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Effect of Cytokinin on Fruit Crops

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A B S T R A C T

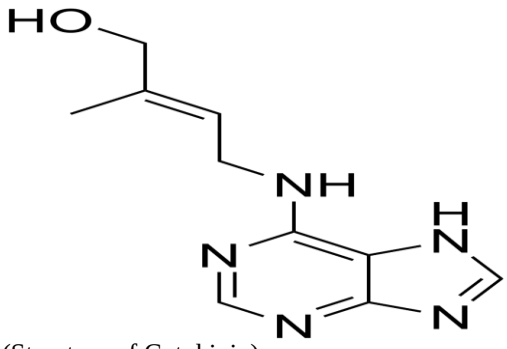
The word for cytokinin is a generic name and naturally occurring substances that are known to promote cell division. The term cytokinin was proposed by Letham in 1963. It is also known to delay senescence. In corn the first naturally occurring cytokinin was found and is named as zeatin. The most widely distributed cytokinins are the synthetic benzyladenine and kinetin. The natural cytokinin found in apical root meristem, inflorescences and developing fruits. The role of cytokinin in plant is cell division, lateral bud development, delaying senescence, Shoot formation or organogenesis, parthenocarpy fruit production, etc. High cytokinin and low auxin could promote formation of shoot buds.

Introduction

Phytohormones produced naturally in higher plants, controlling growth or other physiological functions at a site remote from its place of production and active in minute amounts. plant growth regulators contain naturally occurring phytohormones, their chemical analogs, hormone sensitivity, hormone releasing agents, altering agents and hormone synthesis inhibitors (Hajam *et al.*, 2017). Plant growth regulators are auxins, gibberellins, cytokinin, ethylene, growth retardants and growth inhibitors. Cytokinin plays a key role in the life of higher plant. Main roles of cytokinin are cell division, delay senescence, organogenesis, induce flowering in short day plant, axillary bud formation, etc. The most widely distributed cytokinins are the synthetic benzyladenine and kinetin. The leaves senescence usually occurs with loss of chlorophyll and rapid breakdown of proteins. By kinetin treatment Senescence can be postponed to several days by improving RNA synthesis followed by protein synthesis. High cytokinin and low auxin could promote formation of shoot buds. Plants accumulate solutes very actively with the help of Cytokinin and also help in solute translocation in phloem. Recent studies proved that other phytohormones like cytokinin, may also affect stomatal openings (Acharya and Assmann, 2009). Peleg and Blumwald (2011) reported that cytokinin plays very important role as antagonistic during stress conditions. It has been

hypothesized that CK acts as undesirable regulator against abiotic stress signaling (Nishiyama *et al.,* 2013).

Effect of Cytokinin on different fruit crops



(Structure of Cytokinin)

Apple

Tan *et al.,* (2019) observed on role of cytokinin on outgrowth of auxiliary buds in apple and he opined that high content cytokinin present in more branching mutant type and in wild type exogenous application of ck promotes axillary bud out growth. Magyaretal. (2010) opined that highest regeneration occurs in pretreated apple explant with BA than that of treatment free explant.

Stern *et al.,* (2006) concluded that in apple cv. Golden delicious application of CPPU @ 10mg/l or BA @50mg/l after 2weeek of full bloom shows positive impact on fruit size with no negative impact on yield, fruit shape, seed number. Yuan and Greene (2000) achieved that application of BA in apple increase the endogenous cytokinin (zeatin) which promoted maximum cell division.

Cook *et al.,* (2001) opined that in apple outgrowth of auxiliary bud occurs during spring by following winter dormancy and this spring bud burst promoted by cytokinin from the shoot. Stern *et al.,* (2003) obtained that in warm condition BA shows significant effect on fruit size of apple var. Royal gola.

Pear

Chen et al (2012) obtained that application of CPPU 10ppm and BA 30PPM increases fruit size in pear. Flashiman *et al.,* (2001) and Stern *et al.,* (2002) achieved that use of CPPU and BA have significant effect on pear cv. Spadona and coscia in respect to weight and size of the fruit. Kodota *et al.,* (2003) observed effect of different concentration of cytokinin on pear explant and found that highest shoot multiplication achieved by adding BA @11µm, then BA@4.4µm. He also opined that greater hyper-hydricity caused by TDZ and CPPU than BA and kinetin. Sing *et al.,* (2004) concluded that 10ppm BA application increase leaf chlorophyll contains in pear leaf, so leaf senescence delay.

Flaishman *et al.,* (2001) obtained that application of CPPU @ 10-20ppm on low cilling pear cv. Spadona and cosita 2weeks after full bloom shows positive impact on fruit size with no negative impact in relation to fruit shape and yield. He also compared different time of application of CPPU and opined that cell division at early stage of fruit development have a major role on final fruit size, so it is significant to apply CPPU after 2week of full bloom than one month after blooming. Similarly, Zhang *et al.,* (2007) opined that at early stage of fruit growth CPPU stimulate effective for cell division.

Shargal *et al.,* (2006) observed that application of CPPU or TDZ caused the phase of cell division in parenchyma cell in pulp which helped to achieved better fruit diameter.

Stern *et al.,* (2003) obtained that application of BA on pear cv. Cosica shows significant effect on fruit size with no negative aspect.

Zihang *et al.,* (2008) investigated that application of CPPU induce parthenocarpic in

Japanese pear. He also opined that CPPU not only increased the fruit set percentage but also increase the fruit size in all rosaceae family.

Prunus species

Tsafouros *et al.,* (2018) concluded that BA has positive impact on proliferation of shoot in prunus species explant. Alanagh *et al*., (2010) achieved that BA has significant effect on rootstock GF-677. Similar observation by Andreu *et al.,* (2005) on Adesoto101 rootstock.

Nowak *et al*., (2002) achieved that number of adventitious bud obtain on media containing TDZ or BAP and numerous bud per explant increases.

Mango

Notodiamedio (2000) suggested that application of CPPU 10ppm promotes highest fruit retention, number of fruits per cluster, fruit weight and leaf area.

El-Badawy *et al.,* (2013) observed that highest level of kinetin promotes highest stem diameter, number of branches per plant, number of leaves per plant. In addition, it also reduces the risk of vegetative malformation.

Kiwi fruit

Akbas *et al.,* (2007) investigated that MS medium supplement with BAP @ 0.5mg/l shows highest shoot multiplication than that supplement with kinetin. Caboni *et al*., (2001) observed that BA (4.4µm) helps shoot formation from kiwi fruit explant. Moncalean *et al*., (2001) suggested that on kiwi fruit BA has positive impact on different phase of micropropagation and regulate further development of the regenerants.

Ainalidou *et al.,* (2016) observed that application of CPPU stimulate fruit growth by enlarging small cells. He also opined that apart from the size development CPPU disturb the ethylene production in kiwi fruit by delaying softening of central placenta and indirectly increased shelf life of fruit. Prado *et al.,* (2007) found that better shoot multiplication achieve in presence of Zeatin @ 2-3µm. Ainalidou *et al.,* (2015) opined that CPPU provide superior quality of kiwifruit under good pollination condition. Patterson *et al.,* (1993) observed that kiwi fruit dipping in CPPU shows more greener than untreated fruit.

Yingning *et al.,* (2010) found that successful Shoot multiplication obtained by supplement of IBA @ 0.05-0.1mg/l or BA@0.2mg/l in the medium.

Cherry

Guak *et al.,* (2005) observed that application of promalin (250ppm BA + 1000ppm GA) delay the leaf senescence in sweet cherry. Zhang *et al.,* (2011) achieved that application of CPPU 30days after full bloom shows significant effect on fruit weight.

Citrus

Rathore *et al.,* (2007) observed that highest shoot multiplication achieved successfully in MS medium amended with BAP. Singh *et al.,* (2006) achieved that in kinnow explant culture maximum number of flowers per culture achieved by MS medium supplement with kinetin 0.2mg/l. Saini *et al.,* (2010) obtained that MS medium amended with BA@0.5mg/l shows highest bud per explant in rough lemon.

Khalid *et al.,* (2012) observed that application in kinnow BA @ 30g/l and kinetin at the time of fruit setting shows positive impact of fruit juice. He also observed that highest reducing sugar obtained by application of kinetine @ 20mg/l at the timeof flowering.

Lychee

Dhua *et al.,* (2003) found that spraying of kinetin @ 25mg/l improves the fruit weight, in addition to delaying fruit ripening by reducing ethylene production.

Grapevine

Amiri *et al.,* (2019) found that BA (1.5mg/l) treat grape vine explant showed highest nodes per explant than treated free explant. Jaskani *et al.,* (2008) opined that media containing BA helps highest branching in explant. Zabadal *et al.,* (2006) obtained that at every concentration of CPPU (5,10,15 mg/l) shows significant effect on berry mass and firmness whereas concentration @ 5 and 10mg/l give additional effect i.e. promotes better berry diameter.

Fig

Chai *et al.,* (2019) achieved that applied CPPU (25mg/l) at the time of anthesis promotes parthenocarpy fruit.

Pomegranate

Sharma and Belsare (2011) obtained that foliar spray of CPPU 5ppm in month of Aprilincrease fruit size, juice content of pomegranate where as Supe and Marbhal (2008) observed that BA application promotes maximum fruit drop on pomegranate var. mirdula.

Phalsa

Debnath *et al.,* (2011) achieved that 10ppm kinetin increases shelf life of phalsa.

Guava

Debnath *et al.,* (2011) recorded maximum ascorbic acid and TSS in guava treated with 100ppm BA. Mishra *et al.,* (2005) opined that MS medium contain BAP @ 3mg/l promotes shoot bud proliferation.

Avocado

Benomoualem *et al.,* (2001) investigated that preharvest treatment of Avocado cv.fuerte with TDZ (10mM) or BAP (40mM) induce resistance against fungus. He also opined that cv. Fttnger preharvest treatment with BA caused delaying of fruit softening.

In conclusion the exogenous application of cytokinin might, therefore, act as a powerful tool not only for enhancing cell division, fruit quality and weight and size but also in combating the ill effects generated by various biotic and abiotic stresses in plants in the near future.

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