P-ISSN: 2349-8528

E-ISSN: 2321-4902

www.chemijournal.com

IJCS 2020; 8(5): 487-489

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Received: 19-06-2020

Accepted: 21-08-2020

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Early bud induction through cane regulation and gibberellic acid (GA₃) treatment in grape (*Vitis vinifera* L.) cv. 'Fantasy seedless'

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DOI: <https://doi.org/10.22271/chemi.2020.v8.i5g.10345>

Abstract

Grape, though a temperate crop, is well adopted in sub tropics and tropics. In management of this crop, pruning is an important tool. Gibberellins are plant hormones that govern growth and direct several developmental processes including stem elongation, germination, dormancy, flowering, sex expression and leaf and fruit senescence. 25 canes per vine exhibited the earliest bud burst (4.65) than the other treatments and the maximum days taken for bud burst in canes regulated 50 canes per vine and control (7.56) respectively. The similar trend of bud burst was recorded during second season (2019) of growth. In pooled results, significantly, the earliest bud burst was recorded with respect to 25 canes per vine (4.41) where as bud burst occurred late (7.30 and 7.50) in control and 50 canes per vine respectively. In interaction effect of first year (2018), the earliest bud burst (3.89) was recorded in treatment 25 canes per vine with 30 ppm of GA₃ which was statically on par with 25 canes per vine with 40 ppm of GA₃ (4.22) and bud burst delayed in the treatment 50 canes per vine without GA₃ treatment (7.89).

Keywords: Cane regulation, gibberellic acid, early bud burst, delayed bud burst, ppm and fantasy seedless

Introduction

India is the second largest producer of fruits as it is endowed with varying climatic conditions in different regions of the country. Cultivation of fruit crops plays an important role in the prosperity of any nation. Grape (*Vitis vinifera* L.) was one of the first fruits to be cultivated by human. Since the dawn of civilization, the fermented product of grapes, wine has probably been an important way of consuming grapes (McGovern *et al.* 1996) [7]. In India, the area under grape is estimated as 1, 37,000 ha with an annual production of 29, 51, 000 metric tonnes (Anon, 2018) [2]. Grape, though a temperate crop, is well adopted in sub tropics and tropics. In management of this crop, pruning is an important tool. Therefore, vines are to be pruned twice in a year under sub tropical conditions, like Maharashtra. Backward pruning for vegetative growth and forward pruning for fruiting as the vine does not grow under dormant conditions. The time of pruning varies greatly with the variety and local climatic conditions in different grape-growing regions in India. Crop load adjustment should be considered as one of the technical cultural practices suitable to modify grapevine physiology and plant production towards a defined goal (Matti and Ferrini, 2005) [6]. Gibberellins are much popular and attaining great importance in the field of viticulture. Gibberellins are plant hormones that govern growth and direct several developmental processes including stem elongation, germination, dormancy, flowering, sex expression and leaf and fruit senescence. Fantasy Seedless grape (*Vitis vinifera* L.) is a mid season, attractive, blue-black, referred to as black in the industry, seedless grape with naturally large berries. Cultivar is the result of four generations of hybridization at the USDA Fresno location, starting in 1926. The source of seedlessness is from "Thompson Seedless" and 'Black Monukka', both of which were used as parents in the first generation of crossing and originated from intermating two siblings, one seeded and the other seedless.

Material and Methods

The grape cv. Fantasy Seedless (*Vitis vinifera* L.), aged five years and trained on the trellis system, was utilized for imposition of treatments in the experiment. These vines were raised on Dog Ridge rootstock. The experimental design adopted for the present investigation was split plot design

with four main treatments, four sub treatments and replicated thrice. In each vine four canes were selected randomly and tagged for detailed observation after fore-pruning of 2018 and 2019. GA₃ treatment as dipping; first dipping at berry size is of 3-4 mm and second is at 6-7 mm of berry size.

Main plot treatment: Cane regulation:	Sub plot treatment: GA ₃ treatment
C ₁ : (Control)	G ₁ : Control
C ₂ : (50 canes/vine) - 1 cane/1.00 sq. feet	G ₂ : 20 ppm
C ₃ : (33 canes/vine) - 1 cane/1.5 sq. feet	G ₃ : 30 ppm
C ₄ : (25 canes/vine) - 1 cane/2.00 sq. feet	G ₄ : 40 ppm

Result and Discussion

After fore-pruning, the number of days taken for bud burst influenced by different levels of cane regulation, gibberellic acid treatment and their interaction is tabulated in table 1 for both the seasons (2018 and 2019).

The perusal of data on number of days taken for bud burst during 2018 was significantly influenced by the different levels of cane regulation. Among the different levels of cane regulation, 25 canes per vine exhibited the earliest bud burst (4.65) than the other treatments and the maximum days taken for bud burst in canes regulated 50 canes per vine and control (7.56) respectively. The similar trend of bud burst was recorded during second season (2019) of growth. In pooled results, significantly, the earliest bud burst was recorded with respect to 25 canes per vine (4.41) where as bud burst occurred late (7.30 and 7.50) in control and 50 canes per vine respectively. Sub plot treatments with respect to bud burst did not vary significantly. In interaction effect of first year (2018), the earliest bud burst (3.89) was recorded in treatment 25 canes per vine with 30 ppm of GA₃ which was statically on par with 25 canes per vine with 40 ppm of GA₃ (4.22) and bud burst delayed in the treatment 50 canes per vine without GA₃ treatment (7.89). Whereas, the second year (2019) and pooled mean were did not vary significantly.

Number of days taken for bud burst was significantly influenced by the different levels of cane regulation (Table 1).

25 canes per vine was showed the earliest bud burst than the other treatments and the maximum days taken for bud burst in canes regulated 50 canes per vine and control respectively. Number of days taken for bud burst differed significantly among different levels of cane regulation. This might be due to lesser number of canes per vine has facilitated sufficient assimilates availability, which might have helped for faster growth rate, hence has taken minimum days for bud burst. Similar findings were reported by Abdel-Mohsen (2013)^[1] in Crimson seedless.

In the present study gibberellic acid treatment enhanced early bud burst during growth period of 2018. Endogenous GA or an up-regulation of GA biosynthesis genes, following exposure of perennial endodormant buds to chilling or fluctuations in the levels of GA during the natural bud endodormancy cycle. Similarly in sweet cherry, the endogenous ABA/GA₃ ratio in flower buds increased during natural dormancy induction and decreased during dormancy release (Duan *et al.*, 2004)^[4]. An increased level of GA following exposure to chilling was reported in dormant buds of peach (Frisby and Seeley, 1993)^[5]. Application of GA had contrasting effects (inhibition or induction) on bud break during and after winter dormancy of temperate perennial buds. It was reported that application of GA₃ enhanced bursting of dormant Elberta peach buds (Donoho and Walker, 1957)^[3].

Table 1: Number of days taken for bud burst after fore-pruning in grape (*Vitis vinifera* L.) cv. Fantasy Seedless as influenced by cane regulation and GA₃

Days taken for bud burst after fore-pruning in grape			
Treatment	2018	2019	Pooled
Main plot (Cane regulation)			
C ₁ (Control : without cane regulation)	7.56	7.04	7.30
C ₂ (50 canes per vine)	7.56	7.44	7.50
C ₃ (33 canes per vine)	6.56	6.53	6.54
C ₄ (25 canes per vine)	4.65	4.17	4.41
S.Em ±	0.24	0.27	0.21
CD @ 5%	0.59	0.66	0.52
Sub plot (gibberellic acid)			
G ₁ (Control: without gibberellic acid treatment)	6.76	6.28	6.52
G ₂ (20 ppm)	6.67	6.04	6.35
G ₃ (30 ppm)	6.36	6.47	6.42
G ₄ (40 ppm)	6.53	6.39	6.46
S.Em ±	0.16	0.26	0.14
CD @ 5%	NS	NS	NS
Interactions (Main × Sub)			
C ₁ G ₁ (Control : without cane regulation and GA ₃)	7.33	7.22	7.28
C ₁ G ₂ (without cane regulation and GA ₃ @ 20 ppm)	7.56	6.50	7.03
C ₁ G ₃ (without cane regulation and GA ₃ @ 30 ppm)	7.78	7.33	7.56
C ₁ G ₄ (without cane regulation and GA ₃ @ 40 ppm)	7.56	7.11	7.33
C ₂ G ₁ (50 canes per vine and without GA ₃)	7.89	7.56	7.72
C ₂ G ₂ (50 canes per vine and GA ₃ @ 20 ppm)	7.67	7.33	7.50
C ₂ G ₃ (50 canes per vine and GA ₃ @ 30 ppm)	7.33	7.67	7.50

C ₂ G ₄ (50 canes per vine and GA ₃ @ 40 ppm)	7.33	7.22	7.28
C ₃ G ₁ (33 canes per vine and without GA ₃)	6.11	6.22	6.17
C ₃ G ₂ (33 canes per vine and GA ₃ @ 20 ppm)	6.67	6.56	6.61
C ₃ G ₃ (33 canes per vine and GA ₃ @ 30 ppm)	6.44	6.78	6.61
C ₃ G ₄ (33 canes per vine and GA ₃ @ 40 ppm)	7.00	6.56	6.78
C ₄ G ₁ (25 canes per vine and without GA ₃)	5.70	4.11	4.91
C ₄ G ₂ (25 canes per vine and GA ₃ @ 20 ppm)	4.78	3.78	4.28
C ₄ G ₃ (25 canes per vine and GA ₃ @ 30 ppm)	3.89	4.11	4.00
C ₄ G ₄ (25 canes per vine and GA ₃ @ 40 ppm)	4.22	4.67	4.44
S.Em ±	0.32	0.52	0.28
CD @ 5%	0.65	NS	NS

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