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Role of CPPU and Application Stages with Other PGR's on Bunch and Berry Characters in New Grape cv. Italia under Tamil Nadu Conditions

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A B S T R A C T

An investigation was performed to study the impact of CPPU (alone and in combination with other PGR's) and their application stage on berry development, yield and quality in grape (*Vitis vinifera* L.) cv. Italia at Horticultural College and Research Institute, TNAU, Coimbatore. Treatments were imposed over the vines pruned to standardized pruning level of pruning 50% of canes for crop yield and 50% of canes for vegetative growth and observed for impact on bunch and berry characters. The results revealed that bunches sprayed with CPPU (1 ppm) recorded the maximum berry width at pea stage of 7-8 mm berry size. The maximum peel weight, peel thickness and pedicel thickness was registered with CPPU (1 ppm) imposed both at 2-3 mm and at 7-8 mm berry size stage. But, the results on yield related traits found to be positive with the bunch sprays of GA_3 (10 ppm) + Brassinosteroid (1 ppm) at 7-8 mm berry size.

Introduction

Grape is an excellent fruit crop which found to indulge tremendous usage with them and is so unique that no fruit can challenge their superiority. It found to have a good scope for wider cultivation in all the temperate regions and has been grown more recently in tropical and subtropical climates. There are more than 1000 grape cultivars known all over the world but only a limited number are commercially cultivated. In India, prevalence with wider range of soil and climatic conditions maximized its vitality for better productivity, especially the climatic conditions in Tamil Nadu is unique and favours production in large scale throughout the year. The area under grape cultivation in the last three decades increasing steadily with the introduction of exotic varieties. In that line, an exotic grape cultivar, Italia, introduced from University of California, USA grained greater importance.

Plant bioregulators have gained greater significance in regulating several fruit

development activities like chemical thinning, increasing fruit set and size, enhancing colouration and enhancing or delaying ripening of fruits (Winkler *et al.,* 1974). Both intensive and extensive application has bought enhanced production and betterment with growth and development of fruits with wider utility (Ma, 2007).

CPPU (N-(2-chloro-4-Pyridyl)-N-Phenyl urea), a urea derived cytokinin, synthetic in nature, promotes berry growth in grape. The primary physiological effects of forchlorfenuron on grapevines cause the regulation of fruit set, berry growth and development (Humphery, 2005). It has also been shown to increase the berry size in grape by increasing its diameter, thus leading to spherical berries instead of oblong ones. Usage of CPPU alone or in combination with various PGRs at optimum concentrations and also at appropriate stage observed to stimulate various physiological and biochemical responses thereby improved the growth and productivity of crop (Sasse, 2003). The stage and time of application of bioregulators on grape vary with the region and too cultivar specific (Dokoozlian, 2003). Hence, an attempt was made to assess the impact of CPPU and application stages with certain other PGR's on bunch and berry characters of the newly introduced grape cv. Italia under Tamil Nadu conditions.

Materials and Methods

The present investigation was conducted at College Orchard, Horticultural College and Research Institute, TNAU, Coimbatore located at an altitude of 426.6 m above mean sea level with latitude of 9.19°N and longitude of 77.88°E. The experiment was carried out during the period from February, 2014 to July, 2014. The experiment was laid in Factorial Randomized Blocks Design (FRBD) with two factors *viz.,* 3 bioregulators (CPPU, GA_3 and Brassinosteroid) alone or in combinations and 3 stages of application (2-3 mm berry size stage, 7-8 mm berry size stage and both at 2-3 mm and 7-8 mm berry size stage). The observations on bunch circumference, bunch weight, yield per vine, berry width, peel weight, peel thickness and pedicel thickness were recorded and analyzed as per the methodology outlined by Panse and Sukhatme (1995).

Results and Discussion

The results on impact of bioregulators and application stages with bunch circumference revealed that significant differences due to bioregulators alone (Table 1). Among the bioregulators, the treatment B_4 *i.e.,* GA_3 (10 ppm) + CPPU (1 ppm) recorded the maximum 'bunch circumference' (36.85 cm) and the minimum 'bunch circumference' was registered in control (32.75 cm). This could be attributed to nourished berries and increment with bunch length and berry weight. Observations recorded on 'bunch weight' exhibited significant differences with both bioregulators and application stages including their interaction (Table 1). In contrary to the CPPU implied treatments, the treatment B_5 *i.e.,* GA_3 (10 ppm) + Brassinosteroid (1 ppm) registered the maximum 'bunch weight' (681.61 g) over control (542.70 g). Among the stages of application, the treatments imposed at 7-8 mm berry size stage recorded the maximum 'bunch weight' (652.86 g). The minimum 'bunch weight' was recorded in cumbu stage (608.02 g). With regard to interaction, the treatment B_5S_2 recorded the maximum 'bunch weight' (719.94 g). Exogenous application of GA_3 (10 ppm) + Brassinosteroid (1 ppm) had showed promising results in increasing the bunch weight which might be attributed to certain changes in the metabolism of fruits for the improvement of sink strength followed by efficient partitioning of assimilates towards

the developing sink in response to spray of GA_3 (10 ppm) + Brassinosteroid (1 ppm). Similar results were observed in earlier studies by Anitha (1993), Vivency (1995) and Padashetti *et al.,* (2010).

In a same way, observations recorded on 'yield per vine' showed significant differences with bioregulators and application stages including their interaction (Table 1). Among the bioregulators, the treatment B_5 *i.e.,* GA_3 (10 ppm) + Brassinosteroid (1 ppm) recorded the maximum 'yield per vine' (11.02 kg/vine).

The minimum 'yield per vine' was registered by control (8.54 kg/vine). Among the stages of application, the treatments imposed in 7-8 mm berry size stage recorded the maximum 'yield per vine' (10.49 kg/vine). With regard to interaction, the treatment B_5S_2 recorded the maximum 'yield per vine' (12.70 kg/vine). The minimum 'yield per vine' was recorded in B_4S_1 (8.10 kg/vine). The cumulative effect of physical characteristics of bunches and berries could have contributed for the increase in yield per vine and this might be due to the promotion of cell multiplication, cell expansion and differentiation and continuous mobilization of nutrients and assimilates. Similar observations were made in number of earlier studies in various crops (Tambe, 2002; Velu, 2001; Sasse, 2003; Taiz and Zeiger, 2010).

Observations recorded on 'berry width', 'peel weight' and 'peel thickness' exhibited significant differences with bioregulators and stages of application including their interaction (Table 2). The treatment B_2S_2 recorded the maximum 'berry width' (21.18 mm) followed by B_3S_2 (21.09 mm). The minimum 'berry width' was recorded in B_6S_1 (17.72 mm). For observations on 'peel weight' the treatment B_2S_3 recorded the maximum 'peel weight' (0.63 g), followed by B_2S_2 and B_4S_3 (0.61 g) that all were on par with each other. The minimum 'peel weight' was recorded in control at S_2 stage (0.39 g). In case of 'peel thickness', the treatment B_2S_3 recorded the maximum 'peel thickness' (0.21 mm), followed by B_4S_3 (0.20 mm) that were on par with each other. The minimum 'peel thickness' was recorded in control at S_2 stage (0.11 mm). With regard to 'pedicel thickness', the maximum 'pedicel thickness' was registered by B_2S_3 (2.71 mm) followed by B_4S_3 (2.68 mm), which were on par with each other (data not shown). The minimum 'pedicel thickness' was recorded in control at S_2 stage (1.82 mm).

Generally, the concentration and stage of application of bioregulators significantly affect berry size in grape (Halbrooks and Mortensen, 1987). In the present study, among the treatments, CPPU (1 ppm) registered the maximum 'berry width'. Similar trend was observed for peel weight and peel thickness. Usually, CPPU stimulates periclinal cell division in the berry, leading to more round or oval shaped berries compared to GA application alone (Dokoozlian, 2001).

Arima *et al.,* (1995) reported that CPPU enhances the fruit growth in initial phase by rapid cell division and in the expansion phase by slower cell expansion. With regard to stages of application, CPPU (1 ppm) imposed at pea stage (7-8 mm berry size) registered the maximum berry width. This is in line with the findings of Korkutal *et al.,* (2008), who reported the most effective stage for usage of bioregulators for enlargement of grape berries is pea berry stage.

Increased berry size in grape cv. Red Globe was noticed in treatments of GA_3 (20 ppm) and the combination of GA_3 (20 ppm) with CPPU (3 ppm), applied at 10 mm mean berry size (Quixely and Raath, 2010). Similar effect was also observed by Rizk-Alla *et al.,* (2011) in grape cv. Black Monukka.

Table.1 Effect of bioregulators and application stages on 'Bunch circumference (cm)', 'Bunch weight (g)' and 'Yield per vine (kg)' in grape cv. Italia

Treatments	'Bunch circumference (cm)'				'Bunch weight (g)'				'Yield per vine (kg)'			
	S_1	S_2	S_3	MEAN	S_1	S_2	S_3	MEAN	S_1	S_2	S_3	MEAN
C	32.78	33.02	32.45	**32.75**	552.02	543.30	532.77	**542.70**	8.50	8.75	8.36	**8.54**
B_1	34.52	35.76	34.14	**34.81**	599.96	660.52	609.07	**623.18**	9.68	9.91	9.89	**9.83**
B_2	36.70	36.43	37.04	**36.72**	638.55	654.68	642.36	**645.20**	10.38	10.51	9.54	**10.14**
B_3	33.45	33.24	32.96	**33.22**	659.32	694.84	639.50	**664.55**	10.55	11.01	10.42	**10.66**
B_4	36.90	37.17	36.49	**36.85**	547.46	632.03	613.58	**597.69**	8.10	10.30	9.65	**9.35**
B_5	34.98	35.46	34.73	**35.06**	640.68	719.94	684.20	**681.61**	9.35	12.70	11.02	**11.02**
B_6	35.65	35.52	36.36	**35.84**	618.11	664.73	645.68	**642.84**	9.89	10.24	10.23	**10.12**
MEAN	**35.00**	**35.23**	**34.88**	**35.04**	**608.02**	**652.86**	**623.88**	**628.25**	**9.49**	**10.49**	**9.87**	**9.95**

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Source	Bunch circumference (cm)		Bunch weight (g)		Yield per vine (kg)	
	SEd	CD (0.05%)	SEd	CD (0.05%)	SEd	CD (0.05%)
B	0.29	0.61	5.35	11.15	0.08	**0.17**
S	0.19	NS	3.50	7.30	0.05	**0.11**
B x S	**0.51**	**NS**	**9.26**	**19.32**	**0.14**	**0.30**

C	Control (water spray)	S	Stages of application
B	**Bioregulators**	S_1	at 2-3 mm berry size
B_1	GA_3 (10 ppm)	S_2	at 7-8 mm berry size
B_2	CPPU (1 ppm)	S_3	Both at 2-3 and 7-8 mm berry size
B_3	Brassinosteroid (1 ppm)	NS	Non-significant
B_4	GA_3 (10 ppm) + CPPU (1 ppm)		
B_5	GA_3 (10 ppm) + Brassinosteroid (1 ppm)		
B_6	GA_3 (10 ppm) + CPPU (1 ppm) + Brassinosteroid (1 ppm)		

Table.2 Effect of bioregulators and application stages on 'Berry width (mm)', 'Peel weight (g)' and 'Peel thickness (mm)' in grape cv. Italia

Treatments	'Berry width (mm)'				'Peel weight (g)'				'Peel thickness (mm)'			
	S_1	S_2	S_3	MEAN	S_1	S_2	S_3	MEAN	S_1	S_2	S_3	MEAN
C	18.56	18.98	18.77	**18.77**	0.40	0.39	0.41	**0.40**	0.12	0.11	0.12	**0.12**
B_1	17.90	20.21	19.64	**19.25**	0.43	0.55	0.47	**0.48**	0.14	0.16	0.15	**0.15**
B_2	19.03	21.18	20.75	**20.32**	0.60	0.61	0.63	**0.61**	0.17	0.19	0.21	**0.19**
B_3	18.46	21.09	20.39	**19.98**	0.53	0.49	0.56	**0.53**	0.16	0.15	0.18	**0.16**
B_4	18.13	20.44	19.87	**19.48**	0.56	0.60	0.61	**0.59**	0.17	0.17	0.20	**0.18**
B_5	20.92	20.34	19.53	**20.26**	0.51	0.48	0.52	**0.50**	0.15	0.15	0.17	**0.16**
B_6	17.72	20.05	19.36	**19.04**	0.57	0.54	0.60	**0.57**	0.17	0.16	0.19	**0.17**
MEAN	**18.67**	**20.33**	**19.76**	**19.59**	**0.51**	**0.52**	**0.54**	**0.53**	**0.15**	**0.16**	**0.19**	**0.16**

Source	'Berry width (mm)'		'Peel weight (g)'		'Peel thickness (mm)'	
	SEd	CD (0.05%)	SEd	CD (0.05%)	SEd	CD (0.05%)
B	0.16	0.34	0.007	0.014	0.002	0.004
S	0.11	0.22	0.004	0.009	0.001	0.003
B x S	0.28	0.59	0.012	0.025	0.004	0.008

C	Control (water spray)	S	Stages of application
B	**Bioregulators**	S_1	at 2-3 mm berry size
B_1	GA_3 (10 ppm)	S_2	at 7-8 mm berry size
B_2	CPPU (1 ppm)	S_3	Both at 2-3 and 7-8 mm berry size
B_3	Brassinosteroid (1 ppm)	NS	Non-significant
B_4	GA_3 (10 ppm) + CPPU (1 ppm)		
B_5	GA_3 (10 ppm) + Brassinosteroid (1 ppm)		
B_6	GA_3 (10 ppm) + CPPU (1 ppm) + Brassinosteroid (1 ppm)		

Strong adherence of the berry to the pedicel is one of the characters required for long distance transport of any grape variety. Weaker pedicels result in separation of berries from the bunch by the breakage of pedicels. The maximum 'pedicel thickness' was recorded in the treatment bunch sprayed with CPPU (1 ppm), both at 2-3 mm and at 7-8 mm berry size stage, while it was the minimum in control. This might be due to the increase in cell number and cell layer of the pedicel. Similar observations were also made in tulips by Arima *et al.,* (1995). Moreover, the increase in pedicel thickness by CPPU might also be due to the increased number and density of cells in pedicel. Sharma and Jindal (1981) also reported the beneficial effects of CPPU in improving the pedicel thickness in Beauty Seedless grape, Sarig *et al.,* (1998) in Thompson Seedless and Ben-Arie *et al.,* (1998) in seeded grape.

So, the present study revealed that the bioregulator treatments with CPPU (1 ppm) recorded the maximum berry width at 7-8 mm berry size stage. The maximum peel weight, peel thickness and pedicel thickness was registered with CPPU (1 ppm) imposed both at 2-3 mm and at 7-8 mm berry size. In case of parameters for bunch weight and yield per vine, the combined application of GA_3 (10 ppm) and Brassinosteroid (1 ppm) at 7-8 mm berry size expressed good response.

References

Anitha, N. 1993. Synthetic brassinosteroids and its role in few plant growth processes. *Ph.D., Thesis* submitted to UAS, Bangalore.

Arima, Y., K. Oshima and K. Shudo. 1995. Evaluation of a novel urea type cytokinin. Horticultural uses of for chlorfenuron. *Acta Hort.,* 394: 75-83.

Ben-Arie, R., P. Sarig, Y. Cohen-Ahdut, Y. Zutkhi, L. Sonego, T. Kapulonov and N. Lisker. 1998. CPPU and GA_3 effects on pre and postharvest quality of seedless and seeded grapes. *Acta Hort.,* 463: 349-355.

Dokoozlian, N.K. 2001. CPPU: A Potential New Plant Growth Regulator for California Table Grapes. *Grape Notes Newsletter,* 1: 1-4.

Dokoozlian, N.K. 2003. Use of plant growth regulators in California table grape production. *In:* Proceedings of the 6th Australian table grape technical conference, Mildura, AU. pp 33-39.

Halbrooks, M.C. and J.A. Mortensen. 1987. Influence of gibberellic acid and various management practices on berry, seed

and cluster development in 'Orland Seedless' grape. *In:* Proc. Fla. State Hort. Soc., 100: 312-315.

Humphery, T. 2005. Evaluation of the new active for chlorfenuron in the product sitofex 10 EC plant growth Regulators. APUAA, Canberra, Australia. pp. 1-31.

Korkutal, I., E. Bahar and O. Gokhan. 2008. The characteristics of substances regulating growth and development of plants and the utilization of gibberellic acid (GA_3) in viticulture. *World J. Agrl. Sci.,* 4(3): 321-325.

Ma, H.Y. 2007. Changes of endogenous hormones in grapevine during its development. Northwest Science & Technology University of Agriculture and Forestry.

Padashetti, B.S., S.G. Angadi and S. Pattepur. 2010. Effect of pre-harvest spray of growth regulators on growth, quality and yield of seedless grape genotypes. *Asian J. of Hort.,* 5(1): 218-221.

Panse, V.G. and P.V. Sukhatme. 1985. Statistical Methods for Agricultural Workers, ICAR. Pub. New Delhi, 115-130.

Quxiley, B.W. and P.J. Raath. 2010. Utilization of gibberellic acid, CPPU and bunch applied calcium to increase Red Globe berry firmness. *In:* Proceedings of the 6th table grape symposium, Visalia, California, pp 5-9.

Rizk-Alla, M.S., M.A. Abd El-Wahab and O.M. Fkry. 2011. Application of GA_3 and NAA as a means for improving yield, fruit quality and storability of grape cv. Black Monukka. *Nat. Sci.,* 9: 1-19.

Sarig, P., Y. Zuthki, N. Lisker, Y. Shkelerman and R. Ben-Arie. 1998. Natural and induced resistance of table grapes to bunch rots. *Acta Hort.,* 464: 65-70.

Sasse, J.M. 2003. Physiological actions of brassinosteroids- An update. *J. Plant Growth Regul.,* 22: 276-288.

Sharma, S. and P.C. Jindal. 1981. Effect of 4-CPA and benzyl-adenine on berry drop, yield and quality in Beauty Seedless grape (*Vitis vinifera* L.). *In:* National Symposium on Tropical and Sub-tropical Fruit Crops, Bangalore (Abst.), pp. 117.

Taiz, L. and E. Zeiger. 2010. *In:* Plant Physiology, Sinauer Associates Inc., Publishers, Sunderland, Massachusetts, USA, 519-537.

Tambe, T.B. 2002. Effects of Gibberellic acid in combination with brassinostroid on berry size, yield and quality of Thompson Seedless grape. *J. Mah. Agric. Univ.,* 27(2): 151-153.

Velu, V. 2001. Studies on bud load and certain crop thinning practices on vigour, yield and quality of grapes (*Vitis vinifera* L.) cv. Muscat. *M.Sc., Thesis* submitted to Tamil Nadu Agricultural University, Coimbatore.

Vivency, A.J. 1995. Influence of brassinosteroids and its combination with other growth regulator on productivity in grapes, French bean and tomato. *M.Sc., Thesis* submitted to UAS Bangalore.

Winkler, A.J., J.A. Cook, W.M. Kliewer and L.A. Lider. 1974. General viticulture. University of California Press, Berkeley, U.S.A.

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