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Effect of Forchlorfenuron and N-Acetyl Thiazolidine 4-Carboxylic Acid on Fruit Drop of Apricot (*Prunus armeniaca* L.) cv. New Castle

Debashish Hota*, D. P. Sharma and Niranjan Singh

Department of Fruit Science

Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan

*Corresponding Author E-mail: dhota3@gmail.com

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ABSTRACT

Being the third important stone fruit crops of India, apricot still requires a great improvisation in production point of view. Bio-regulators are being used by the growers to increase the yield by improving the yield attribute parameters. Keeping the objective to increase the yield, in the recent studies; twenty six-year-old apricot cv. New Castle trees were subjected to 11 treatments viz. Forchlorfenuron (CPPU) at 5 and 10 ppm and N-acetyl thiazolidine 4-carboxylic acid (NATCA) at 50 and 100 ppm and their combinations were applied at pink bud and petal fall stage during the year 2015 and 2016. Out of the two time of spray the petal fall stage was found to be superior in both the years. The minimum (27.03 %) fruit drop was observed in tree receiving 50 ppm NATCA at petal fall stage.

Key word: *Forchlorfenuron (CPPU), N-acetyl thiazolidine 4-carboxylic acid (NATCA), Foliar Spray, Petal Fall stage*

INTRODUCTION

Apricot (*Prunus armeniaca* L.) the third important stone fruit crop next after peach and plum, in respect to area and production; still require an attention towards its increasing yield by decreasing the fruit drop and increasing the fruit size.In Himachal Pradesh, apricot is being cultivated at an elevation of 900 m to 2000 m above mean sea level over an area of 3660 ha with an annual production of 4704 MT in 2014-15[1].Leading growing districts are Solan, Shimla, Sirmour, Chamba, Kullu, Mandi, and Kinnaur.A low-moderate chilling New Castle is the most commercial cultivar of apricot in the mid-hills of Himachal Pradesh. This cultivar ripens towards the third week of May when no other fruit is available and hence fetches higher prices in the market. However, with the advancement of age, its fruit size and quality decreases which has less demand in market. Many of the commercially available plant growth regulators are used in stone fruit production which enhance fruit size and quality and delay the storage disorder[8]. It is obvious that changes in the level of endogenous hormones due to biotic and abiotic stress alter the crop growth and any sort of manipulation including exogenous application of growth substances would help for yield improvement.

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Plant growth regulators provide effective means for the improvement of productivity as a result of direct influence on the qualitative as well as quantitative aspects of fruit growth[16]. Forchlorfenuron, a synthetic cytokinin with strong growth regulation activities has been found very effective in enhancing fruit growth by stimulating cell division and cell elongation. It has been found highly effective in increasing fruit size in some fruit crops[4]. Besides, it also modifies other fruit characteristics such as shape, dry matter content, carbohydrate metabolism and ripening process. Its treatment could also increase firmness of individual fruit, reducing TSS content and TSS /acid ratio of fruit, as well as, promote starch degradation but had no effect on titratable acid content[13].

Elanta Super is a organic growth promoter which contains N Acetyl Thiazolidine 4- Carboxylic Acid (NATCA), 10% Folic acid with 0.2% adjuvant, used for plant growth increase in both fruit & production quality.It is a derivative of organic amino acid , which helps to develop fruits to its optimum level of size, shape, quality and taste. It is also useful for fruit setting, enhances quality, size, colour as well as taste and keeping quality of fruits.It is also a stabilizer buffer, to tolerate certain types of stresses more effectively[3].This study aimed to throw some light of the prospective on the use of CPPU and NATCA singly or in combinations to promote the yield quantitatively and qualitatively in New Castle Apricot.

MATERIALS AND METHODS

The present investigations was carried out in the 26 years old apricot cv. New Castle planted in a spacing of 3×3 meter at experimental orchard of theDepartment of Fruit Science, Dr. Y.S. Parmar University of Horticulture and Forestry during the years 2015 and 2016.For the experiment, thirty trees were selected on the basis of uniform vigour and were maintained under uniform cultural practices during the entire course of investigation.The two bio-regulators i.e. CPPU (5 and 10 ppm), NATCA (50 and 100 ppm) and their combinations CPPU + NATCA (5 + 50 ppm) are applied at two different stage i.e. pink bud and petal fall stage, while the untreated plant remain the control (Table 1).
Eleven treatment with three replication was setup with Randomized Block Design (RBD). For each treatment, 10 litres of spray solution was made. In order to decrease the surface tension of the droplets and facilitate absorption, a few drops of Teepolwere added to the solution prior to spray.

Table 1: Description of application of forchlorfenuron (CPPU) and N-acetyl thiazolidine 4-carboxylic acid

Treatments	Chemicals	Concentration (ppm)	Time of application
T_1	CPPU	5	Pink bud
T_2	CPPU	10	Pink bud
T_3	CPPU	5	Petal fall
T_4	CPPU	10	Petal fall
T_5	N-ATCA	50	Pink bud
T_6	N-ATCA	100	Pink bud
T_7	N-ATCA	50	Petal fall
T_8	N-ATCA	100	Petal fall
T_9	CPPU + N-ATCA	5 + 50	Pink bud
T_{10}	CPPU + N-ATCA	5 + 50	Petal fall
T_{11}	CONTROL		

The spray solutions of different plant growth regulators were applied on the trees with the help of foot sprayer to wet the developing buds and flower completely without causing runoff at morning hours without obstruction of wind drift.

Fruit drop

Fruit set was determined as per the procedure suggested by Westwood[15]. Four fruiting arms of equal length were selected and marked on each tree in all possible directions. The fruit drop was counted by dividing the fruit retained per arm at harvesting stage from the total number of fruit set at initial stage. The percent of fruit drop was calculated by formula given below:

$$\text{Fruit drop (\%)} = \frac{\text{Total number of fruit set- number of fruit retained}}{\text{Total number of fruit set on fruiting arm}} \times 100$$

RESULT AND DISCUSSIONS

A cursory glance of average pooled data of 2014-15 and 2015-16 presented over the years in Table 2, exhibit significant effects of forchlorfenuron andN-acetyl thiazolidine 4-carboxylic acidonfruit set, fruit retention, fruit drop and fruit yield in apricot cv. New Castle.

Maximum fruit drop (35.66 %) was recorded in control which was statistically at par with T_2 (10 ppm CPPU at pink bud). The minimum (27.03 %) fruit drop was observed in tree receiving 50 ppm NATCA at petal fall (T_7), which was statistically at par with T_4 (10 ppm CPPU at petal fall), T_8 (100 ppm NATCA at petal fall), T_9 (5 ppm CPPU + 50 ppm NATCA at pink bud) and T_{10} (5 ppm CPPU + 50 ppm NATCA at petal fall).

Both the chemicals have significantly affected the fruit drop when applied at petal fall stage. The application at this stage may be related to the stimulus of ovule development, once the ovule produces endogenous hormones that help in decreased fruit drop [14].It may also be due to accumulation of higher rates of auxin and cytokinin after the pollination and fertilisation, which act as an accelerator for increasing the size of fruit. While in contrast presence of growth inhibitor in dormant to semi-dormant (up to the induction of flower primordia) condition may inhibit the effect of exogenous application of growth regulator [5].

Exogenous amino acids are absorbed by the leaves, promoting chelation and transport of mineral nutrients, increasing levels of proline and hydroxyproline, (which in turn may augment tolerance to biotic and abiotic stress), stimulating enzymatic systems (such as those of nitrate reductase, malate dehydrogenase, phosphorylase, phosphatase and peptidase), enhancing flower and fruit set, increasing chlorophyll concentration and photosynthetic output. As a result, application of amino acid biostimulants has been associated with accelerated biomass accumulation, decreased fruit drop and/or increased fruit yield in several crops[9]. Basak and Bielicki[2] found that the effects of LG 221 (vegetable extract rich in amino acids) reduce russeting and increase fruit set in trees damaged by late frost in apple cv. JonagoldDecosta, Golden Delicious and Gala Must. Decreased fruit drop has been reported by various researchers when amino acids were applied on Mango (*Mangifera indica*)[12] (Tahiti lime (*Citrus latifolia*)[6], pear (*Pyrus communis*), apple (*Malus domestica*)[9], papaya (*Carica papaya*)[11], kiwi (*Actinida deliciosa*)[10], and watermelon (*Citrullus lanatus*)[7]. However increased level of CPPU may have an adverse effect on the fruit retention and increased the level of fruit drop.

Table 2: Effect of forchlorfenuron and N-acetyl thiazolidine 4-carboxylic acid on fruit drop of apricotcv New Castle

Treatments	Fruit drop(%)
T_1-CPPU (5 ppm)	31.42(5.69)
T_2-CPPU (10 ppm)	32.40(5.78)
T_3-CPPU (5 ppm)	30.85(5.63)
T_4-CPPU (10 ppm)	27.45(5.33)
T_5-NATCA (50 ppm)	31.01(5.66)
T_6-NATCA (100 ppm)	30.87(5.64)
T_7-NATCA (50 ppm)	27.03(5.29)
T_8-NATCA (100 ppm)	27.68(5.35)
T_9-CPPU+NATCA(5+50 ppm)	28.73(5.45)
T_{10}-CPPU+NATCA(5+50 ppm)	28.33(5.41)
T_{11}-Control	35.66(6.05)
$CD_{0.05}$	0.31

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