A STUDY ON CHEMICALLY INDUCED LOOSE BUNCH PRODUCTION IN THOMPSON SEEDLESS GRAPE

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ABSTRACT

This research was conducted tostudies onchemically induced loose bunches production in grapes (Vitis vinifera L.) variety Thompson Seedless.The objective of this research was to determine the most appropriate concentration of NAAand IBA,amongst 25, 50, 75 ppm at 100 % cap fall stage.A relation was noticed between reduced the number of berries per cluster as well as cluster compactness and increased berry diameter and berry weight with spraying the NAA and IBA concentration at full bloom had positive effects respectively. However, spraying NAA 75 and 50 ppm, hada clear trend on increasing the yield and quality parameters. The obtained results indicated that there is a good chance of replacingother chemical products for reducingthe excessive fruit setfor improving yield and quality in this respect the application of NAA 75 ppm at 100% cap fall stage is recommended.

Keywords:*chemically inducedberry thinning, loose bunches, yield and quality, thompson seedless grapes.*

INTRODUCTION

Grape (*Vitis vinifera* L.) is one of the most important fruit crops of the temperate zone, which has acclimatized to sub-tropical and tropical agro-climatic conditions prevailing in the eastern zone of Afghanistan specially Nangarhar province. Chemical berrythinning is an established practice in all grape producing areas of the world. The immediate objective of thinning is an increase in berry size because an excessive fruit set always results in a high percentage of small berries. Seedless table grapes are a commercially attractive commodity with high consumer demand (Ahmad *et al*., 2015). A common problem encountered in the production of these varieties is their tendency to produce small berries in compact clusters. Physical and chemical regulation thinning of these clusters is necessary in order to avoid this phenomenon and to allow the berries to attain the required size and shape of commercial acceptance. The utilization of chemical compounds as thinning agents is advisable on grapes in areas where the environment is conducive to fungus development, especially on compact clustered varieties; bunch rot can be very injurious to grapes, adversely affecting their quality, appearance, and crop yield.A tight cluster tends to be compact and subject to rotting unless thinning of the berries is undertaken. (Ferrara *et al*., 2014). Therefore, the present investigation is aimed at this target.

OBJECTIVE

To study on chemically induced loose bunch production in thompson seedless grape

METHODOLOGY

The present study was conducted during 2020&2021 atNangarhar Province Angor Bagh area eastern region of Afghanistan. Twelve years old healthy grapevines having uniform growth and vigour were selected for the experiment. These vines were trained on extended 'T' trellises. The vines clusters were sprayed with NAA, IBA and GA_3 chemicalthinning agents'viz., 100% bloom stage. The treatments were imposed at seven different chemical thinningagents' levels in a Randomized Block Design with three replications. Vines were planted at a spacing of3.0 x 1.5m apart.The treatment details studied in the experiment were.

Thompson Seedless Grape	
Treatment	**Treatment details**
T_1	NAA 25 ppm
T_2	NAA 50 ppm
T_3	NAA 75 ppm
T_4	IBA 25 ppm
T_5	IBA 50 ppm
T_6	IBA 75 ppm
T_7	Standard GA_3.

All the vines under experiment belonged to the variety "Thompson Seedless and were given uniform cultural practices such as fertilizers, irrigation and plant protection measures.

RESULTS AND DISCUSSION

The results of the present investigation as well as relevant discussion have been summarized under the following headings

Berry characters

The berry length was minimum (2.06 cm) in treatment T_7Standard $GA_3$and maximum (2. 48 cm) in treatment T_3, which is closely follow by T_2 (2.40 cm). All chemically applied treatments were superior compared to control (Table 1). Such marked improvement in berry elongation could be due to the application of GA_3 by the stimulated cell enlargement in the mesocarp parenchyma tissue. GA_3 application helps in berry elongation due to rapid cell division and accumulation of photosynthates, this increase also could be attributed to the berry elongation in the present investigation. These findings are supported by many workers (Ahmad *et al*., 2015).

The berry breadth was minimum (1.23 cm) in treatment T_7(StandardGA_3) and maximum (1.74 cm) in treatment T_3(NAA 75 ppm). Which was closely followed by (1.58 cm) inT_2 (NAA 50 ppm) significant difference was observed among the treatments respectively.In addition, the increment of berry diameter and weight could be explained as a results of spraying NAA, IBA at different concentrations and GA_3 treatment which was reflected on bunch weight. These results are in conformity with the results obtained by (Cangi and Kilic 2011).

Berry's character was significantly affected by the application of chemical thinning agents (Table 1). The berry weight was recordedminimum of (2.12 gr) was found in treatment T_7(StandardGA_3) and maximum (2.60 gr) in treatment T_3(NAA 75 ppm)followed by (2.58 g) which was found in treatment T_2(NAA 50 ppm)Application of NAA on Thompson seedless grapes a reduced berry set and weight per cluster.Spraying oil at the time of full bloom had the most significant effect on the increase in berry weight was mainly due to cell division at initial stages and later due to faster expansion of cells associated with the influx of metabolites and water into the berry which caused the overall increase in berry weight. The above results are in conformity with the findings of several research workers (Chen-JinYong *et al*., 2005)

The 50 berries weight has significantly differed among the treatment of NAA, IBA, and GA_3chemical thinning agent foliar application (Table 1). In Thompson seedless variety grape the maximum numbers of 50 berry weight (168.30 gr) were found in T_3(NAA 75 ppm) followed by NAA 50 ppm (143.89 gr) and minimum (123.68 gr) were found in T_7(Standard GA_3). All the treatmentswere significantly affected the foliar application of a chemical thinning agent. The slighter increase in 50 berry physical characters with an increase in GA_3concentrations and its repeated application could be attributed to the increase in cell division and elongation at different stages of growth and development of berry and bunch in addition to the aggregate effect of increase in 50 berry weight seems to increase the weight of the bunch. The findings are in accordance with the findings of Tecchio *et al*., (2006) in Red Globe grapes.

Table 1 : Studies onconventional and non- conventional chemical on berry and bunch character in grapes variety Thompson seedless

Treatments	Berry length (cm)	Berry breadth (cm)	Berry weight (g)	50 Berry weight (g)	Bunch length (cm)	Bunch breadth (cm)	No of berry per bunch	Bunch weight (g)
T_1	2.32	1.52	2.53	140.45	18.02	16.57	85.61	238.27
T_2	2.40	1.58	2.58	143.89	18.08	16.80	98.38	248.28
T_3	2.48	1.74	2.60	168.30	18.13	16.92	103.01	280.28
T_4	2.32	1.39	2.47	133.99	17.79	16.43	83.55	236.77
T_5	2.30	1.34	2.37	132.00	17.47	16.42	79.20	235.23
T_6	2.16	1.23	2.31	140.10	17.31	15.51	72.67	234.27
T_7	2.06	1.23	2.12	123.68	16.27	14.77	65.93	210.07
S. Em. +	0.03	0.03	0.07	1.02	0.15	0.24	2.33	3.75
C.D. @ 5%	0.05	0.04	0.10	1.44	0.21	0.34	3.30	5.30
CV %	2.55	3.83	4.83	1.26	1.50	2.61	4.81	2.70

These findings are in close agreement with Kaplan *et al*. (2017) who mentioned that the cluster weight and berry weight of 'Flame seedless' grapes were significantly increased after the vines were sprayed with GA_3at bloom and fruit set. Moreover, spraying GA_3, on another seedless grape cultivar at full bloom increased cluster weight, berry weight, berry diameter, length and yield per vine (Zahedi *et al*., 2013) on 'Crimson seedless' grape.

Bunch character

The looseness of clusters treated at the bloom stage tended to increase with higher levels of NAA. Usually, the higher the concentration of NAA the higher was the cluster looseness. The clusters that received the application of NAA at bloom were loosened considerably, the loosest clusters resulted from the 75 ppm treatment significantly.

The results obtained in the present study in respect tobunch length showed that T_3(NAA 75 ppm), was significantly superior (18.13 cm) to the rest of treatments followed by T_2(NAA 50 ppm) with a length of 18.08 cmwhile T_7(Standard GA_3) showed minimum bunch length (16.27 cm) than the rest of chemical thinning agent's treatments significantly. Bunch length was significantly increased in Thompson seedless grapes with the use of growth regulators. Application of Forchlorfenuron (CPPU) on grapes at pre-bloom stage and during bloom stages caused a high percentage of berry set and elongation of the bunch as compared tothe post bloom period while bunch size was increased with the application of Forchlorfenuron (CPPU) in the post bloom period. The results are in conformity with the findings of earlier workers (Zahedi*et al*., 2013).

The data on bunch breadth recorded at the time of harvest are presented hereunder. In respect of bunch breadth was significantly influenced by the foliar-applied treatment. Maximum bunch breadth (16.92 cm) was observed in treatment T_3(NAA 75 ppm) followed by (16.80 cm) with T_2(NAA 50 ppm)and minimum bunch breadth (14.77 cm) noted in treatment T_7(Standard GA_3) respectively.The use of other plant growth regulators to thin compact seeded varieties has not been done commercially. However, naphthalene acetic acid (NAA) has shown promise in some earlier experiments.Breadth of the bunch was more pronounced in the case of conventional thinning agents. The increase in length and size of the bunch with full bloom application of GA_3 like substances was observed to be significant over thinning alone while full bloom application recorded a significant increase over control. Similarly in n the present study the bunch elongation effect increased with increasing GA_3 concentrations at the full bloom stage. Similar results are obtained by Masroor Ahmad *et al*., (2005)

The foliar application of NAA, IBA and GA_3 induced chemicals had exhibited a significant effect on the number of berry per cluster, weight, length and breadth in Thompson seedless varieties of grape (Table 1). The maximum number of berry per bunch(103.01) were observed in T_3(NAA75 ppm), closely followed by98.38inT_2(NAA 50 ppm).All NAA and IBA treatments were found to be superior as compared to 65.93 which was recorded inT_7(Standard GA_3) respectively. The data clearly indicates that berry number in all the treatments differ significantly from that in standard GA_3, at different concentrations and cap fall stages. Thinning the flower clusters by reducing the fruit set helps in increasing the size and shape of berries. Similar results have also been reported by Ferrara *et al*(2015).

The maximum bunch weight was observed (280.28 gr)in T_3(NAA 75) ppm), closely followed by248.28gr in T_2(NAA 50 ppm) as compared to 210.07gr in T_7(Standard GA_3). Thus from the above results, it is clear that due to the high metabolic activity of the vine and accumulation of carbohydrates as a result of NAA and IBA spray.Similar results were obtained by (Guerios*et al*., 2016). Therefore, the increase in bunch weight by GA_3 application at full bloom is not only due to an increase in berry weight but also due to an increase in berries number. These findings are in conformity with the results obtained by (Cecilia and Mattew. 2008).

Omariand Sampth (2016) observed maximum bunch length in the 'Kishmish Charni' grape cultivar treated at 25 ppm GA_3 at full bloom stage. A loose cluster is less susceptible to the bunch rot and has a better ability to withstand the effects of rainfall better than a compact cluster. Treatments were made by momentarily immersing the clusters in the desired solution (Zahedi*et al*., (2013) reported the increased bunch width (11.35 cm) with GA_3 (100 ppm) being applied at full bloom stage followed by GA_3 at 50 ppm in the variety 'Perlette'.

Chemical composition

The quality of the table grape is judged by various organic and inorganic components that are present in the juice. In grape, a variety is judged as superior or inferior depending upon its TSS content percentage of sugar acid content and sugar acid blend for the taste. The data obtained in respect of TSSacidity ratio. TSS acid ratio are presented in (Table 2)for Thompson seedless variety of grape. In respect of chemical thinning agents, it's observed that TSS was significantly affected by the chemical thinning agent's treatment. The significantly minimum TSS was noticed (16.52)in T_7 (standard GA_3)and maximum 17.67 was recorded in T_3(NAA

Table 2 : Studies onconventional and non- conventional chemical on quality attributes and yield attributes in grapes variety Thompson seedless

Treatment	TSS (°Brix)	Acidity (%)	TSS/acid ratio	No of bunches per vine	Yield/vine (kg)	Yield (t/ha)
T_1	16.91	0.77	22.45	30.13	7.30	16.36
T_2	17.57	0.65	25.71	31.22	7.87	17.72
T_3	17.67	0.59	30.79	31.82	8.65	21.32
T_4	16.51	0.87	21.78	29.50	7.10	16.33
T_5	16.71	0.77	21.94	28.98	6.46	16.12
T_6	16.44	0.77	21.20	28.41	6.40	13.84
T_7	16.52	0.89	20.26	24.67	5.28	12.37
S. Em. +	0.04	0.02	1.27	1.38	0.15	0.11
C.D. @ 5%	0.06	0.02	1.80	1.95	0.21	0.16
CV %	0.43	3.97	9.40	8.16	3.21	1.18

75 ppm)followed by 17.57 in T_2 (NAA 50 ppm)significantly. The data indicates that berry size had a profound effect on total soluble solids compared to other growth regulators. Improvement in the total soluble solid of grapes was seen in this investigation, the total soluble solids in grapes increased continuously during the berry development period, which might be due to the quick metabolic transformation in soluble compounds. These reasons were earlier reported by many previous workers (Ahmad *et al*., 2015).

Acidity was significantly affected by the non-conventional chemical thinning agent's treatment level. The significantly minimum acidity wasnoticed(0.59) in T_3(NAA 75 ppm)and(0.65) in T_2(NAA50 ppm)and(0.89) in T_7(standard GA_3) respectively. The acidity of berries showed decreasing trend from initial values reaching the lowest value at maturity mainly might be due to the transformation of organic acid into sugars. A similar decrease in acidity was also reported by Abbas and El – Saeid.(2012) in Beauty Seedless grapes.

The TSS/ acid ratio was significantly affected by chemical thinning agentsat different treatment levels. The significantly minimum TSS/ acid ratio was noticed in $T_7$and $T_6$and maximumTSS/ acid ratio were recorded in treatmentT_3, $T_2$and T_1 respectively. Improvement in TSS the acid ratio of grapes was seen in this investigation, the increase in TSS acid ratio might be due to rapid conversion of starch to sugars because of continuous cell division and elongation of berries with continuous raise in the sugars. These findings are in agreement with the results reported by previous workers Liu *et al*., (2016).

The gradual increase in total sugars, TSSacid ratio and decrease in acidity during maturity may be due to the conversion of starch and acid to sugars in addition to the continuous mobilization of sugars from leaves to fruits (Yamamoto *et al*., 2015).

Yield

The yield of grapes was significantly affected by foliar application of chemical thinning agents (Table 2). The results obtained in the present study in respect of the number of bunches per vine, yield per vine and yield per hectareshowed that a significantly lower number of bunches per vine was obtained from T_7 (standard GA_3) andhigher numbers of bunches wereobtained inT_3, T_2,and T_1respectively. Whilesignificantly minimum yield per vinewere obtained from T_7(standard GA_3) and maximum yield per vine was obtained from T_3 (8.65 kg/vine), closely followed by (7.87kg/ vine) and (7.30 kg/vine) respectively in Thompson seedless. Moreover, spraying GA_3 on the seedless grape cultivars at full bloom stage increased bunch weight and yield per vine. These results are in line with the findings obtained by (Ferrara *et al*., 2015) in Ruby Seedless;

The maximum yield per hectare was obtained from T_3(21.32 tonnes/ha) closely followed by T_2(17.72 tonnes/ha), T_1(16.36 tonnes/ha) while minimum yield T_7 (12.37 tonnes/ ha) was obtained from spraying standard GA_3 respectively. The cumulative effects of the physical character of berry, bunch and their weight have resulted in an increase in yield per vine and tonnage harvested from a unit area. Similar increase in yield was reported by many previous workers, Masroor Ahmad *et al.,* (2005)

The cumulative effects of the physical characteristic of berry/bunches and their weight have resulted in an increase in yield per vine and tonnage harvested from a unit area.A similar increase in yield was reported by many previous workers (Reynuld, *et al*., 2016).To explain the mode of action for using lemongrass extract at fullbloom is that if contains about 75-82%, oil.(Sangeetha *et al*., 2015). Zhu*et al*. (2016) confirmed that oil was used as a photosynthetic inhibitor as a mode of acting alone or in combination with the other thinners to induce flower and fruit abscission.

CONCLUSION

The results of this experiment showed that thinning is a mandatory practice to avoid bunch compactness, the spraying NAA 75 ppm, NAA 50 ppm at 100% cap fall stage had a clear trend on increasing yield and quality parameters. However, the obtained results indicates a good chance to replace NAA 75 ppm, NAA 50 ppm instead of products of $GA_3$to reduce the excessive fruit set for improving yield and fruit quality in Thompson seedless.Since the results presentedhas pertained to only one season, therefore, it will be desirable to continue further study for confirmation of the result.

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