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CONTROL OF BOTRYTIS BUNCH ROT OF GRAPE WITH CANOPY MANAGEMENT

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ABSTRACT

Two field trials with 10 years old grapevines cv. Ruby seedless (highly susceptible cultivar) were conducted at Nobaryia region, Egypt. In these trials, treatments consisted of leaf removal, shoot removal, topping, (leaf removal, shoot removal and topping) and a nonmanaged control. An additional trial, compared the leaf removal treatment with nonmanaged control .All plots were established in a split – plot design with or without fungicides .The above mentioned treatments were applied during the growing season starting at full bloom till veraison stage (the beginning of ripening) in order to control botrytis bunch rot.

The obtained results showed that the disease incidence and severity of botrytis bunch rot was best reduced by using any of the used canopy management treatments compared with the nonmanaged control. But, the greatest reduction in incidence and severity occurred in the treatment with leaf removal + shoot removal and topping. In additional trial, leaf removal also reduced disease incidence and severity in nonsprayed control compared with the in tact nonsprayed control.

The greatest reduction in incidence and severity was in the treatments with three sprays of fungicide (Euparen M) at bloom, pre-close and veraison. Also, the produced fruit yield from treated vines was significantly higher during the first and the second seasons in comparison with that of untreated vines.

Key words: bunch rot, disease incidence, disease severity, canopy management, veraison stage, intact.

INTRODUCTION

Grapevine (*vitis vinifera* L.) is the leading fruit crop all over the world. In Egypt, grapevine occupies the second rank among fruit crops after citrus. However, the area under this economic crop was about 141233 feddans and the average of grape production reached 1009563 tons (Anonymous, 2000).

Under Nobaryia region environmental conditions, bunch rot is a serious disease of grapes (*vitis vinifera* L.) which caused by *Botrytis cinerea* pers.

Disease severity increases in years when late – season rains occur, but serious yield losses may occur without rain moisture. In these instances, Botrytis infection of grape berries commonly occurs in cultivars with dense canopies or tight berry clusters. In Egypt, first symptoms of disease on susceptible cultivars are generally appeared when fruit sugar levels begin to increase (veraison).

Savage and Sall (1983&1984) reported that canopy management by hedging or by means of wire systems resulted in a moderate reduction of bunch rot incidence and severity. Wind speed through grapevine canopies was shown to increase markedly after leaf removal (English *at al.*, 1989) and development of *B. cinerea* decreased inversely with wind speed (Thomas,

1988) Research into other potential means of canopy management has shown positive effects of increased yield and higher quality fruit resulting from changes in canopy microclimate. (Smart, 1985) *Botrytis* bunch rot of grape was significantly reduced by canopy management. Also integrating leaf removal with chemical control may reduce the need for multiple fungicide applications (Bettiga *et al.*, 1989). Rot reduction after leaf removal was greatest when leaves were pulled from the fruit zone on both sides of cordon - trained vines (Stapleton and Grand, 1992). The aim of this study was to investigate the use of grapevine canopy management alone or combined with fungicide applications for control of Botrytis bunch rot.

MATERIALS AND METHODS

A field trail was conducted in two successive seasons (1999 and 2000) on a 10 years old Grapevines cv. Ruby seedless commercial vineyard in Nobaryia, Egypt. Vines on this site were moderately vigorous, cordon – trained, super – pruned and planted on a spacing of 3.5 × 1.5 m. supported on Y shape.

Methods of fertilization, irrigation and other cultural practices for grapevine were as recommended to commercial vineyard in this site. A 2 ×5 split – plot design with 3 replicates was used to study subplot effects of leaf removal, shoot removal, Topping, leaf removal + shoot removal + Topping and control treatment (unmanaged) in which no canopy management was practiced. Within each of the canopy management treatments, vines were either not sprayed or sprayed with Euparen M (Tolylfluanid) at 200g/100 liter water at bloom, preclose and veraison.

Canopy management treatments:

1. **Leaf removal**: Leaves and laterals located opposite, one node above and one node below each flower cluster, were removed by hand at late bloom, resulting in window of exposed clusters
2. **Shoot removal**: Shoots were removed at late bloom. All interspur and crown shoots were removed and spurs were thinned to two shoots.
3. **Topping**: Topping was done at late bloom with Tope trimmers, shoots about 100 cm. long were Toped back 30 – 45 cm.
4. **Leaf removal, shoot removal and Topping** were done at late bloom
5. **Control (unmanaged)** without canopy management

The fungicide applications (subplot) were also investigated in this trial. Spray timings were established according to growth stages of the grapevine. Treatments included single application of Euparen M (Tolylfluanid) at 200g/100 liter water at bloom, preclose, and veraison stage. The fourth treatment include 3 sprays at the timings described, and the fifth treatment was a nonsprayed control. The spray treatments were applied to the two inside rows of a four- row block. In each treatment, one of these paired rows had the leaf removal treatment and the other was the intact control.

Bunch rot and yield evaluations were conducted at harvest. Three randomly selected vines from each treatment were hand harvested and evaluated for incidence and severity of bunch rot and yield.

Bunch rot incidence was evaluated by counting diseased clusters per vine.
The disease severity was determined by counting rotted berries and converting these figures to a percent rot/cluster based on the average number of berries/cluster according to (Gubler *et al.*, 1987)
Yields were obtained by taking cluster weights/vine.

RESULTS

Botrytis bunch rot disease was relatively low in both incidence and severity. Orthogonal contrasts identified significant difference resulting from canopy management in the first season (Table 1). The mean subplot effects of canopy management showed that bunch rot incidence percentage was significant, reduced from 46.69 to 12.33, 18.30, 22.16 and 28.93% in the control the treatment of leaf removal + shoot removal + topping), leaf removal, shoot removal and topping treatments, respectively. Fungicide applications in canopy management treatments were more effective in reducing disease incidence than the canopy management treatments without fungicide usage.

The disease severity of bunch rot was also influenced by canopy management treatments in subplot and by fungicides in the main plot (Table 1).

Bunch rot disease severity was significantly reduced from 24.34 to 3.59, 4.93, 6.90 and 7.57% in the control, the treatment of (leaf removal and topping treatments), leaf removal, shoot removal and topping treatments, respectively. Fungicide applications further reduced bunch rot severity. The greatest reduction was occurred in the treatment of (leaf removal + shoot removal + topping) where severity was reduced from 24.34 to 3.59%. Yields were significantly increased in all treatments that reduced the infection of bunch rot. The average weights of clusters harvested from vines treated with canopy management treatments and from untreated control vines subplot were 11.3, 10.14, 11.5, 12.75 and 6.84 kg/vine for leaf removal, shoot removal, topping, the treatment of (Leaf removal + shoot removal + topping) and the untreated control, in subplot and by fungicides in main plot, respectively in the first season (1999).

In the second season (2000), it is clear from the data in table (2) that each treatment took the same trend of the data obtained in the first season (Table 1).

The mean subplot effects of canopy management showed that bunch rot incidence percentage was significantly reduced from 45.02 to 15.24, 20.88, 24.52 and 27.14% in the control, the treatment of (leaf removal + shoot removal + Topping), leaf removal, shoot removal and Topping treatments, respectively. Fungicide applications in canopy management treatments were more effective in reducing disease incidence than the canopy management treatments without used of fungicide.

Table (1). Effect of canopy management practices and Fungicide on incidence and severity of Botrytis bunch rot and yield of grapevine cv. Ruby seedless (During season 1999).

Canopy management / Treatment	Disease incidence (diseases clusters %)					
	Leaf removal	Shoot removal	Topping	Leaf + shoot removal + Topping	Control	Mean
Disease incidence (disease clusters %)						
Sprayed	12.26	12.25	22.19	7.19	66.21	19.42
Non sprayed	24.33	32.07	35.67	17.47	50.18	31.94
means	18.30	22.16	28.93	*12.33	46.69	
Disease severity (Percent rot per clusters)						
sprayed	4.18	5.93	6.67	2.30	15.67	6.95
Non sprayed	5.67	7.87	8.47	5.18	33.00	12.04
Means	4.93	6.90	7.57	*3.59	24.34	
Yield/vine (Kg)						
Sprayed	11.40	10.40	12.75	13.50	7.00	11.09
Non sprayed	9.80	8.87	10.25	12.00	6.67	10.12
Means	11.30	10.14*	11.50	12.75	6.84	

[r] Results are expressed as an average of three replicates.
Figures followed by an asterisk denote a significant (P<0.05) effect from that treatment.
[s] Sprayed with tolylfluanid at 200g/100L.W. at bloom, preclose and veraison.

The disease severity of bunch rot was also influenced by canopy management treatments in subplot and by fungicides in the main plot in (Table 2). Bunch rot disease severity was significantly reduced from 28.00 to 4.56, 5.25, 6.15 and 7.04% in the control, the treatment of (leaf removal + shoot removal + Topping), leaf removal, shoot removal and topping treatments, respectively. The fungicide applications further reduced bunch rot severity. The greatest reduction was occurred in the treatment of (leaf removal shoot removal + Topping), where severity was reduced from 28.00 to 4.56%.

Yields were significantly increased in all treatments that reduced the infection of bunch rot. The average weights of clusters harvested from vines treated with leaf removal, shoot removal, topping, the treatment of (leaf removal + shoot removal and topping) and from unmanaged control vines and by fungicides were 10.97, 10.00, 11.67, 13.67 and 6.83 Kg/vine, respectively in the second season (2000). Meanwhile, the average weights of clusters harvested from vines treated with leaf removal, shoot removal, topping, the treatment with leaf removal + shoot removal and topping, and the unmanaged control vines and without fungicides in the main plot were 9.75, 8.83, 10.17, 11.93, 5.97 Kg/vine, respectively in the second season (2000).

Table (2). Effect of canopy management practices and Fungicide on incidence and severity of Botrytis bunch rot and yield of grapevine cv. Ruby seedless (During season 2000).

Canopy management / Treatments	Leaf removal	Shoot removal	Topping	Leaf + shoot removal + Topping	Control	Mean
Disease incidence (Disease clusters %)						
Sprayed	18.67	20.40	17.93	11.14	40.37	21.70
Non sprayed	30.37	33.87	23.83	19.33	49.67	31.41
Means	24.52	27.14	20.88	15.24	45.02	
Disease severity (Percent rot per cluster)						
Sprayed	4.13	6.20	5.37	3.44	18.23	7.59
Non sprayed	6.37	7.87	6.93	5.67	37.77	12.92
Means	5.25	7.04	6.15	4.56	28.00	
Yield/Vine (Kg)						
Sprayed	10.97	10.00	11.67	13.67	6.83	10.63
Non sprayed	9.75	8.83	10.14	11.93	5.97	9.32
Means	10.36	9.42	10.91	12.80	6.40	

[r] Results are expressed as an average of three replicates.
Figures followed by an asterisk denote a significant (P<0.05) effect from that treatment.
[s] Sprayed with (Euparen M) tolylfluanid at 200g/100L.W. at bloom, preclose and veraison.

Leaf removal significantly reduced the incidence and severity of bunch rot disease (Table 3). Orthogonal contrast analysis of the data indicated that disease incidence was significantly reduced from 49.67 in the control treatment to 34.00% when leaves were removed. Leaf removal also significantly decreased the disease severity. Data showed a reduction in the severity from 14.55 rot per cluster in the control treatment to 11.07% rot per cluster in the leaf removal treatment.

Single fungicide (Euparen M) application at bloom, preclose and veraison resulted insignificant reduction of disease incidence in the vines managed by leaf removal (Table 3). Similarly, Euparen M applications at bloom, preclose and veraison were significantly reduced bunch rot incidence on leaf removal vines. Fungicide (Euparen M) application on intact vines resulted in better disease control, but the greatest reduction in the incidence and disease severity occurred when applications of Euparen M were made at bloom, preclose and veraison stages in the first season (1999).

In the second season, it is clear from the data in table (4) that all treatments took the same trend of the data obtained in the first season (1999).

The obtained results from Table (4) indicated that the disease incidence was significantly reduced from 50.18 in the control treatment to 36.00% when leaves were removed. Leaf removal also significantly decreased disease severity. Data show a reduction in severity from 14.68 rot per cluster in the control treatment to 11.49% rot per cluster in the leaf removal treatment.

Table (3). Effect of canopy management practices and Fungicide on incidence and severity of Botrytis bunch rot and yield of grapevine cv. Ruby seedless (During season 1999).

Timing of application / Leaf treatment	Timing of Fungicide application					
	Control	Bloom	Preclose	Verasion	Bloom + Preclose + Verasion	Mean
Disease incidence (Disease clusters %)						
Leaf removal	34.00	21.63	24.00	26.46	12.67	23.75
Leaves intact	49.67	33.37	34.67	35.83	29.00	36.51
Means	41.84	27.50	29.34	31.15	20.84	
Disease severity (Percent rot per cluster)						
Leaf removal	31.17	5.67	6.93	7.45	4.13	11.07
Leaves intact	42.67	7.00	8.53	9.24	5.33	14.55
Means	36.92	6.34	7.73	8.35	4.73	
Yield/Vine (Kg)						
Leaf removal	7.18	9.37	8.12	9.00	10.97	8.93
Leaves intact	5.97	7.24	7.00	7.87	9.22	7.46
Means	6.58	5.31	7.56	5.44	10.10	

Results are expressed as an average of three replicates means differences with orthogonal contrasts.
Figures followed by an asterisk denote a significant (P < 0.01) effect from that treatment
Sprayed with Euparen M at 200g / 100 L.W

Table (4). Effect of Canopy management practices and Fungicide on incidence and severity of Botrytis bunch rot and yield on grapevines cv. Ruby seedless (During season 2000).

Timing of Application / Leaf treatment	Timing of Fungicide application					
	Control	Bloom	Preclose	Veraison	Bloom + Preclose + Veraison	Mean
Disease incidence (disease clusters %)						
Leaf removal	36.00	23.40	25.18	28.67	14.30	25.51
Leaves intact	50.18	33.37	36.83	37.93	30.00	37.66
Means	43.09	28.39	31.01	33.30	22.15	
Disease severity (Percent rot per cluster)						
Leaf removal	33.67	5.37	6.87	7.37	4.18	11.49
Leaves intact	43.00	7.14	8.43	9.18	5.67	14.68
Means	38.34	6.26	7.65	8.28	4.93	
Yield/Vine (Kg)						
Leaf removal	7.33	9.85	7.83	8.17	11.40	8.92
Leaves intact	6.67	7.83	6.87	7.40	9.37	7.63
Means	7.00	8.84	7.35	7.79	10.39	

*** Results are expressed as an average of three replicates.**
*** Figures followed by an asterisk denote a significant (p<0.01) effect from that treatment.**
Spray with Euparen M (Tolylfuanid at 200g/100L.W.

DISCUSSION

Controlling of Botrytis bunch rot disease of grape through the use of canopy management is a viable alternative to repeat fungicide applications. Data from field trials showed that leaf removal + shoot removal and topping resulting in excellent disease control even under conditions otherwise causing severe rot. Other treatments used in this study also reduced the

incidence and severity of bunch rot but less than the treatment with leaf removal + shoot removal and topping. The discrepancy in data obtained from both treatment with (leaf removal + shoot removal + topping) and other treatments can be explained partially on the basis of the stage of plant growth when these treatments were performed.

Shoot removal has potential for use in bunch rot control strategies. Although disease control was minimal when fungicides were not used, excellent control was achieved when fungicides were applied to vines in which shoots were removed at cluster set. Savage and Sall (1984) reported that midseason hedging was associated with slightly lower disease levels. the obtained results also showed that topping offers only minimal disease control of bunch rot.

The fungicides currently are used widely in controlling *B. cinerea* on grapes, but generally become less effective as the grapevine matures because of heavy canopy growth and bunch closing. Usually, by the third fungicide application at or near veraison stage, it becomes virtually impossible to penetrate the canopy with enough volume to adequately protect the cluster targets. Preliminary spray efficiency data have shown that the canopy (Gubler *et al.*, 1987).

Results of fungicides timing trials also lead to question the need for a fungicide application at bloom. The obtained data from this trial showed an significant difference in disease control between single fungicide applications made at bloom, preclose or veraison and three sprays at the timing described. These results were in the same line with McClellan and Hewitt (1973) who reported that applications at bloom were most effect. They added that the ability of *B. cinerea* to infect immature grape berries via senescing flower parts resulting in latent infection. Savage and Sall (1982), however, stated that the absence of fungus in the immature berries. The fungicides alone do not provide an adequate protection against *Botrytis cinerea* during severe disease pressure. By integrating the cultural control practice of leaf removal with chemical control. This will provide adequate protection against *B. cinerea.*

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مقاومة عفن البوطريتس على عنقود العنب باستخدام إدارة رأس الشجرة

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أجريت تجربتين في الحقل على شجيرات عنب عمرها 10 سنوات صنف روبي سيدلس (صنف شديد الحساسية للإصابة) في منطقة النوبارية – مصر. في هاتين التجربتين كانت المعاملات تشمل إزالة الأوراق ، إزالة الأفرع ، التطويش ، (إزالة الأوراق + إزالة الأفرع + التطويش) ومعاملة الكنترول بدون إدارة رأس الشجرة. كما أجريت تجربة إضافية لمقارنة معاملة إزالة الأوراق بمعاملة الكنترول (بدون إدارة رأس الشجرة). تم تصميم التجربة بنظام القطع المنشقة سواء المرشوشة أو غير المرشوشة بالمبيد الفطري. المعاملات المذكورة عالية استخدمت خلال موسم النمو ابتداءً من مرحلة التزهير الكامل حتى مرحلة بداية النضج ، لمقاومة عفن البوطريتس على عنقود العنب.

أظهرت النتائج المتحصل عليها أن نسبة وشدة الإصابة بعفن البوطريتس للعنقود قلت بدرجة عالية باستخدام أي من معاملات إدارة رأس الشجرة مقارنة بمعاملة الكنترول (بدون إدارة رأس الشجرة) ، ولكن كان أحسن تقليل في نسبة وشدة الإصابة في المعاملة باستخدام (إزالة الأوراق + إزالة الأفرع + التطويش).

في التجربة الإضافية قللت إزالة الأوراق أيضاً نسبة وشدة الإصابة في معاملة الكنترول غير المرشوشة مقارنة بمعاملة الكنترول ذات الأوراق السليمة وغير المرشوشة ، وقد حصل على نقص كبير في لنسبة وشدة الإصابة بالمرض في المعاملة ذات الثلاث رشات بمبيد اليوبارين- إم عند التزهير ، وقبل تكوين الثمرة ، ومرحلة بداية النضج. وكان محصول الثمار المنتج من شجيرات العنب المعاملة أعلى معنوياً في كلا الموسمين (1999 ، 2000) مقارنة بمحصول شجيرات العنب غير المعاملة.