A Study on Impact of Silixol (OSA) on Berry Cracking in Fantasy Seedless Grapes

International Journal of Agriculture Innovations and Research
Volume 6, Issue 4, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy):
Received: 10/01/2018 | Accepted on: 17/01/2018 | Published: 22/01/2018

A Study on Impact of Silixol (OSA) on Berry Cracking in Fantasy Seedless Grapes

S. D. Ramteke*, Vikas Urkude, S. R. Bhagwat, U. V. Deshmukh and A. P. Birhade
National Research Centre for Grapes, P. B. No. 3, Manjri Farm Post, Solapur road, Pune - 412 307, India. Phone No. 020-26956075
* Corresponding author: sdramteke@yahoo.com

***Abstract* – Berry cracking, a disorder where fruit surface cracks mainly due to heavy irrigation or rain after long dry spell resulting in significant commercial losses in the table and wine grapes production. A research experiment was conducted under field conditions during the session 2016-17 at National Research Centre for Grapes, Pune to evaluate the effect of Silixol (OSA) on berry cracking in Fantasy Seedless grapes. The experiment was performed in the randomised block design, with five replications. Foliar spraying of Silixol in combination of different chemicals was applied thrice at an interval of 10 days before veraison stage. Total rainfall, temperature and humidity were also recorded timely during the experiment. Among the all treatments, T6 (Si + Ca gluconate + Boron) showed significantly lowest percentage of berry cracking followed by T8 (Si Powder + Ca gluconate + Boron) as compared to control. The quality parameters such as T.S.S. and acidity were greatly influenced by the application of Silixol. The highest total soluble solid (21.5 °β) was recorded with the application of T1 (Silixol @ 4 ml/l). Yield per hectare (20.43 t/ha) and Brix yield (234.6 t/ha) were found highest in treatment T1 (Silixol @ 4 ml/l). This approach demonstrated the ability of Silixol to reduce the berry cracking and also improve the quality of grapes.**

***Keywords* – Berry Cracking, Silixol, Grape, Fantasy Seedless.**

I. Introduction

Grape (Vitis spp.) is one of the major important fruitcrop in India having export potential. Grape is grown undera variety of soil and climatic conditions in three distinctagro-climatic zones, namely, subtropical, hot tropical and mild tropical climatic regions in India. Approximately, one million tonnes of grapes are harvested annually in India. The productivity of grapes in India is very high, and yields also increasing rapidly. In spite of this, a substantial amount of berry gets cracked every year and these were reported by grape growers. This is a physiological disorder where fruit surface cracks mainly due to heavy irrigation or rain after long dry spell. Berry Cracking is an important industry issue because its effect leads to significant commercial losses in table and wine grape production [1, 2]. Berry cracking exposes profitability by increasing harvest costs and decreasing yield. Fruit quality and storage life, both on the vine and in cold storage are also reduced due to the threat of bunch rot; flexibility in marketing is therefore lost. When there is significant rain during the harvest season, splitting and disease has a major impact on the volume and quality of the fruit, crushed, and as a result the quality can be reduce dramatically, hence the reduction in financial returns.

Berry Cracking is defined as bursting, cracking or rupturing of the berry skin. It is normally linked to rainfall events that occur during berry ripening. This disorder is characterized by cracks developed after a rain on the skin of the fruits, sometimes deep into the flesh, affecting the stem end area, the calyx end and the cheeks of the fruit (side cracks). These cracked berries lose their commercial value for fresh fruit market, and can be only sold locally or to processing industry [3]. In physiological terms, splitting or cracking which occurs at the stage of ripening can be attributed to excessive rates of volume growth resulting from large imbalances between the fruit flows to and from fruit. Splitting of grape berries can take place before harvesting [4, 5] or during storage [6].

Silixol is one of the stimulant used for minimizing loses by physiological disorders in grapes. It is derived from synthetic chemical process on silicon; it contains Ortho Silicic Acid (OSA), which is a stable form of silicon. It contains 2.8% OSA measured as Silicon (0.8%). It acts as stress reliever and support during critical abiotic stress condition for normal plant growth by providing essential support to the fundamental structure. Silixol helps crops to overcome stress during critical growth stages such as flowering, fruit settings; fruit development etc. and improves quality and yield. Nutrient management is essential for maximum yield, good quality and profitability in grapes [7]. To overcome this problem, an investigation was carried out during the session 2016-17 at National Research Centre for Grapes, Pune (latitude 18.32 °N, longitude 73.51 °E), to study the bio-efficacy of Silixol and its impact on berry cracking in Fantasy Seedless grapes.

II. Materials and Methods

The field experiments were carried out in Fantasy Seedless grapes grafted on Dogridge rootstock in experimental vineyard for the year (2016-2017) in National Research Centre for Grapes (NRCG), located in the city of Pune. In the experiment, three each of 10 year old trees, highly crack-susceptible cultivars of grapes, were selected for study. Each treatment including the untreated control was replicated thrice. These trees were grown on grape vineyard and irrigated with about 5 liters of water per plant on alternate day from the middle of November to middle of February. Grape bunches were sprayed with Silixol and micronutrients thrice at an interval of 10 days in veraison stage. The treatment details were T1 (Silixol @ 4ml), T2 (Calcium gluconate @ 2g/l), T3 (Ca gluconate @ 2 g/l + Boron @ 0.5g), T4 (Ca nitrate @ 2g/l), T5 (Ca nitrate @ 2 g/l + Boron), T6 (Silixol + Ca gluconate @ 2 g/l + Boron @ 0.5g), T7 (Silixol + Ca nitrate @ 2 g/l + Boron @ 0.5g), T8 (Si Powder @ 1g/l +

International Journal of Agriculture Innovations and Research
Volume 6, Issue 4, ISSN (Online) 2319-1473

Ca gluconate @ 2 g/l + Boron @ 0.5g), T9 (Si Powder @ 1g/l + Ca nitrate @ 2 g/l + Boron), T10 (Calbury @ 2g/l), T11 (Calbury @ 4g/l) and T12 (Control).

In order to determine the effect of Silixol on fruit yield and quality, berry quality parameter and occurrence of physiological disorders and other observations were recorded at harvest. The percent affected berries were calculated by dividing number of affected berries to total number of berries and obtained value expressed in percentage. The observation on berry length and berry diameter derived by averaging 50 berries randomly from each treatment and measured using vernier caliper (0-300 mm, RSK™) and expressed in millimeter (mm). The fifty berry weight was derived by averaging a randomly selected berry from 5 bunches. Berry skin thickness was measured using micro screw gauze (No. 103-101-10, Mitutoyo, Japan) and expressed in micrometer (µm). Total soluble solids and acidity were derived by the juice of 10 berries randomly from each treatment and measured by hand refractometer (ERMA INC, Tokyo, Japan) and Acid-base titration method respectively. Total soluble solids (TSS) were expressed in degree brix (°β) and acidity was expressed in percentage (%). Estimation of reducing sugar of berry was determined by dinitrosalicylic acid method (DNSA). Estimation of total Phenols by was done by following the Folin-Ciocalteu colorimetric methods. The data was analyzed by one-way analysis of variance (ANOVA) using SAS software (V 9.3).

III. Results and Discussion

Berry cracking incidence is predominately found in coloured grapes. The different chemicals were applied on Fantasy Seedless variety as per the protocol and the incidence of berry cracking was recorded at harvest. The data showed that the application of Silixol alone or in combination with other chemicals significantly lowered the incidence of berry cracking. Among the all treatments, T6 (Si + Ca gluconate + Boron) showed significantly lowest percentage (4.72 %) of berry cracking followed by T8 (Si Powder + Ca gluconate + Boron) as compared to control (8.05).

In addition to the incidence of berry cracking, various parameters of berry were also evaluated, results of which are summarized in table 1. Observations of Silixol on berry length, berry diameter, skin thickness, 50 berries weight, TSS and acidity were recorded at physiological maturity. The maximum berry length (22.12 mm) and berry diameter (16.33 mm) were recorded with the application of T1 (Silixol @ 4 ml/l). The quality parameters such as T.S.S. and acidity were greatly influenced by the application of Silixol. Among the quality parameters the highest Total Soluble Solid (21.5 °β) was recorded with the application of T1 (Silixol @ 4 ml/l). Yield per hectare (20.43 t/ha) and Brix yield (234.6 kg/ha) were found highest in treatment T1 (Silixol @ 4 ml/l). TSS/Acid ratio was found to be better in T6 (Silixol + Ca gluconate + Boron).

Among the all treatments, T1is found to be highly significant for most of the characters i.e. 50 berry weights, berry length and berry diameter. Control (T12) showed lowest value for the parameters i.e. Berry cracking percentage, 50 berry weight and yield per hectare. This increase in yield was in line with studies appeared where a formulation containing the stabilized silicic acid along with boric acid has been tried successfully as foliar sprays on various crops [8, 9, 10]. Also the result depicted here tie in with the earlier studies having formulation of 0.8 % stabilized silicic acid has resulted in increased quality as well as quantity of peanut, common bean, soybean and potato [11, 12, 13]. The effects of Silixol in its biochemical's parameter are depicted in table 2. There was a significant increase in reducing sugar content (mg/g fresh wt) in berries due to Silixol application. The treatment T1 (Silixol 4 ml/l) recorded the highest reducing sugar (224.14 mg/g fresh wt) in comparison to other treatments. The highest phenol content (2.21 mg/g fresh wt) of berry was found in treatment T10 (Calbury @ 2 g/l)

Table 1: Effect of Silixol on berry cracking, yield and quality parameters in Fantasy Seedless grapes

Treatments		**Cracking**	**Berry Length**	**Berry Diameter**	**50 Berry Wt**	**Skin Thickness**	**TSS**	**Acidity**	**TSS/Acid Ratio**	**Yield/ha**	**Brix Yield**
		(%)	**(mm)**	**(mm)**	**(g)**	**(µm)**	**(°β)**	**(%)**		**(ton)**	**kg/ha**
T-1	Silixol (4ml/l)	4.72	22.12	16.33	142.50	0.27	21.5	0.61	35.25	20.43	234.64
T-2	Calcium gluconate (2g/l)	6.51	19.35	14.25	131.21	0.28	19.6	0.65	30.15	18.83	196.23
T-3	Ca gluconate + Boron (0.5g)	7.09	20.15	14.94	132.69	0.28	19.1	0.67	28.51	18.99	194.48
T-4	Ca nitrate (2g/l)	6.97	20.68	15.23	135.84	0.29	19.5	0.65	30.00	19.42	202.30
T-5	Ca nitrate + Boron	5.60	19.79	14.67	131.55	0.29	21.1	0.60	35.17	18.87	219.39
T-6	Silixol + Ca gluconate + Boron	4.08	21.95	15.98	138.27	0.30	21	0.59	35.59	19.87	222.14
T-7	Silixol + Ca nitrate + Boron	4.75	21.68	16.21	140.55	0.30	20.7	0.61	33.93	20.13	223.31
T-8	Si Powder (1g/l) + Ca gluconate + Boron	4.13	20.48	15.87	139.26	0.29	20.8	0.60	34.67	19.99	220.96
T-9	Si Powder (1g/l) + Ca nitrate + Boron	4.51	20.22	15.64	137.06	0.29	21.4	0.61	35.08	19.67	224.92
T-10	Calbury (2g/l)	5.44	21.32	15.78	137.84	0.28	21.1	0.59	35.76	19.75	226.83
T-11	Calbury (4g/l)	4.16	21.85	16.10	140.15	0.28	20.4	0.62	32.90	20.11	219.18
T-12	Control	8.05	19.77	14.13	130.50	0.26	19.2	0.68	28.24	18.71	193.95
C.D @ 5%		**1.13**	**0.47**	**0.45**	**14.62**	**0.01**	**0.84**	**0.03**	**0.80**	**0.34**	**7.2**
Significance		**	**	**	**	**	**	**	**	**	**

Table 2: Effect of Silixol on biochemical parameters of Fantasy Seedless grapes

Treatments		Reducing sugar (mg/g fresh wt)	Total phenol (mg/g fresh wt)
T-1	Silixol (4ml/l)	224.15	2.04
T-2	Calcium gluconate (2g/l)	202.65	1.91
T-3	Ca gluconate + Boron (0.5g)	166.88	1.87
T-4	Ca nitrate (2g/l)	195.20	1.80
T-5	Ca nitrate + Boron	179.23	1.83
T-6	Silixol + Ca gluconate + Boron	187.56	1.87
T-7	Silixol + Ca nitrate + Boron	193.89	1.99
T-8	Si Powder (1g/l) + Ca gluconate + Boron	187.99	1.79
T-9	Si Powder (1g/l) + Ca nitrate + Boron	207.58	2.02
T-10	Calbury (2g/l)	212.87	2.21
T-11	Calbury (4g/l)	168.76	1.88
T-12	Control	160.33	1.60
C.D @ 5%		**0.48**	**0.06**
Significance		**	**

IV. Conclusions

Berry Cracking is an important industry issue because its effect leads to significant commercial losses in the table and wine grape production. It exposes profitability by increasing harvest costs and decreasing yield. One of the important strategies to restrict berry cracking is careful water management with the use of anti transparent agent and micronutrient like boron before the veraison stage. With the aim of this strategy, small attempts were done to restrict berry cracking disorder. The outcome of this studies revealed that the foliar application of Silixol (0.8 % OSA) in combination with Ca glucanate &Boron significantly improved the quality of grapes and reduced berry cracking. The highest berry length, diameter, weight and yield were recorded in plants treated with Silixol 4 ml/l. Hence, it can be recommended that Silixol (4 ml/l) should be applied before veraison and repeated twice after 10 days to improve grape quality and reduce berry cracking of Fantasy Seedless.

Acknowledgment

The author thanks Mr. Vikas Urkude, Mr. Sharad Bhagwat, Mr. Umakant Deshmukh and Mr. Anil Birhade, for their assistance in conducting the research andthe preparation of this manuscript. The authors also grateful to the Director of ICAR-National Research Centre for Grapes, Pune for providing the necessary facilities to carry out the study.

References

[1] J. A. Considine and P. E. Kriedemann,"Fruit splitting in grapes: determination of the critical turgor pressure",*Australian Journal of Agricultural Research,*vol. 23, 1972, pp. 17–24.

[2] A. J. Winkler, J. A. Cook, W. M. Kliewer and L. A. Lider, *General Viticulture 4th edn*, Berkeley, CA: University of California Press, 1974.

[3] S. D. Ramteke, V. Urkude, S. D. Parhe and S. R. Bhagwat, "Berry Cracking; Its Causes and Remedies in Grapes - A Review". *Trends in Biosciences,* vol. 10(2), 2017, pp. 549-556.

[4] J. T. Meynhardt, "A histological study of berry-splitting in some grape cultivars", *South African Journal of Agricultural Science*, vol. 7, 1964b, pp. 707-716.

[5] V. Dvornic, N. Pomohaci and E. Smit, "The response of the main Romanian vine varieties to rainfall during the period of grape ripening (In Romania)". *Gradinar. ViaLiv.*, vol. 14, 1965, pp. 31-35.

[6] A. L. Ryall and J. M. Harvey, "The cold storage of vinifera table grapes". *USDA*, Agriculture Handbook, 1959.

[7] S. D. Ramteke, R. G. Somkuwar, S. D. Shikhamany and J.Satisha,"Growth regulators in increasing pedicel thickness and shelf life in Tas-A-Ganesh grapes (Vitis Vinifera) grafted on 1613 C rootstock",*Indian J. Agric. Sci.*,vol. 72(1), 2002, pp. 3-5.

[8] G. Karremans, E. Bent and H. M. Laane, "Strategy for the use of a foliar spray with stabilized oligomeric silicic acid and boric acid (OSAB®;)", Abstract submitted to *Proceedings of 3rd Conference on Silicon in Agriculture at Brazil,* 2005.

[9] H. M. Laane, "Effect of OSAB3 (foliar spray of Silicic Acid and Boric Acid) on Bangalore blue grapes", Presented at *Indo-US Workshop on Silicon in Agriculture*, at University of Agricultural Sciences. GKVK Campus, India, 2010.

[10] H. M. Laane HM, "Foliar silicic acid technology for plants", Abstract submitted in *Proceedings of 5th International Conference on Silicon in Agriculture,* Beijing, 2011.

[11] C. A. Costa Crusciol, R. P.Soratto, G. S. A Castro and C. H. M. J. F. Neto, "Foliar application of stabilized silicic acid on soybean, common bean and peanut", *Rev Ciênc Agron*, vol. 44, 2013, pp. 404–410.

[12] V. F. deSilva, J. C. Moraes and B. A. Melo,"Influence of silicon on the development, production and infestation by insect pests in potato crop",*Ciênc Agrotec Lavras*, vol. 34, 2010, pp. 1465–1469.

[13] R. P. Soratto, A. M. Fernandes, C. A. Costa Crusciol and G. D. de Souza-Schlick,"Yield, tuber quality and disease incidence on potato crop as affected by silicon leaf application"*Pesq Agropec Bras Brasilia*,vol. 47, 2012, pp. 1000–1006.

Authors' Profiles

Authors 1
Name: **Dr. Sahadeo D. Ramteke**
Date of Birth: January 18th, 1966
Designation: Principal Scientist (Plant Physiology)
Address: ICAR-National Research Centre for Grapes, Pune
Education : Ph.D. (Physiology), UAS Dharwad

Achievement in Research field;
Having 20+ years of experience in R&D of Grapes
Published more than 85 Research Article in esteemed Journals
Published 100+ popular articles in various publication
Written 7 books both in Marathi and English
Written more than 10 chapters in various books
Awarded **Best Outstanding Scientist award – 2017** by Society of Tropical Agriculture, New Delhi
Received **Best Citizens of India** award for the year **2013** by The International Publishing House, New Delhi.

International Journal of Agriculture Innovations and Research
Volume 6, Issue 4, ISSN (Online) 2319-1473

Authors 2
Name: **Mr. Vikas Urkude**
Date of Birth: January 29th, 1988
Designation: SRF (Plant Physiology)
Address: ICAR-National Research Centre for Grapes, Pune
Education: M. Tech (Biotechnology)
E Mail: vikasurkude@gmail.com

Achievement in research field:
Having 4 years of R&D experience in Agriculture field
Published 4 research and 3 review article in esteemed journals
Published 5 popular articles in various publication both in Marathi and English

Authors 3
Name: **Mr. Sharad Bhagwat**
Date of Birth: June 2nd, 1987
Designation: SRF (Plant Physiology)
Address: ICAR-National Research Centre for Grapes, Pune
Education: M. Sc (Botany)
E Mail: sharadbhagwat55@gmail.com

Achievement in research field:
Having 5 years of R&D experience in Agriculture field
Published 5 research and 1 review article in esteemed journals
Published 15 popular articles in various publication both in Marathi and English