

Coconut Milk, a Source of Growth and Development Promoting Substances for Crops

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SUMMARY

Cytokinin either in synthetic (Kinetin) or natural (Zeatin) plays pivotal roles in plant growth and development. Coconut milk is expressed from the endosperm (white portion) of coconut plant. It contains growth hormones along with enzymes, carbohydrates, alcohols, lipids, amino acids, nitrogenous substances, and organic acids. Kinetin called zeatin along with other growth regulating substances. The growth regulators are extracted from the unripe coconut milk following specific analytical spectrophotometric procedure. Bioassay of coconut milk discloses that it has the ability to increase physiological activities. Hence, phenomena beginning with seed germination to development of yield and yield attributes are the features of crop production triggered by both kinetin or its like substance i.e. zeatin.

INTRODUCTION

Coconut Milk (CM) is the liquid endosperm of *Cocos nucifera* L. It contains various biologically active compounds (Jean et al., 2009) especially growth substances such as auxin, gibberellins, cytokinins, and their natural inhibitors-regulators viz., ethylene, abscisic acid, phenols and flavonols. Minute quantities of auxin and gibberellin, zeatin and kinetin are present in CM. The biological activities of CM can be studied precisely if the growth hormones are extracted from the endosperm (milky white portion only) of unripe fresh fruit (Mamaril et al., 1988). Generally, the endosperm is crushed in a grinder mixture and squeezed out the CM. The growth hormones are extracted from the CM within eight hours of crushing. If CM needs to be stored, it is sterilized at 120°C at 15psi for 15 minutes to prevent microbial activity during storage at room temperature. Methylene chloride (CH₂Cl₂ b.p.40.1°C) is used as the solvent in the extraction process at a ratio of 25:1 (v/v), CM:CH₂Cl₂, and stirred well. The CH₂Cl₂ extracts are prepared at different pH levels viz., first extract at pH 5.5-6.5, 2nd extract by adding diluted HCl to reach the pH 2.0; and the third extract is obtained at pH 11 adding diluted NaOH to the CM. The concentrate is freeze dried to remove the CH₂Cl₂ completely, and it's weighed. To estimate the fraction of CM, one liter of aseptic CM is dialyzed against 2 changes of 500ml each of distilled water per 4-5 hours. The dialyze is absorbed on an activated charcoal (Sigma no C-250-350 mesh) column. Then, the absorbate is eluted stepwise by 200ml each of 95% ethanol, acetic acid, 25% acetonitrile and basic alcohol containing 10% NH₄OH. The column is washed several times with water after each elution, and washings are pooled with the preceding eluant. Fractions are concentrated via recycling procedure that recovers the solvents. The concentrates are adjusted to pH 7.0, and diluted with the culture medium to appropriate concentrations (5-10ppm) prior to testing for the biological activity. Finally, the absorption curves of the growth hormones IAA, GA, Zeatin, Kinetin, and Abscisic acid and the CM extracts or fractions are determined in the 180nm to 300nm region with UV-Vis spectrophotometer.

Discussion

In the recent past, coconut milk as a rich source of kinetin and its physiological roles on growth and development of crop plants under different situations have been studied elsewhere (Dutta, 2019; Bey, 2022; Basumatary, 2022; Cai et al., 2018; Lazim et al., 2015; Martin et al., 2015; Kobayashi et al., 1995; Tulecke, 1996). Seed germination and early seedling development are essential events in the plant life cycle that are controlled largely by the interactions between several plant hormones. Cytokinins and cytokinin analogues have the ability to promote germination. Rate of germination, germination speed, uniformity of germination and emergence in rice crop are enhanced by soaking of seeds in priming agent like CM. This is because of improved mobilization of stored material from endosperm to embryo during germination as a result of hydrolytic enzyme α -amylase activity. Number of tiller per plant is increased significantly with treatment of the coconut milk and kinetin. The increase in tillering by exogenous application of zeatin, a natural kinetin could be due to a change in endogenous hormone contents. The leaves show cell enlargement by the action of kinetin. The reason behind is that Kinetin induces cell divisions irrespective of light and darkness. The beneficial effects of cytokinin are due

to formation of-SH compound and its activities on plant growth parameters viz., plant height, number of branches and dry matter accumulation. While cytokinins are limiting, it affects plant growth as a regulatory function on shoot apical meristem (SAM). The reduced activity of the SAM could also be the cause of the incomplete apical dominance. One of the classical functions of cytokinin is the regulation of plastid development. So, cytokinin increases the rate of greening and stimulates ultrastructural changes characteristic for the etioplast-to-chloroplast transition. The enrichment of dry matter is associated with chlorophyll content and photosynthetic activity in leaves. Cytokinin increases sink capacity, CGR, RGR and dry matter production. Cytokinins induce nitrate reductase activity in some plants. Cytokinins play a role in preserving the structure and function of the photosynthetic machinery under stress conditions. Cytokinin amplifies sink activities by stimulating assimilate accumulation in chloroplasts of older leaves. The role of Cytokinin in the biosynthesis of Chlorophyll, stimulation of tetrapyrrole biosynthesis, chloroplast transcription, and enhancement of photosynthetic efficiency has also been demonstrated. Cytokinin increases the nitrogen content of rice grain. By increasing cytokinin activity on rice, panicle meristems, grain number and yield of rice can be increased by kinetin. Growth and yield of rice are augmented by cytokin. Higher yield attributes and yield can be achieved with application of cytokinin in different crops. Sink capacity, seed set, yield attributing characters and seed filling percentage are increased by cytokinin.

CONCLUSION

Exogenous application of synthetic cytokinin (Kinetin) and natural cytokinetin (Zeatin) provides opportunities for enhancing crop yield. As cytokinins move from root to shoots acropetally, root exposure to cytokinin brings about the remarkable plant growth and yield development in crop plants.

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