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INFLUENCE OF GROWTH REGULATOR SCHEDULE ON FRUIT YIELD AND QUALITY OF MANJRI NAVEEN GRAPE VARIETY

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KEYWORDS

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ABSTRACT

The different concentration of GA₃ (i.e. 1, 2, 5, 10, 15 and 20 ppm) and CPPU (i.e. 0.5, 1 and 2 ppm) were apply at a different physiological stage (i.e. at pre bloom and berry development stages) as a different schedule at two growing seasons. The all traits observed significant. The schedule 3 of high concentration of compounds showed significant effect on berry length (27.3 mm), 50 beery weight (195.1 g), bunch weight (388.9 g), yield per vine (14.8 kg), bricks yield (444.2), yield per hecter (25.9 ton) and pedicel thickness (2.59 μ m). Number of berries per bunch(94) and berry diameter(19.3 mm) observed highest in schedule 2.Yield per hecter was positively correlated with berry length (0.959*) and pedicel thickness (0.967*). Berry length significantly positive correlated with pedicel thickness (0.983*). Thus, the study clearly indicates that the schedule 3 of higher concentration of GA₃ and CPPU was best suited for the Manjri Naveen Grape variety for recording higher yield and quality.

INTRODUCTION

India sticks on 9th rank in the world's grape production from last two years. In 2015 the production of grapes in India was 2.4 lakh tonnes which was much below than 12.5 lakh tonnes of the top producer of grapes, China. Grape was contributed 2.9% in total production of fruits in 2013-14. In India Maharashtra state was the leading grape producer with 2160 Mt/ha which contribute 83.6% in production in 2013-14 (Anonymous, 2014). Every aspect of plant growth and development is controlled by plant hormones. Plant growth regulators enthused the activity of hormones. Since inception series of experiments was carried out about growth regulator aiming to improve yield and quality of grapes but the role of gibberellins on berry growth has not been completely known yet. GA₃ was often used for improve the quality of fruit like Guava (Bisen *et al.*, 2014) and Vegetable like chilli (Raj *et al.*, 2016).Plant growth regulators was also effective in floral bud drop (Jawanda *et al.*, 1974) and losses caused by abiotic stress (Ratnakumar *et al.*, 2016).

GA₃ and CPPU was applied for improve quality of berry and yield of grapes. The number of applications of these two growth regulators varies from two to five. So this experiment was carried out to know the effective dose of growth regulator to get maximum yield and quality of berries.

Manjri Naveen (Karibasappa, 2011) is recently released variety of ICAR-NRC Grapes, Pune. It is a clonal selection from the Centennial Seedless having uniform naturally bold white seedless berries with firm pulp and have good export value. Therefore, it has a scope for well balance scheduling of plant growth regulators to increase the yield potential. The pre bloom application of GA₃ alone were given to develop optimum rachis to produce a loose bunch. The application of both GA₃ and CPPU were given to increase the berry size and bunch development. Hence, the experiment was conducted to know best schedule suitable for variety Manjri Naveen.

MATERIALS AND METHODS

Pune lies in the foothills of Sahyandri Mountains between 18°32' Nand 73°51' E, respectively. It has an altitude of 559 metres above mean sea level. The temperature ranges from 22°C to 41°C in summer and 8°C to 25°C in winter. The precipitation ranges from 650 mm to 700 mm. Grape variety Manjri Naveen a clonal selection from Centennial Seedless was grafted on Dogridge rootstock in the year 2007. The vines were planted at a spacing of 2.4 meter between rows and 1.2 meter between vines. The vines were trained to bilateral cordon. Vertical shoot positioning was followed in this training system so has to harvest maximum sunlight required for better yield and quality. In practice, three parallel rows were selected. Four plants from each row was selected for imposition of treatment. All the recommended standard cultural practices were followed to maintain the vines healthy. In this region, double pruning and single cropping pattern is followed.

Five foliar application of different concentrations of gibberellic acid and two applications of CPPU was given at pre bloom and berry development stage (Table 1). The spraying was done at pre bloom stage, 2nd at 4-5 days after pre bloom stage, 3rd at 4-5 days after second spray. In addition, two sprays during berry development

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stage i.e. 3-4 mm berry size and 6-7 mm berry size, respectively were given.

In order to determine the effect of GA₃ and CPPU on fruit yield and quality, berry quality parameter were studied. At the time of harvest bunches which fulfil the requirement of export standards were only selected and harvested as per the standard practices. The observation on berry length, berry diameter and pedicel thickness derived by averaging 50 berries randomly from each treatment and measured using Vernier calliper (RSK, China). Number of berries per bunch was recorded by manually counting from 10 bunches. The fifty berry weight was derived by averaging randomly selected berries from 5 bunches. The bunch weight was recorded by averaging the weight of 10 bunches randomly from each treatment and expressed in gram. Yield per vine was calculated by averaging all bunch weight of vine. Soluble solid concentration was determined from the juice using digital refractometer (model ERMA INC, Tokyo Japan) which was calibrated before use by distilled water and reading was adjusted to zero (Anonymous, 2007). Total soluble solid were

expressed in degree brix (°B) while, titrable acidity percentage was expressed as grams of tartaric acid per 100 ml of juice (Weaver and Winker, 1952). Such observations were previously recorded by Khot *et al.*, 2014, Khot *et al.*, 2015, Ramteke *et al.*, 2015, Ramteke *et al.*, 2015 and Ramteke *et al.*, 2016.

The data recorded as eight replicates for two consecutive production seasons and pooled together after passing normality test. The data was analysed by one way factor analysis of variance using the SAS (V 9.3) software (SAS, 2011). The means were compared by multiple range test at p≤0.05. Correlation study were based on 8 records per parameters and analysis was done by OPSTAT, HAU, Haryana (Sheron *et al.*, 1998).

RESULTS AND DISCUSSION

The study revealed that differences among the concentrations used were distinguished for all of the parameter studied (Table 2). Whereas, significant differences were recorded for yield

Table 1: Details of spraying schedule followed during bunch and berry development stage

Sr.No	Stage	Schedule 1 (T1)	Schedule 2 (T2)	Schedule 3 (T3)	Schedule 4 (T4)Control
A.	Pre bloom Application				
1.	Pre bloom Stage	GA ₃ @ 1 ppm	GA ₃ @ 2 ppm	GA ₃ @ 5 ppm	No chemicals were sprayed.
2.	4-5 Days after first spray	GA ₃ @ 2 ppm	GA ₃ @ 5 ppm	GA ₃ @ 10 ppm	
3.	4-5 Days after second spray	GA ₃ @ 5 ppm	GA ₃ @ 10 ppm	GA ₃ @ 15 ppm	
B.	Berry Development Stage				
1.	3-4 mm berry size	GA ₃ @ 10 ppm + CPPU@ 0.5 ppm	GA ₃ @ 15 ppm + CPPU@ 1 ppm	GA ₃ @ 20 ppm + CPPU@ 2 ppm	
2.	6-7 mm berry size	GA ₃ @ 10 ppm + CPPU@ 0.5 ppm	GA ₃ @ 15 ppm + CPPU@ 1 ppm	GA ₃ @ 20 ppm + CPPU@ 2 ppm	

Table 2: Effect of Bio regulator on berry and bunch characters in Manjri Naveen grapes pooled mean data 2013-14 and 2014-15.

	Berry Length	Berry Diameter	Pedicel Thickness	Number of Berries per Bunch	50 Berry Weight	Bunch Weight	Yield per Vine	TSS	Acidity	TSS/ Acidity	Bricks Yield	Yield per hactor (ton)
Schedule 1	22.5C	18.6A	1.88C	68B	169.2B	351.7B	9.9C	18.3A	0.54B	33.9A	345.3C	17.7C
Schedule 2	25.8B	19.3A	2.22B	94A	163.9B	317.5C	12.4B	17.1B	0.59A	29.0C	398.5B	21.9B
Schedule 3	27.3A	17.2B	2.59A	89A	195.1A	388.9A	14.8A	16.5B	0.56B	29.5CB	444.2A	25.9A
Schedule 4	21.1D	16.5B	1.62D	73B	138.7C	267.4D	8.1D	16.8B	0.56B	30.0B	273.4D	17.8C
LSD	0.97	1.23	0.20	5.18	9.31	20.02	0.80	0.60	0.02	0.93	26.73	1.52
Significance	**	*	*	**	**	**	**	**	**	**	**	**

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≤0.05, * Significant at 5% level; ** Significant at 1% level of significance.

Table 3: Phenotypic correlation coefficients of fruit yield and yield characters in Manjri Naveen grapes

	Berry Length	Berry Diameter	Pedicel Thickness	Number of Berries per Bunch	50 Berry Weight	Bunch Weight	Yield per Vine	TSS	Acidity	TSS/ Acidity	Bricks Yield	Yield per hactor (ton)
Berry Length	1.000											
Berry Diameter	0.298	1.000										
Pedicel Thickness	0.983*	0.215	1.000									
Number of Berries per Bunch	0.867	0.306	0.770	1.000								
50 Berry Weight	0.839	0.194	0.906	0.441	1.000							
Bunch Weight	0.717	0.226	0.808	0.270	0.984*	1.000						
Yield per Vine	0.991	0.239	0.996*	0.783	0.899	0.793	1.000					
TSS	-0.434	0.553	-0.408	-0.611	-0.101	0.071	-0.403	1.000				
Acidity	0.467	0.352	0.310	0.842	-0.098	-0.254	0.332	-0.502	1.000			
TSS/Acidity	-0.509	0.198	-0.418	-0.802	-0.010	0.186	-0.422	0.903	-0.827	1.000		
Bricks Yield	0.972*	0.372	0.984*	0.746	0.919	0.832	0.983*	-0.259	0.303	-0.309	1.000	
Yield per hactor (ton)	0.959*	0.001	0.967*	0.810	0.809	0.679	0.963*	-0.634	0.399	-0.602	0.900	1.000

* Significant at 5% level of significance.

contributing parameters (berry length, number of berries per bunch, 50 berry weight, bunch weight, yield per vine, yield per hectare) and quality parameters (TSS, acidity, TSS acidity ratio). Similar results were also reported in our earlier study (Ramteke *et al.*, 2015).

The effect of gibberellic acid and CPPU on yield and quality parameters were depicted in Table 2. Yield and quality parameters were increased with increasing concentration of applied GA₃ along with CPPU on Manjri Naveen Grapes. Comparing with the control, schedules were recorded higher level of berry length, pedicel thickness, bunch weight, yield per vine and brix yield. Application of Gibberellic acid (GA₃) @ 20 ppm with CPPU @ 2 ppm during berry development stage recorded higher berry length (22.71%), berry diameter (14.50%), bunch weight (31.24%), fifty berry weight (28.90%) (Dass and Randhava, 1968), and yield per vine (45.27%) over control in Manjri Naveen grapes. The result of present study are in accordance with, Dimovska *et al.*, 2006, Pires *et al.*, 2000 and Gowda *et al.*, 2006, Khot *et al.*, 2014, Khot *et al.*, 2015, Ramteke *et al.*, 2015, Ramteke *et al.*, 2015 and Ramteke *et al.*, 2016. The combined application of GA₃ and CPPU in Fujiminori grapes showed increased berry weight by 75 percent over control. This was achieved by the stimulated cell division during early fruit development stage and cell enlargement during the later stage of berry growth (Kennedy, 2002). In Schedule 1 TSS was maximum and the TSS and acidity ratio in berries was reduced with increase in concentration of Gibberellic acid (GA₃) and CPPU (Dass and Randhava, 1968). The acidity was maximum in schedule 2. The TSS observed more 8.19 percent and acidity observed more 5.08 percent over control. Jawanda *et al.*, 1974 and Fathi *et al.* 2011 considered the increase and low acidity when other growth regulator such as para chlorophenoxy acetic acid sprayed on different grape cultivar. Brix yield and yield per vine was increase with the increased concentration of Gibberellic acid (GA₃) and CPPU. Brix yield was said to be key decisive factor for considering yield of vine (Somkuwar and Ramteke, 2006).

Phenotypic correlation study among the different yield and quality characters (Table 3) revealed that pedicel thickness was highly and positively correlated with yield per vine and brix yield. Morris *et al.*, 1985 observed reduced percentage of soluble solid and increased acidity due to heavy fruit load in concord grapes. Likewise, berry length, number of berries per bunch, 50 berry weight and bunch weight had positive correlation with both yield per vine and yield per hectare and the similar results were reported by Fatahi *et al.*, 2004, Patil and Patil, 1995. Berry length was negatively correlated with TSS and TSS acid ratio. Positive and significant correlation was found between pedicel thickness and yield per vine. The TSS was negatively correlated with berry length, pedicel thickness, number of berries per bunch, fifty berry weight, bunch weight, yield per vine, acidity, bricks yield and yield per hectare (Somkuwar *et al.*, 2012, Gupta *et al.*, 2015). While yield per vine showed negative association with TSS (Somkuwar *et al.*, 2012), TSS: Acid ratio and berry diameter in the same study. TSS was showed positive correlation with berry diameter. Bricks yield recorded negative correlation with bunch weight whereas, positive correlation with yield per vine (Somkuwar *et al.*, 2012).

Based on these results, it had been concluded that schedule 3 performed better for yield per vine and yield per hectare via other parameters *i.e.* berry length, pedicel thickness, fifty berry weight, bunch weight and brix yield. Yield was subscribed mainly by bunch weight and berries per bunch. Therefore, from this experiment it can be concluded that with increase in the concentration of GA₃ along with CPPU it resulted in increase in the yield and yield contributing parameters. Hence it can be said that schedule 3 was best suited for the Manjri Naveen Grape variety followed by schedule 2 under the Pune conditions.

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