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## Effect of Elanta super (n-Acetylcysteine-4-carboxylic acid) on fruit set, yield and quality of apple cv. Starking delicious

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### Abstract

Apple is predominant temperate fruit crop of North Western Himalayan region of India. Apple dominates the fruit production and contributes about 49% of the total area and 85% of the total fruit production in Himachal Pradesh. In spite of the tremendous increase in area and production of apple, fruit quality particularly size, shape and colour is one of major concern. Keeping the objective to increase fruit set, yield, shape and colour an experiment was conducted in a private orchard at Sandhu in district Shimla, Himachal Pradesh. The trial was laid out in a randomized block design with five treatments, which were replicated four times. Elanta super @ 1.0ml/L and 1.5ml/L was applied at pink bud, 30 days after pink bud, petal fall, 15 days after petal fall and 30 days after petal fall stage during the year 2015 and 2016. Foliar spray of Elanta Super at petal fall stage @1.0ml/L followed by 1.5ml/L 15 days after petal fall recorded maximum fruit set (22.73% and 28.68%), L/D ratio (0.93 and 0.98) and colour of fruit (62.50% and 76.58%) during both the years. Lowest fruit drop (17.78% and 16.36%) and highest yield (102.50 and 89.13kg/tee) and fruit weight (137.62g and 144.15g) was recorded in trees sprayed at petal fall stage @1.0ml/L followed by 1.5ml/L 30 days after petal fall stage.

**Keywords:** apple, n-acetyl thiazolidine-4-carboxylic acid (NATCA), fruit set and petal fall stage

### Introduction

The fruit production in Himachal Pradesh witnessed a significant progress during the past few decades. Apple dominates the fruit production and constitutes about 49% of the total area and 85% of the total fruit production in the state. In Himachal, there has been a tremendous progress in proliferation of apple orchards and area has increased from 35,076 hectare in 1975 to 1,10,879 hectare with an annual production of 7,77,126 MT in 2016 (anonymous, 2016). Apple has revolutionized the social-economic condition of the hill people and has earned the distinction of being an apple state of India. In spite the tremendous increase in area and production of apple, fruit quality particularly size, shape and colour is of major concern, due to its outstanding economic importance. In apple fruit size and colour has for a long time been regarded as an important factors as these characters decides the market value of apple crop. These quality characters can be improved to a limited extent by proper orchard management practices. The crop load is one of the most important factors that can be influenced to get a good fruit size. Other cultural factors that can affect fruit size are pruning, pollination, nutrition and soil management and use of growth promoters. Growth promoters play an important role in enhancing the size and improving the shape and colour of fruit.

Growth regulators are widely used in different countries for improving fruit size and quality (Dal Cin *et al*, 2008 and Lurie, 2010) [9]. 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 (Zahoor *et al.*, 2011) [16]. Elanta super is organic growth promoters which contain N-Acetylcysteine-4-Carboxylic Acid used in increasing yield and quality of apple fruits. Elanta assists in complete utilization of physiological reserves in plant, stimulate normal metabolic processes. 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 a stabilizer buffer, to tolerate certain types of stresses more effectively (Berg, 1986) [3]. This study aimed to see the effect of Elanta Super (NATCA) on fruit set, yield and quality of apple cv. Starking Delicious.

### Materials and Methods

The present investigations was carried out in a private orchard at Sandhu, Shimla situated at an elevation of 2310m a m s l during the year 2015 and 2016. The location of experimental area fall under high hills wet temperate agro climatic zone of Himachal Pradesh. Thirty five years

old plants of apple cv. Starking Delicious having uniform size and vigour planted at a distance of 6x6m were selected for the study. The experiment was laid out in a randomized block design, with five treatments replicated four times. Elanta super was sprayed at pink bud stage, one month after pink bud, petal fall stage, 15 days after petal fall and 30 days after petal fall stage @1.0ml/L and 1.5ml/L concentrations. The spray solution was applied with the help of foot sprayer to the bud and developing fruits completely without causing runoff

**Table 1:** Description of application of Elanta Super (N-Acetyl Thiiazolidine-4-Carboxylic Acid)

Treatments	Concentration (ml/L)	Time of application
T <sub>1</sub>	1.0	Pink bud stage
	1.5	One month after 1 <sup>st</sup> spray
T <sub>2</sub>	1.5	Petal fall stage
T <sub>3</sub>	1.0	Petal fall stage
	1.5	15 days after Petal fall stage
T <sub>4</sub>	1.0	Petal fall stage
	1.5	30 days after Petal fall stage
T <sub>5</sub>	Control	No spray

For fruit set four fruiting arms of equal length were selected and marked on each tree in all directions. The number of the flower clusters on these fruiting arms was counted and after 10 days of petal fall, the number of fruits was also counted. The percent fruit set was calculated as per formula given below

$$\text{Fruit Set (\%)} = \frac{\text{Total number of fruit set}}{\text{Total number of clusters}} \times 100$$

Total number of fruits retained on the marked branches was counted at the time of harvest and the percentage of fruit drop was calculated as:

$$\text{Fruit drop (\%)} = \frac{\text{Total number of fruit set} - \text{fruits retained at maturity}}{\text{Total number of fruit set}} \times 100$$

The yield of fruits under different treatments was recorded at the time of harvest by weighing the total fruits. The size of the fruit was measured in terms of length and diameter. The fruit diameter was worked out by averaging the values of cheek and suture diameter. The length and diameter of ten randomly selected fruits were measured with the help of Vernier Callipers and was expressed in millimetres (mm). The length to diameter ratio of fruits was calculated by dividing the length with diameter. The ten selected fruits taken for recording the fruit size data were weight on top pan balance and the average value was expressed in grams per fruit. The data generated from these investigations were appropriately computed, tabulated and analysed by OPSTAT by applying Randomized Block Design (RBD). The level of significance was tested for different variables at 5 percent level of significance.

## Results and Discussions

### Fruiting parameters

The data on the fruit set, fruit drop and yield as affected by different treatments are presented in Table 2.

It is evident from the data presented in Table 1 that foliar application of Elanta Super exerted a significant influence on fruit set, fruit drop, yield and quality of apple during both the years. The maximum fruit set (22.73% and 28.68%) was recorded in plants sprayed with Elanta Super @1.0ml/l at

petal fall stage followed by 1.5ml/l 15 days after petal fall which was statistically at par with T<sub>4</sub> during 2015 and 2016. The minimum fruit set (15.55% and 16.00%) was recorded in control. Minimum fruit drop (17.18% and 16.36%) was recorded in trees treated with Elanta Super @1.0ml/l at petal fall stage followed by 1.5ml/l sprayed 30 days after petal fall which was statistically at par with T<sub>3</sub>. Whereas, maximum fruit drop (25.82% and 23.19%) was recorded in control which was significantly higher than all other treatments. Maximum yield (32.00kg/tree and 49.13kg/tree) was recorded in T<sub>4</sub>, which was statistically at par with T<sub>3</sub> during the year 2015, whereas, in 2016 it was statistically at par with T<sub>2</sub> and T<sub>3</sub>. Control had the lowest fruit yield (24.00kg/tree and 32.86kg/tree) which was statistically at par with T<sub>1</sub> and T<sub>2</sub> during the year 2015 but significantly higher than other treatments during the year 2016.

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 bio-stimulants has been associated with accelerated biomass accumulation and/or increased fruit yield in several crops (Maini, 2006) [10]. Basak and Bielicki (2010) 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. Jonagold Decosta, Golden Delicious and Gala Must. Increased fruit set has been reported by various researchers when amino acids were applied on Mango (Morales-payan, 2015) [13], Tahiti lime (Flores-Torres, 2013) [6], pear, apple (Maini, 2006) [10], papaya (Morales-Payan and Stall, 2003) [12], kiwi (Mancilla, 2000) [11], and watermelon (Fuentes-Fuster, 2012) [7].

### Physico-chemical characteristics

It is apparent from the data presented in Table 3 that Elanta Super (an amino acid derivative) significantly influenced the Physico-chemical characteristics of apple during both the years.

Different treatments of Elanta Super had a significant effect on fruit weight of apple. During 2015, maximum fruit weight (137.62g) was recorded in T<sub>4</sub> which was closely followed by T<sub>3</sub> (136.59g) and were statistically at par with each other. Whereas, in 2016 maximum fruit weight (144.15g) was recorded in T<sub>3</sub> which was closely followed by T<sub>4</sub> and T<sub>2</sub> and were statistically at par with each other. Minimum fruit weight (98.75g and 106.83g) was recorded in control which was statistically at par with T<sub>1</sub> during both the years. Fruit size in terms of length and breadth was also significantly affected by different treatments of Elanta Super during the year 2015. However, fruit breadth was not significantly affected by different treatments of Elanta Super in 2016. During 2015, maximum fruit size in terms of length (60.81mm) was recorded in T<sub>4</sub> which was statistically at par with T<sub>3</sub> and breadth was maximum (66.73mm) in T<sub>4</sub> which was significantly higher than all other treatments. In 2016, maximum fruit length (67.33mm) was recorded in T<sub>4</sub> which was closely followed by T<sub>3</sub> (65.02mm) and these were statistically at par with each other. However, fruit breadth was not significantly affected by different treatments of Elanta Super. In 2015, Minimum fruit size (53.00mm x 62.30mm and 61.69 x 63.29mm) was observed in control which was

statistically at par with T<sub>1</sub> and T<sub>2</sub> in 2015 but significantly lower than all other treatments in 2016. In 2015, maximum L/D ratio (0.93) was recorded in T<sub>3</sub> which was statistically at par with T<sub>4</sub> and in 2016 maximum L/D ratio was observed in T<sub>4</sub> which was statistically at par with T<sub>1</sub>, T<sub>2</sub> and T<sub>3</sub>. Minimum L/D ratio was recorded in control during both the years of study. Fruit colour was maximum (62.50% and 76.85%) in trees treated with Elanta Super @ 1.0ml/l at petal fall followed by 1.5ml/l 15 days after petal fall which was statistically at par with T<sub>1</sub> and T<sub>3</sub>. Whereas, minimum fruit colour (45% and 57.63%) was observed in control T<sub>4</sub> and T<sub>1</sub>.

Elanta super is a biostimulant for crops, claimed to contain an amino acid L-cysteine and a vitamin folic acid. It is possible that the amino acids and vitamins in the Ergostim enabled the better utilization of higher levels of fertilizer resulting in better plant growth (Kulasegaram and Kathiravetpillai, 1982)<sup>[8]</sup>. Elanta super may increase the growth promoting substances as it contain rich amount of amino acid and folic acid. Foliar application of mixture of amino acids and algae suspension significantly increased the weight of bunches and the size of grape berries (Nagy and Pinter, 2015)<sup>[14]</sup>.

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 (Cruz-Castillo *et al.*, 2002). Besides, it also modifies other fruit characteristics such as shape, dry matter content, carbohydrate metabolism and ripening process. (Nevine *et al.*, 2016)<sup>[15]</sup>.

**Table 2:** Effect of Elanta Super (an amino acid derivative) on fruiting and fruit quality of apple cv. Starking Delicious

Treatments	Fruit set (%)		Fruit drop (%)		Yield (kg/tree)	
	2015	2016	2015	2016	2015	2016
T <sub>1</sub>	17.19	18.95	20.12	19.52	26.00	39.00
T <sub>2</sub>	17.75	19.27	22.43	18.87	26.50	45.12
T <sub>3</sub>	22.73	28.68	18.43	17.86	28.50	44.54
T <sub>4</sub>	20.81	26.84	17.78	16.36	32.00	49.13
T <sub>5</sub>	15.55	16.00	25.82	23.19	24.00	32.86
CD <sub>0.05</sub>	3.28	4.24	1.77	2.32	3.94	5.79

**Table 3:** Effect of Elanta Super (an amino acid derivative) on fruit quality of apple cv. Starking Delicious

Treatments	Fruit weight (g)		Size (mm)				L/D ratio		Fruit Colour (%)	
			Length		Breadth					
	2015	2016	2015	2016	2015	2016	2015	2016		
T <sub>1</sub>	104.80	113.73	54.97	63.48	63.95	64.20	0.86	1.00	60.00	71.64
T <sub>2</sub>	117.93	140.28	55.71	62.52	64.12	63.59	0.89	1.00	51.75	63.00
T <sub>3</sub>	136.59	144.15	59.36	63.53	65.02	65.08	0.93	1.00	62.50	76.85
T <sub>4</sub>	137.62	140.69	60.81	66.73	67.33	65.23	0.91	1.03	60.50	75.10
T <sub>5</sub>	98.75	106.83	53.00	62.30	61.69	63.29	0.85	0.97	45.00	57.63
CD <sub>0.05</sub>	8.56	7.10	2.74	2.82	2.33	NS	0.02	0.03	6.07	4.08

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