

Study on Changes in Physiological Parameters and Yield with the Application of N-ATCA (*Elanta super*), GA₃ and CPPU in Sonaka grapes

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Elanta Super is a organic growth promoter which contains N Acetyl Thiazolidine 4- Carboxylic Acid (N-ATCA), 10% Folic acid with 0.2% adjuvant, used for plant growth increase in both fruit & production quality. It also enhances quality, luster, brix, elongation and size of berry, keeping quality and taste of table grapes. Therefore, the current study aims to see the mechanism and changes due to Elanta Super spraying along with GA₃ and CPPU on quality, photosynthesis and yield in Sonaka grapes. Field experiment was conducted during 2013-14 in Sonaka grapes at location Tasgaon, Sangli, Maharashtra, India. The experiment was laid in randomized block design with five treatments during fruiting seasons. Grapes bunches were sprayed with Elanta Super, GA₃ and CPPU at 45, 75 and 90 DAP (days after pruning) with different treatments T1 (0.25 ml Elanta Super + 15 ppm GA₃), T2 (0.50 ml Elanta Super + 15 ppm GA₃), T3 (1 ml Elanta Super + 15 ppm GA₃), T4 (1 ml Elanta super + 15 ppm GA₃+1 ppm CPPU) and (T₅ control).

Berry length, berry diameter and berry skin thickness were derived by averaging the 10 berries randomly from each treatment and measured using vernier caliper (RSK, China) and expressed in millimetre (mm). Berry skin thickness was measured using micro screw gauze (No. 103-101-10, Mitutoyo, Japan) and expressed in micrometer (µm). The mean bunch weight was derived by averaging the weight of ten bunches randomly from each treatment. Total soluble solids and acidity were derived by the juice of 50 berries randomly from each treatment and measured by hand refractometer (ERMA INC, Tokyo, Japan) and Acid-base titration methods, respectively. Total soluble solids (TSS) were expressed in degree brix (°B) and acidity was expressed in percentage (%). The leaf area (cm²) was measured using leaf area meter (model CI- 203 Leaf area meter, CID, Inc. USA).

The fully mature leaf was used for total chlorophyll quantification by DMSO method, Jifon *et al.* [4].

Photosynthetic rate, transpiration rate and stomatal conductance were recorded using (IRGA) Infra-Red Gas Analyzer (model Li6400, LI- COR Biosciences, Nebraska, USA). The newly matured leaf i.e., 5th leaf from the apex was selected to record the photosynthetic rate. The data were statistically analysed using GLM procedure of SAS system software version 9.3 SAS, [6].

Significant differences were observed in berry parameters and yield due to Elanta Super spraying with GA₃ and CPPU. Highest berry length (32.27mm) and berry diameter (16.23mm) were found with application of 1 ml Elanta Super along with 15 ppm GA₃ and 1 ppm CPPU as compared to T₅ (control). Application of Elanta Super shows berry length elongation with GA₃ and CPPU. The findings support the views of Ramteke and Somkumar [5] reported that berry length increased with application of Quantum (N-ATCA) in Tas-A-Ganesh grapes. Maximum bunch weight (523.41g) was recorded with application of 1 ml Elanta super along with 15 ppm GA₃ and 1 ppm CPPU whereas, for control it was recorded 370.60g (Table 1). With respective to quality parameters highest total soluble solids were recorded with application of 0.5 ml Elanta Super (21.00 °B). This indicates that Elanta Super must be helping in synthesis of sugar and metabolism of organic acid and also help to have higher total soluble solids in berries. The maximum yield was recorded (16.52 kg/vine) with application of 1 ml Elanta Super along with 15 ppm GA₃ and 1 ppm CPPU. These results are in contrast with the studies of Dubravec *et al.* [2], Ramteke and Somkumar [5] reported that mean bunch weight and yield per vine was increased by Ergostim and Quantum (N-ATCA), respectively in

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Table 1
Effect of Elanta Super, GA₃ and CPPU spraying on yield and quality parameters in Sonaka grapes

Treatment	Berry length (mm)	Berry Diameter (mm)	Skin thickness (μm)	Avg. Bunch weight (g)	TSS (°β)	Acidity (%)	Yield/Vine (kg)
T1	28.37 ^c	15.85 ^{bc}	24.50 ^c	484.75 ^b	19.00 ^c	0.10 ^b	15.50 ^b
T2	32.22 ^a	16.12 ^{ab}	25.25 ^c	514.20 ^a	21.00 ^a	0.10 ^b	16.45 ^a
T3	29.20 ^b	15.55 ^c	31.00 ^b	398.28 ^c	20.25 ^b	0.11 ^a	12.74 ^c
T4	32.27 ^a	16.23 ^a	33.21 ^a	523.41 ^a	20.50 ^b	0.10 ^b	16.52 ^a
T5	25.70 ^d	15.10 ^d	24.50 ^c	370.60 ^d	20.50 ^b	0.10 ^b	11.85 ^d
CV %	2.021	1.772	2.083	2.347	1.651	1.577	2.326
LSD 5%	0.800	0.374	0.773	14.423	0.448	0.002	0.455
Significances	**	**	**	**	**	**	**

Note: - CV- Coeff Var, LSD - Least Significances Difference, The values are means those marked with different letters of the alphabet in the same column are significantly different at $P \leq 0.05$

grapes, Fantac (N-ATCA) in Rice, Srivastava *et al.* [8] and in strawberries also, an increase in the berry weight and yield has been reported by Himelrick [3] which are similar active ingredient as Elanta super.

Application of Elanta Super with GA₃ and CPPU increased the leaf area, leaf chlorophyll content, photosynthesis, transpiration rate and stomatal conductance in Sonaka grapes. Leaf area (223.1 cm²) and total chlorophyll (2.06 mg/g) were found higher with application of 1 ml Elanta Super along with 15 ppm GA₃ and 1 ppm CPPU (Table 2). Somkuwar *et al.*

[7] reported increase in leaf area by increasing the number of shoots might have contributed to better photosynthesis. Dubravec and Licul [1] reported an increase in chlorophyll content in the samples with the application of Agrigospon and Ergostim (N-ATCA) which are similar active ingredient and products that of Elanta Super. Increased Photosynthesis (11.30 μmol/cm²/sec), transpiration rate (4.07 mmol/cm²/sec) and stomatal conductance (0.21 cm S⁻¹) were found with the application of 1 ml Elanta Super along with 15 ppm GA₃ and 1 ppm CPPU (Table 2).

Table 2
Effect of Elanta Super, GA₃ and CPPU spraying on Gas exchange parameter and Leaf chlorophyll content in Sonaka grapes

Treatments	Leaf Area (cm ²)	Total chlorophyll (mg/g)	Chlorophyll a (mg/g)	Chlorophyll b (mg/g)	Photosynthesis (μmol/cm ² /sec)	Transpiration rate (mmol/cm ² /sec)	Stomatal conductance (cm S ⁻¹)
T1	164.80 ^d	1.60 ^d	1.12 ^c	0.25 ^e	8.90 ^d	3.24 ^d	0.17 ^c
T2	201.30 ^b	1.98 ^b	1.16 ^b	0.69 ^a	10.50 ^b	3.81 ^b	0.19 ^b
T3	171.10 ^c	1.83 ^c	1.04 ^e	0.66 ^b	10.00 ^c	3.58 ^c	0.17 ^c
T4	223.10 ^a	2.06 ^a	1.55 ^a	0.37 ^c	11.30 ^a	4.07 ^a	0.21 ^a
T5	159.40 ^e	1.54 ^e	1.08 ^d	0.29 ^d	8.20 ^e	3.09 ^e	0.11 ^d
CV %	1.267	1.528	1.019	3.571	2.143	2.094	2.695
LSD 5%	3.125	0.036	0.016	0.021	0.281	0.099	0.006
Significances	**	**	**	**	**	**	**

Note: CV- Coeff Var, LSD - Least Significances Difference, The values are means those marked with different letters of the alphabet in the same column are significantly different at $P \leq 0.05$

Table 3
Correlation among an assortment of physiological parameters with yield in Sonaka grapes.

Pearson Correlation Coefficients, N = 5
 Prob > |r| under H0: Rho=0

	Berry length	Berry diameter	Bunch weight	Leaf size	Total chlorophyll	Photosynthesis	Yield
Berry length	1	0.933*	0.845	0.906*	0.951*	0.951*	0.841
Berry diameter		1	0.970*	0.838	0.799	0.833	0.967*
Bunch weight			1	0.783	0.672	0.699	0.999**
Leaf size				1	0.929*	0.923*	0.765
Total Chlorophyll					1	0.987*	0.659
Photosynthesis						1	0.685
Yield							1

Note: * Significant at 5% & ** Significant at 1%

Significant and positive correlations were found among physiological parameters with yield when Sonaka grapes treated with Elanta Super along with GA₃ and CPPU (Table 3). Average bunch weight is positive correlated with yield viewing heavy impact on production with Elanta super application. Moreover, leaf area was correlated through photosynthesis retaining greenness in leaf and berries are more prospective surveillances.

On the basis of these results, it can be concluded that the application of Elanta Super along with GA₃ and CPPU significantly increased berry parameters like berry elongation, skin thickness, TSS and acidity also leaf area, chlorophyll content and gas exchange parameters *viz.* photosynthesis, transpiration rate and stomatal conductance. Conversely application of 1 ml Elanta Super along with 15 ppm GA₃ and 1 ppm CPPU was found to be more proficient treatment for improving physiological parameters and yield attributes in Sonaka grapes.

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