fruit juice is musky and acidic to some extent. Passion fruits are normally purplish and some yellow species which cracks when opened, containing hundres of crunchy fleshy seeds surrounded by yellow membranous sac with juice. Passiflora edulis is a perennial vine species, have tendrils on every leaf axils and possess a reddish purple hue at young stage (**anonymous 2023**).

Carbon dioxide enrichment for promoting growth and productivity of greenhouse crops is a well-established commercial practice, including both stimulation and inhibition of rooting. Injecting CO_2 into the mist increased the CO_2 concentration in the atmosphere to 1100 µ 11^{-1} (**Lin *et al*., 1984**) .

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The concentration of CO2 showed increased in the growth, as measured by dry weight (**Ronald *et al*., 1992**)

Another environmental factor that also influences the seed germination process is temperature (**Carvalho and Nakagawa, 2000; Marcos-Filho, 2005; Bewley et al., 2014**). The influence can be in the germination percentage and rate, affecting water absorption and regulating the biochemical reactions that regulate the metabolism involved in the germination process (**Bewley and Black, 1994; Marcos Filho, 2005**). Therefore, germination will occur within certain temperature limits and consequently the maximum germination efficiency will occur in a particular temperature range (**Carvalho and Nakagawa, 2000; Bewley et al., 2014).**

Varieties

Passion fruit has two distinct forms , the standard yellow (Passiflora edulis f. flavicarpa Deg.) and the purple (Passiflora edulis f. edulis). The yellow are more acidic and less starchy while the purple are less acidic and more starchy. Both two form viz., purple passion fruit (P. edulis) and yellow passion fruit (P. edulis var. flavicarpa) are of commercial importance. The hybrids of these two have also been developed for cultivation.

Propagation

Passion fruit is propagated through seed, stem cutting, grafting and serpentine-layering technique. Seedlings and grafted plants are more vigorous than the plants raised by cuttings. Passion fruit vines originating from cutting or grafting starts fruiting at 7-6 months while plants raised from from seeds come in fruiting at 10-12 months. Vegetatively propagated plants are true to type while seeding plants are not genetically uniform due to cross pollination.

About

Purple Passion fruit is a perennial crop which is commercially propagated by seed and the rate of germination percentage can be increases by the use of plant growth regulators GA_3 and different light intensity and also by maintaining the temperature.

GA_3 helps in breaking the seed dormancy which results in early and enhanced seed germination and this increase the germination of the seed.

Light is an important factor which influence the seed germination This is because the light is responsible for the activation of phytochrome, a soluble chromoprotein which, in the inactive form (Pr), absorbs red light (R) wavelength and is transformed into an active (Pfr) form which absorb far red light (FR).

Material And Methods

The present investigation entitled "**Effect of light and GA_3 on germination of purple Passion fruit** (***Passiflora edulis sims***) seed" was conducted at the experimental field

on the Department of Horticulture , Naini Agricultural. Institute, Sam Higginbottom university of Agriculture, Technology and Sciences , Prayagraj (U.P.) during 2023-2024.

TREATMENT DETAILS

- **Factor 1-GA3**

  GA_3-200 ppm

  GA_3-300 ppm

- **Factor 2- light intensity**

  Light intensity- 1500 lux

  Light intensity- 2000 lux

- **Factor 3- CO_2 Concentration**

  CO_2 – 1000 ppm

  CO_2 – 2000 ppm

Effect

the Effect of light on seed germination and seedling shape of succulent species using light and darkness. From the study he observed that all species were considered neutral photoblastic. Eleven species had similar seed germination in both light and dark conditions, and three taxa (M. compressa and the two varieties of Ferocactus latispinus) showed higher germination with light than without it. . Seed mass was an important factor because with higher seed mass there was lower dependence to light. These findings support that small seed mass and light requirements have coevolved as an adaptation to ensure germination.

the synergetic action of light and temperature on seed germination of some solanaceae members in germination chamber. The influence of combined of three alternative temperature regimes from 10 to 40 °C, with 10°C intervals, under three light levels (the continuous white light, alternative and darkness) were tested. The optimum condition for the germination of the seeds was varied with species (species-dependent): some species like Hyoscyamus muticus and Withinia somnifera germinate easier under combined effects of light and temperature. It is concluded that the regime of light suppressed the effects alternating temperatures on seed germination of Datura innoxia species. It was concluded that synergized effects of light and alternating temperatures, enhanced seed germination of Hyoscyamus muticus and Solanum nigrum. Thus, the light regime can play a vital role in present and future weed management strategies.

The Light-Mediated Seed Germination Connecting Phytochrome B to Gibberellic Acid. Light and water are not the only factors regulating seed germination. For many plants, seed germination is repressed by the hormone abscisic acid (ABA) and stimulated by another hormone, gibberellin (GA). In Arabidopsis, the activation of phytochrome leads to decreased levels of ABA and increased levels of GA, releasing the repression and allowing the stimulation of seed germination. When phytochrome B is activated by red light, seed

germination is promoted by epigenetic transcriptional activation of gibberellic acid biosynthetic enzymes via histone demethylation.

GA3 500ppm was found to be the most effective treatment resulting in significant increase in seed germination (75.50%), decrease in mortality percentage (16.63), increase in seedling height (72.94 cm), seedling girth (0.63 cm), per cent buddable seedling (80.44%) and early germination (8.0 days) followed by (1.0%) thiourea in case of aonla (*Emblica officinalis*).

A Bimodal Temperature Response and Effect of Light Intensity in the Photocontrol of Germination of Seeds in Jussiaea suffruticosa and in this study he observed that in the germination of seeds both under continuous and cyclic light treatments. The response depends on light intensity both under continuous and intermittent light treatments. This dependence is much more noticeable in the region of minimum germination (30 ^{o} Both preincubation in darkness at 35 ^{o} and high light intensities (15500 lux) tend to eliminate the bimodal temperature response.

Different levels of GA3 (0, 50, 100, 250, 500, 750, or 1000ppm for seed treatment. They germinated the seed under greenhouse conditions in black polythene bags and he found that GA3 treatment improved germination parameters with GA3 at 100ppm giving the best overall results.

Reference photos:-

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