Protecting Red Roomy Grapevines Growing Under Minia Region Conditions from Sunburn Damage

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Abstract: Red Roomy grapevines grown under Minia region conditions were subjected to two protectants namely calcium carbonate and purshade each at 0.5 to 2.0 % as a trial for solving the problem of sunburn on the fruiting. The vines received two sprays at two weeks after berry setting and at one month later. A remarkable promotion on plant pigments (chlorophylls a & b, total chlorophylls and total carotenoids), berry setting %, yield, cluster weight and dimensions, berries colouration % as well as physical and chemical characteristics of the berries was observed in response to spraying $CaCO_3$ or purshade each at 0.5 to 2.0 %. Sunburned berries %, shot berries % and total acidity %, tended to reduce with protectant treatments. Using $CaCO_3$ was preferable than using purshade in this connection. A slight effect was detected on all the investigated characters with increasing concentrations from 1.0 to 2.0 %. Carrying out two sprays after berry setting of $CaCO_3$ at 1.0 % succeeded in reducing sunburn damage and improving yield and fruit quality of Red Roomy grapevines grown under Minia region conditions.
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1.Introduction

Red Roomy grapevine cv. Grown under Minia region faces some problems concerning the yield decline and coloration of the berries which in turn negatively affect the marketing to local and foreign markets. When temperature reached above 95 ° F, sunburn is happened. Sunburn is caused by a combination of UV, visible and infrared radiation. It caused uneven ripening and the incidence of rot **(Bose *et al*., 2001)**. Previous studies showed that using $CaCO_3$ and purshade proved to be beneficial in protecting the plants from sunburn **(Peter, 2008).**

Finding out compounds acts as a superior reflective particle barrier to the impaired effects of solar radiation and water stress is considered an important task. Compounds such calcium carbonate, Sunscreen (compound contains aluminum silicates) and purshade (compound containing $CaCO_3$) acts as a proper reflective particle barrier to the harmful effects of solar radiation and heat Treating late in maturity season grapevine cv. Red Roomy with such two compounds materially assisted in the reduction of Sunburn damage and was accompanied with improving yield and quality of the berries.

Using several protectants or antisunburn compounds was very profitable for controlling sunburn damage and improving productivity of different fruit crops **(Begqvist *et al*., 2001; Spayd *et al*., 2002; Glenn and Puterka, 2002; During and Davtyan, 2002; Morsy *et al*., 2008; Glenn, 2009; Ahmed *et al*., 2011 and 2012 and Ebrahiem- Asmaa, 2012).**

This study was initiated for examining the effect of two protectants namely purshade and $CaCO_3$ on alleviating the adverse effects of sunburn on yield and berries coloration of Red Roomy grapevines grown under Minia region.

2.Material and Methods

This study was carried out during 2011 and 2012 seasons on twenty- one uniform in vigour 12 years old. Red Roomy grapevines grown in a private vineyard located at Salah El- Deen Village, Minia district, Minia Governorate where the soil texture is clay. Winter pruning was done at the second week of Jan. during both seasons using head pruning system leaving 72 eyes/ vine (15 fruiting spurs × four eyes + six replacement spurs × two eyes). The selected vines are planted at 2 × 2 m. apart. Surface irrigation system was followed.

The present experiment included the following seven treatments from the control, $CaCO_3$ and purshade (derived from $CaCO_3$ and contains 0.42 g Ca L, 62.5 % $CaCO_3$ by weight and 37.5 % intergradients by weight).

1- Control (untreated vines with Ca compound).
2- Spraying calcium carbonate at 0.5 %.
3- Spraying calcium carbonate at 1.0 %.
4- Spraying calcium carbonate at 2.0 %.
5- Spraying purshade at 0.5 %.
6- Spraying purshade at 1.0 %.
7- Spraying purshade at 2.0 %.

Each treatment was replicated three times, one vine per each. Calcium carbonate and purshade were sprayed twice at two weeks after berry setting (last week of June) and at one month later (last week of July). Both compounds were shaken well with water before spraying. During spraying, avoid contact of these materials with eyes for preventing eye damage

and respiratory system irrigation. If solutions reached eyes, wash thoroughly with warm soap and water and if irrigation persists seek medical attention. Randomized complete block design was adopted.

During both seasons, the following parameters were recorded:

1. Plant pigments namely chlorophylls a & b, total carotenoids and total chlorophylls (mg/ g^{-1} F.W) (according to **Wettstein, 1957 and Hiscox and Isralstam, 1979).**
2. Percentage of berry setting.
3. Percentage of berries coloration.
4. Percentage of sunburned berries.
5. Percentage of shot berries.
6. Yield and number of clusters/ vine.
7. Cluster weight and dimensions (length & width).
8. Some physical characters of the berries namely berry weight and dimensions (longitudinal and equatorial in cm).
9. Some chemical characteristics of the berries namely T.S.S %, total acidity % and T.S.S/ acid **(A.O.A.C., 1995)**.

Statistical analysis was done using new L.S.D at 5 % **(Mead *et al*., 1993).**

3.Results and Discussion

Plant pigments:-

It is clear from the data in Table (1) that two sprays of calcium carbonate or purshade each at 0.5 to 2.0 % significantly promoted the three plant pigments namely chlorophylls a & b and total carotenoids as well as total chlorophylls in relative to the check treatment. Using calcium carbonate was preferable than using purshade in enhancing plant pigments. Increasing concentrations of each protectant from 1.0 to 2.0 % failed significantly to promote these pigments. The maximum values were recorded on the vines that treated twice with calcium carbonate at 2.0 %. The untreated vines exhibited the minimum values. These results were true during both seasons.

Berry setting, yield and cluster weight and dimensions:-

Data in Tables (2 & 3) clearly show that berry setting %, yield expressed in weight and number of clusters/ vine as well as cluster weight and dimensions (length & width) were significantly improved in response to foliar application of calcium carbonate or purshade each at 0.5 to 2.0 % comparing with the check treatment. The promotion was significantly associated with increasing concentrations of each protectant. Using calcium carbonate was superior than using purshade in this connection. Increasing concentrations of each protect from 1.0 to 2.0 % had no significant effect on these parameters. From economical point of view, using calcium carbonate at 1.0 % gave the best results with regard to yield. Under such promised treatment, yield per vine reached 11.0 and 15.2 kg during both seasons, respectively. The untreated vines produced 7.2 and 7.7 kg during 2011 and 2012 seasons. The percentage of increase on the yield due to using the best treatment over the check treatment reached 52.8 and 97.4 % during both seasons, respectively. Number of clusters did not alter significantly with the present treatments in the first season of study. These results were true during both seasons.

Percentages of berries colouration, shot berries and sunburned berries:-

It is evident from the data in Tables (3 & 4) that spraying the two protectants namely calcium carbonate and purshade each at 0.5 to 2.0 % significantly was responsible for reducing the percentages of berries colouration, shot berries and sunburned berries rather than non- application. The reduction on these unfavourable phenomena was significantly in proportional to the increase in concentrations of both the two protectants. No significant reduction was observed on such three parameter among the higher two concentrations of each protectant. Using calcium carbonate was preferable than using purshade in reducing such phenomena. Treating the vines twice with calcium carbonate at 2.0 % gave the lowest values. The highest values were recorded on untreated vines. Similar results were announced during both seasons.

Physical and chemical characteristics of the berries:-

Data in Tables (4 & 5) obviously indicate that spraying the two protectants namely calcium carbonate or purshade each at 0.5 to 2.0 % significantly was followed by promoting quality of the berries in terms of increasing berry weight and dimensions (longitudinal & equatorial), T.S.S % and total sugars % and decreasing total acidity in relative to the check treatment. There was a gradual promotion on quality of the berries with increasing concentration of each protectant from 0.5 to 2.0 %. Using calcium carbonate surpassed the application of purshade in promoting quality of the berries. Increasing concentrations from 1.0 to 2.0 % failed significantly to enhance quality of the berries. The best results were obtained with using calcium carbonate at 1.0 % (since no significant promotion was detected among the higher two concentration). Untreated vines produced unfavourable effects on both physical and chemical characteristics of the berries. These results were true during both seasons.

Discussion:

The reducing effects of $CaCO_3$ and purshade on sunburn damage might be attributed to the following reasons (according to **Peter, 2008**):

1. Their effects in reducing fruit temperature and the exposure to U.V. radiation.
2. Leaving a protective powdery film on the surface of fruits.
3. Reducing temperature damage which reflects on enhancing biosynthesis of plant pigments and photosynthesis.
4. Reflects substantial amounts of infrared light and UV light keeping exposed fruit surfaces markedly cooler while allowing photosynthetically active radiation to pass through to leaf and fruit surfaces.
5. Protective coating reduces the intensity of the hot spot.
6. Prevents insects through produces an unfamiliar and hostile environment causing strong repellency, inability to recognize the host plant and irrigation feeding and egg laying are markedly reduced.
7. Reflects excessive infrared and UV radiation from the vine canopy.
8. Protect berries from direct sunlight and keep grapevine canopies cooler.
9. Reduce the temperature of treated leaves by 8 to 10 ◌̊ F.

These results are in harmony with those obtained by **Ahmed *et al*. (2011) and (2012) and Ebrahiem-Asmaa (2012).**

Table (1): Effect of spraying calcium carbonate and purshade protectants on some plant pigments in the fresh leaves of Red Roomy grapevines during 2011 and 2012 seasons.

Protectant treatments	Chlorophyll a (mg/ 100 g F.W)		Chlorophyll b (mg/ 100 g F.W)	
	2011	2012	2011	2012
1- Control (untreated vines)	22.3	24.0	8.0	8.3
2- Spraying calcium carbonate at 0.5 %	28.0	29.7	11.0	11.4
3- Spraying calcium carbonate at 1 %	29.7	31.5	11.8	12.2
4- Spraying calcium carbonate at 2 %	30.0	31.8	12.0	12.3
5- Spraying purshade at 0.5 %	23.5	25.2	8.7	9.1
6- Spraying purshade at 1 %	25.0	26.7	9.8	10.2
7- Spraying purshade at 2 %	25.6	27.3	10.	10.3
New L.S.D at 0.05	**0.9**	**1.0**	**0.4**	**0.4**
Protectant treatments	**Total chlorophylls (mg/ 100 g F.W)**		**Total carotenoids (mg/ 100 g F.W)**	
1- Control (untreated vines)	30.3	32.3	4.4	5.0
2- Spraying calcium carbonate at 0.5 %	39.0	41.1	6.0	6.6
3- Spraying calcium carbonate at 1 %	41.5	43.7	6.8	7.4
4- Spraying calcium carbonate at 2 %	42.0	44.1	6.9	7.5
5- Spraying purshade at 0.5 %	32.2	34.3	4.9	5.5
6- Spraying purshade at 1 %	34.8	36.9	5.2	5.8
7- Spraying purshade at 2 %	35.6	37.6	5.3	6.0
New L.S.D at 0.05	**0.7**	**0.7**	**0.3**	**0.3**

Table (2): Effect of spraying calcium carbonate and purshade protectants on the percentage of berry setting, number of clusters/ vine, yield and cluster weight of Red Roomy grapevines during 2011 and 2012 seasons.

Protectant treatments	Berry setting %		No. of clusters/ vine	
	2011	2012	2011	2012
1- Control (untreated vines)	5.1	5.2	24.0	25.0
2- Spraying calcium carbonate at 0.5 %	7.0	7.3	25.0	32.0
3- Spraying calcium carbonate at 1 %	7.9	8.2	25.0	34.0
4- Spraying calcium carbonate at 2 %	8.0	8.3	25.0	35.0
5- Spraying purshade at 0.5 %	5.6	5.9	25.0	27.0
6- Spraying purshade at 1 %	6.1	6.4	25.0	29.0
7- Spraying purshade at 2 %	6.2	6.5	25.0	30.0
New L.S.D at 0.05	**0.4**	**0.4**	**NS**	**2.0**
Protectant treatments	**Yield (kg.)/ vine**		**Cluster weight (g.)**	
1- Control (untreated vines)	7.2	7.7	300.0	306.5
2- Spraying calcium carbonate at 0.5 %	10.2	13.2	407.0	413.6
3- Spraying calcium carbonate at 1 %	11.0	15.2	440.0	447.0
4- Spraying calcium carbonate at 2 %	11.1	15.8	442.0	450.0
5- Spraying purshade at 0.5 %	8.5	9.4	340.0	346.5
6- Spraying purshade at 1 %	9.3	11.0	372.0	379.0
7- Spraying purshade at 2 %	9.4	11.4	376.0	380.0
New L.S.D at 0.05	**0.7**	**0.7**	**31.1**	**32.0**

Table (3): Effect of spraying calcium carbonate and purshade protectants on cluster length and width as (cm.) and percentages of berries colouration and shot berries of Red Roomy grapevines during 2011 and 2012 seasons.

Protectant treatments	Cluster length (cm.)		Cluster width (cm.)	
	2011	2012	2011	2012
1- Control (untreated vines)	22.0	22.9	11.0	11.7
2- Spraying calcium carbonate at 0.5 %	26.0	27.0	15.0	15.8
3- Spraying calcium carbonate at 1 %	28.0	28.9	17.6	18.4
4- Spraying calcium carbonate at 2 %	29.9	30.7	18.0	18.8
5- Spraying purshade at 0.5 %	23.1	24.0	12.0	12.7
6- Spraying purshade at 1 %	24.5	25.4	13.1	14.0
7- Spraying purshade at 2 %	24.8	25.7	13.4	14.2
New L.S.D at 0.05	**1.0**	**1.0**	**0.8**	**0.9**
Protectant treatments	**Berries colouration %**		**Shot berries %**	
1- Control (untreated vines)	51.0	51.9	7.1	7.0
2- Spraying calcium carbonate at 0.5 %	64.0	65.0	3.0	2.9
3- Spraying calcium carbonate at 1 %	79.0	80.0	2.0	1.9
4- Spraying calcium carbonate at 2 %	79.9	80.8	1.8	1.7
5- Spraying purshade at 0.5 %	54.0	54.8	6.1	6.0
6- Spraying purshade at 1 %	57.0	57.9	5.0	4.8
7- Spraying purshade at 2 %	57.8	58.3	4.0	3.9
New L.S.D at 0.05	**2.0**	**2.1**	**0.5**	**0.5**

Table (4): Effect of spraying calcium carbonate and purshade protectants on the percentage of sunburned berries as well as berry weight and diameters of Red Roomy grapevines during 2011 and 2012 seasons.

Protectant treatments	Sunburned berries %		Berry weight (g.)	
	2011	2012	2011	2012
1- Control (untreated vines)	15.0	14.8	4.22	4.18
2- Spraying calcium carbonate at 0.5 %	6.2	5.9	5.50	5.66
3- Spraying calcium carbonate at 1 %	2.1	1.9	5.82	5.99
4- Spraying calcium carbonate at 2 %	2.0	1.7	5.84	6.00
5- Spraying purshade at 0.5 %	13.5	13.2	4.52	4.68
6- Spraying purshade at 1 %	12.0	11.7	4.91	5.06
7- Spraying purshade at 2 %	11.7	11.3	4.95	5.10
New L.S.D at 0.05	**0.8**	**0.9**	**0.15**	**0.14**
Protectant treatments	**Berry longitudinal (cm.)**		**Berry equatorial (cm.)**	
1- Control (untreated vines)	1.90	1.90	1.77	1.78
2- Spraying calcium carbonate at 0.5 %	2.41	2.45	2.28	2.32
3- Spraying calcium carbonate at 1 %	2.66	2.70	2.53	2.57
4- Spraying calcium carbonate at 2 %	2.68	2.72	2.55	2.59
5- Spraying purshade at 0.5 %	2.00	2.05	1.87	1.91
6- Spraying purshade at 1 %	2.11	2.17	1.98	2.02
7- Spraying purshade at 2 %	2.13	2.19	1.99	2.03
New L.S.D at 0.05	**0.06**	**0.07**	**0.05**	**0.05**

Table (5): Effect of spraying calcium carbonate and purshade protectants on some chemical characteristics of the grapes of Red Roomy grapevines during 2011 and 2012 seasons.

Protectant treatments	T.S.S %		Total acidity %	
	2011	2012	2011	2012
1- Control (untreated vines)	18.5	18.7	0.739	0.740
2- Spraying calcium carbonate at 0.5 %	20.3	20.5	0.629	0.622
3- Spraying calcium carbonate at 1 %	21.0	21.4	0.592	0.593
4- Spraying calcium carbonate at 2 %	21.2	21.6	0.590	0.591
5- Spraying purshade at 0.5 %	19.0	19.2	0.700	0.705
6- Spraying purshade at 1 %	19.5	19.8	0.666	0.669
7- Spraying purshade at 2 %	19.6	19.9	0.660	0.667
New L.S.D at 0.05	**0.4**	**0.4**	**0.030**	**0.028**
Protectant treatments	**T.S.S/ acid**		**Total sugars %**	
1- Control (untreated vines)	25.03	25.27	17.2	17.0
2- Spraying calcium carbonate at 0.5 %	32.27	32.96	19.6	19.5
3- Spraying calcium carbonate at 1 %	35.47	36.09	19.3	19.2
4- Spraying calcium carbonate at 2 %	35.93	36.55	19.4	19.3
5- Spraying purshade at 0.5 %	27.14	27.23	17.8	17.7
6- Spraying purshade at 1 %	29.28	29.60	18.7	18.5
7- Spraying purshade at 2 %	29.70	29.84	18.8	18.6
New L.S.D at 0.05	**1.11**	**1.22**	**0.5**	**0.4**

Conclusion

For protecting Red Roomy grapevines from sunburn damage, enhancing berries colourations and yield quantiteva1ly and qualitatively, it is essential for spraying calcium carbonate twice at 1.0 %.

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