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## Effect of multiple nutrient sprays on quality and yield of apple under mountainous regions of Kashmir

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**Abstract**

The present investigation aimed at evaluating the importance of multi nutrient sprays Viz the Bio-efficacy of Cytonutri CaB as a multi nutrient spray and Aura XL as organic product. The sprays were used on apple cv. Red Delicious for a period of two years at farmers field in district Shopian during 2016 and 2017. Healthy trees of uniform age (25 years) were selected. Cultural practices and plant protection measures were uniform for all the selected trees, irrespective of treatments. On each tree four branches from four sides were marked, for different flower and fruit observation measures. The experimental design was RBD with four replications in each treatment. T1 comprised of Cytonutri CaB spray @ 1.5ml/litre at fruit set, 15DAFS and 30 DAFS. in T2 the concentration was raised to 3ml/litre and was again sprayed at fruit set, 15 DAFS and 30 DAFS. While as T3 comprised of five sprays with first spray of Aura XL(1ml) at Prebloom, 2<sup>nd</sup> spray of Cytonutri CaB +Aura XL (1.5 ml+ 1ml) at fruit set, 3<sup>rd</sup> and 4<sup>th</sup> spray of Cytonutri CaB at 15 and 30 DAFS @ 1.5ml/litre and 5<sup>th</sup> spray of Aura XL @ 1ml/Litre at fruit color change. The results revealed that spraying apple trees with the Cytonutri CaB and Aura XL individually or in combination had significant impact on increasing bloom density, fruit set, yield fruit, size and s had positive impact on reducing flower drop and fruit drop. However, it could be concluded that promising Treatment is cytonutri Ca B along with low concentration Of Aura XL.

**Keywords:** Apple, multiple nutrient, sprays, quality, yield

**Introduction**

Apple is the principal fruit crop of Kashmir occupying about 45% of total fruit area and 75% of total fruit production. It is the main source of income for more than 70 % of rural population either directly or indirectly. However, the cultivation of apple during recent past has encountered various problems which are decreasing the profitability and thereby posing serious threat to its sustainability. One among these limitations is the improper nutrient management especially that of essential nutrients particularly Ca, B. These elements are essential for plant growth, yield and fruit quality. Among these nutrients Ca is especially important because apples are stored for longer periods and the deficiency of calcium cannot be substituted by any other factor for the maintenance of fruit quality under storage conditions. Low Ca concentration leads to many physiological disorders like bitter pit, cork spot, water core etc. Likewise B is essential for proper fertilization and pollen tube. In foreign countries foliar nutrition is an important orchard management practices where 5-6 sprays of different essential nutrients is in vogue. However, till date very little attention was paid towards the importance of these nutrients on apple cultivation in Kashmir valley, but with the development of leaf nutrient analysis in recent years orchardists are now becoming more and more aware about the nutritional profiles of their soils and orchards. Besides during last few years the not only the apple orchards in valley are showing decline both in quality and quantity but are facing a serious threat from high quality apples imported from New Zealand, USA, China. Although, nutrient deficiency can be overcome by soil application of the particular nutrient but foliar nutrition has several advantages over the soil applications like low application rates, uniform application, immediate response, fixation under unfavorable conditions, mobility problems etc. The deficiency and toxicity problems, apart from time of application have to be considered in developing appropriate programs for managing nutrient sprays. In order to evaluate the importance of multi nutrient sprays, the Bio-efficacy of Cytonutri CaB as a multi nutrient spray and Aura XL as organic product were UED in present study was on apple cv. Red Delicious for a period of two years at farmers field in district Shopian. The Cytonutri CaB contains Ca contains boron 1% (p/v) and Ca 17 % (p/v).

## Materials and Methods

The present investigation was carried out in district Shopian at Farmers field for a period of two years during 2016 and 2017. Healthy trees of uniform age (25 years) were selected. Cultural practices and plant protection measures were uniform for all the selected trees, irrespective of treatments. On each

tree four branches from four sides were marked, for different flower and fruit observation measures. The experimental design was RBD with four replications in each treatment. In each treatment three trees were selected and treatments were applied as per the details given in the table

**Table A:** Treatment details of the experiment for different multi-nutrient sprays

Treatment details	S. No.	Treatment	Stage of crop	Conc.
		T-1	1 <sup>st</sup> spray (Cytonutri CaB)	Fruit set
		2 <sup>nd</sup> spray	15DAFS	1.5ml/l
		3 <sup>rd</sup> spray	30DAFS	1.5ml/l
T-2		1 <sup>st</sup> spray (Cytonutri CaB)	Fruit set	3 ml/l
		2 <sup>nd</sup> spray	15DAFS	3 ml/l
		3 <sup>rd</sup> spray	30DAFS	3 ml/l
T-3		1 <sup>st</sup> spray (Aura XL)	Prebloom	1ml/l
		2 <sup>nd</sup> spray(Aura XL and cytonutri)	Fruit set	1ml+1.5ml/l
		3 <sup>rd</sup> spray (Cytonutri)	15DAFS	1.5ml/l
		4 <sup>th</sup> spray (Cytonutri)	30DAFS	1.5ml/l
		5 <sup>th</sup> spray (Aura XL)	Fruit Color change	
Observations recorded		1. Bloom density 2.flower drop 3.fruit set 4.premature fruit drop 5.Fruit Weight 6. Fruit yield 7. Fruit Size 8. Fruit colour 9.TSS 10.Firmness		

Observations were recorded at different stages of fruit development as well as after storage for a specific period of time. Bloom density was recorded as the number of floral buds per linear meter of marked shoots counted on four random branches from all four sides of the tree as a measure of flower density in the month of April. Based on the number of flowers that were retained on each labelled branch (per linear meter) the number of flowers were counted as expressed as percent flower drop.

$$\text{Flower drop (\%)} = \frac{\text{Initial number of flowers} - \text{No. of retained flowers}}{\text{Initial number of flowers}} \times 100$$

Fruit set (%) was calculated as the ratio of total number of fruits per spur to the total number of flowers per spur (average of 50 blossoms) as follows

$$\text{Percentage of fruit set} = \frac{\text{Total number of fruits per spur}}{\text{Total number of flowers per spur}} \times 100$$

Premature fruit drop was measured after the June drop as

$$\text{Fruit drop (\%)} = \frac{\text{Initial number of fruits} - \text{No. of retained fruits}}{\text{Initial number of fruits}} \times 100$$

Fruit yield (kg/tree) was taken as the total yield/tree (kg) at the time of harvest. While as Fruit size was measured with the help of vernier caliper. The TSS (°B) The total soluble solids were determined by using hand refractometer. Fruit calcium content was analysed through spectrophotometry and the shelf life was recorded by storing the fruits under ambient conditions and PLW (Physiological weight loss) was calculated after a period of 30 days as follows

$$\text{PLW} = \frac{\text{Initial fruit weight} - \text{Weight after storage}}{\text{Initial fruit weight}} \times 100$$

The Fruit firmness (kg/cm<sup>2</sup>) Measured with effigy pressure tester plunger and expressed as kg/cm<sup>2</sup> and

## Results and Discussion

### Bloom Density

Maximum Bloom density of 183.44 was observed with T3 (Aura XL and Cytonutri CaB). Untreated and Control plants had least value for bloom density. The data revealed that there is a significant increase in bloom density with the application of plant agro-chemical cytonutri CaB during both the years.

### Flower Drop

The data on flower drop (table 1) revealed that significantly least flower drop of 19.67 % was recorded with T3 (Aura XL and Cytonutri CaB), whereas, significantly maximum flower drop was observed in untreated control plants.

### Fruit Set (%)

Significant differences were recorded in fruit set percentage among the different treatments. During course of testing, maximum fruit set of 32.74 % was recorded with treatment T3 (Aura XL and Cytonutri CaB) which was followed by treatment T2 (29.24%) and T1 (28.43%), however, significantly low fruit set of 24.51 % was obtained in control. The data depicted in table 1, revealed that the agro-chemical under testing had positive impact on fruit set and thereby there is a positive correlation between the chemical and fruit set.

### Fruit Drop (%)

The minimum fruit drop of 7.05% was observed in the treatment T3 (Aura XL and Cytonutri CaB) that differ significantly with treatment T1, T2 and control (T4), however, the fruit drop (9.92%) was comparatively more in control. The perusal of data presented in table 1 revealed that there is significant reduction in the fruit drop on the trees sprayed with chemical as compared to control.

**Table 1:** Effect on bloom density, flower drop, Fruit set and Fruit drop of apple cv. Red delicious

Treatments	Bloom Density (%)	Flower Drop (%)	Fruit set (%)	Fruit Drop (%)
T <sub>1</sub>	175.14	24.41	28.43	7.89
T <sub>2</sub>	174.40	24.67	29.24	7.32
T <sub>3</sub>	183.44	19.67	32.74	7.05
T <sub>4</sub>	175.79	24.87	24.51	9.92
C.D.	0.747	0.21	0.04	0.15

**Fruit Length (mm)**

The longest fruit of 75.24 mm was recorded with T<sub>3</sub> (Aura XL and Cytonutri CaB), whereas the control (Water spray) had least length 68.31 mm. The data presented in table 3 revealed that all treatment differ significantly from each other and there is significant increase in fruit length with the treatments T<sub>3</sub>, T<sub>2</sub> and T<sub>1</sub> during the testing period in comparison with control.

**Fruit breadth (mm)**

Maximum fruit breadth of 73.56 mm was obtained with treatment T<sub>3</sub> (Aura XL and Cytonutri CaB) which was at par with T<sub>2</sub> and T<sub>1</sub>, whereas the control (Water spray) had fruit of least breadth 67.98 mm. The data presented in table 2, revealed that there is significant increase in fruit breadth with the treatments T<sub>3</sub>, T<sub>2</sub> and T<sub>1</sub> during course of testing in comparison with control.

**Fruit Weight (g)**

The highest fruit weight of 160.23 g was recorded with treatment T<sub>3</sub> (Aura XL and Cytonutri CaB) which was at par with T<sub>1</sub> and T<sub>2</sub>. All the treatments had significantly higher fruit weight as compared to control which had the least fruit weight (149.24%).

**Yield (kg/tree)**

Highest fruit yield of 179.00 kg/tree was obtained with the treatment T<sub>3</sub> (Aura XL and Cytonutri CaB), followed by treatment T<sub>2</sub> which recorded fruit yield of 177.23 kg/tree and T<sub>1</sub> (176.45 kg/tree), while the control recorded the yield of 159.54 kg/tree. Further the data presented in table 2 revealed that all the treatment differs significantly from control w.r.t yield.

**Table 2:** Effect on various physical parameters of apple cv. Red Delicious.

Treatments	Fruit Length (mm)	Fruit breadth (mm)	Fruit Weight(g)	Yield (Kg/tree)
T <sub>1</sub>	72.05	71.26	158.25	176.45
T <sub>2</sub>	73.47	72.54	158.87	177.23
T <sub>3</sub>	75.24	73.56	160.23	179.00
T <sub>4</sub>	68.31	67.98	149.24	159.54
C.D (0.05%)	0.24	2.41	2.34	3.41

**Fruit Colour (%)**

Maximum fruit colour was observed with control (87.01%) which was significantly different from all the treatments. All the chemical treatments had least fruit colour compared to control. It may be due to reduced senescence caused by calcium.

**Fruit Firmness (lbs)**

The data revealed that the chemical sprays had significant effect on fruit firmness with 13.29, 13.12 lbs and 13.01 values

obtained in T<sub>2</sub> (Cytonutri CaB), T<sub>3</sub> and T<sub>1</sub> respectively, whereas, control had low fruit firmness of 13.09 lbs.

**TSS (<sup>0</sup>B)**

The perusal of data revealed that no significant effect on TSS was observed with chemical treatments. However, maximum TSS of 14.87 <sup>0</sup>B was observed with T<sub>2</sub> (Cytonutri CaB) followed by 14.87 <sup>0</sup>B in T<sub>2</sub> and 13.72 in T<sub>3</sub> respectively. However low TSS was obtained in control (13.26<sup>0</sup>B).

**Table 3:** Effect of Cytonutri on fruit colour, firmness and TSS (<sup>0</sup>B) of Apple cv. Red Delicious

Treatment	Fruit Colour (%)	Fruit firmness (lbs)	TSS ( <sup>0</sup> B)
T <sub>1</sub>	85.11	13.01	14.74
T <sub>2</sub>	83.18	13.29	14.87
T <sub>3</sub>	83.29	13.12	13.72
T <sub>4</sub>	87.01	12.09	13.26
CD <sub>0.05</sub>	2.05	0.80	NS

Phytotoxicity – No symptoms were observed

**Table 4:** Phyto toxicity Symptoms on apple due to multi-nutrient sprays

	Wilting				Vein Clearing				Necrosis				Epinasty				Hyponasty			
	1	3	7	10	1	3	7	10	1	3	7	10	1	3	7	10	1	3	7	10
T <sub>1</sub>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T <sub>2</sub>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T <sub>3</sub>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
T <sub>4</sub>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Apple, similarly to other dicotyledonous horticultural and field crops, requires boron for normal development and fruit formation. It is especially valid for crops produced for sugar and starch content. In winter apple, calcium and magnesium

supply is also important in addition to that of boron, since the deficiency or improper ratio of these elements can reduce yield and storability<sup>1</sup>. Among the microelements, boron has the greatest effect on the yield quality and quantity of plants

[2]. If it is not available in the necessary amount and form, then problems can be detected in flower formation and fertilization, furthermore, carbohydrate and lipid formation is also inhibited. As a secondary consequence, the strength of cell walls also decreases<sup>3</sup> which increases the susceptibility of the plant to diseases (mainly to those caused by microorganisms). Calcium has a significant influence on the characteristics of plasma colloids and their osmotic potential. It promotes longitudinal growth and cell division in meristematic tissues<sup>[4]</sup>. It has a specific effect on cell elongation and differentiation, it influences the structure and permeability of cell membranes<sup>[5]</sup>.

Wojcik *et al.*<sup>[6]</sup> observed that Boron sprays after bloom increased fruit set and apple yield. No significant differences between treatments in fruit weight losses during storage, number of apples infected by *Penicillium* sp., *Monilina* sp. and *Botrytis cinerea* were noted. Boron sprays after bloom decreased mean fruit weight, fruit firmness after storage, and increased calcium (Ca) concentration in apples, and sensitivity of fruits to bitter pit, internal breakdown, and *Gloeosporium*-rot. Application of boron to foliage have a higher increase of fruit set, vegetative growth and yield<sup>[7]</sup>

### Conclusion

Plant nutrients especially Nitrogen, calcium and boron play an important role in growth, fruit set, fruit retention and development and cause efficient yield and quality improvement. Our results revealed that spraying apple trees with the cytonutri CaB and Aura XI individually or in combination had significant impact on increasing bloom density, fruit set, yield fruit, size and s had positive impact on reducing flower drop and fruit drop. However, it could be concluded that promising Treatment is cytonutri Ca B along with low concentration Of Aura XL

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