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Abstract

Through a grant from the Leopold Center for Sustainable Agriculture, a grape cultivar by management system trial was established in 2002 at the ISU Horticulture Station (Hort Station), Ames, and at the ISU Armstrong Research and Demonstration Farm, Lewis. The trial was designed to evaluate 15 cultivars under three management systems. In 2002, 10 wine cultivars (Maréchal Foch, Frontenac, Cynthiana, St.Croix, Chambourcin, Seyval Blanc, La Crosse, Vignole, Traminette, Edelweiss), and four seedless table cultivars (Marquis, Vanessa, Reliance, Mars) were planted, with the seedless cultivar Jupiter added in 2003. The three management systems being evaluated are 1) a conventional system that relies on herbicides for weed control, and the application of insecticides and fungicides on a regular basis; 2) an IPM/best management system that uses herbicides as needed, and relies on monitoring to determine the need for insecticides and fungicides; and 3) an organic-approved system that relies on alternative methods of weed control and the use of organic-approved insect and disease control strategies.

Keywords

Horticulture

Disciplines

Agricultural Science | Agriculture | Horticulture

2002 Leopold Grape Cultivar by Management System Trial

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Introduction

Through a grant from the Leopold Center for Sustainable Agriculture, a grape cultivar by management system trial was established in 2002 at the ISU Horticulture Station (Hort Station), Ames, and at the ISU Armstrong Research and Demonstration Farm, Lewis. The trial was designed to evaluate 15 cultivars under three management systems. In 2002, 10 wine cultivars (Maréchal Foch, Frontenac, Cynthiana, St. Croix, Chambourcin, Seyval Blanc, La Crosse, Vignole, Traminette, Edelweiss), and four seedless table cultivars (Marquis, Vanessa, Reliance, Mars) were planted, with the seedless cultivar Jupiter added in 2003. The three management systems being evaluated are 1) a conventional system that relies on herbicides for weed control, and the application of insecticides and fungicides on a regular basis; 2) an IPM/best management system that uses herbicides as needed, and relies on monitoring to determine the need for insecticides and fungicides; and 3) an organic-approved system that relies on alternative methods of weed control and the use of organic-approved insect and disease control strategies.

Materials and Methods

Vines were planted 8 × 10 ft apart (545 vines/acre) with three vines/replication. Treatments were replicated five times at the Hort Station and three times at the Armstrong Farm. The vines are being trained to the bilateral cordon system on a two-wire trellis with wires at 3.5 and 6.0 ft above the ground and line posts spaced 24 ft apart. Vines with a procumbent (trailing) growth habit are trained to the top wire, whereas those with a semiupright to upright growth habit (Chambourcin, La

Crosse, Seyval, Traminette, Vignole) are trained to the midlevel wire with three sets of catch wires added above. This report summarizes the 2004 growing season.

In 2004, the conventional and IPM/best management treatments were fertilized at a rate of 40 lb/acre actual N with urea. For the organic-approved treatment, an equivalent rate of corn gluten meal was applied. Weeds in the conventional and IPM/best management treatments were controlled with a preemergence application of oryzalin followed with wick applications of glyphosate as needed. A straw mulch was used to control weeds in the organic-approved treatment. All treatments received a dormant application of liquid lime sulfur. Captan fungicide was applied to the conventional and best management plots, and a fixed copper fungicide with hydrated lime was applied to the organic-approved plots for disease control. Beginning in July, treatments were applied on a weekly basis at the Hort Station and twice in August at the Armstrong Farm. No insecticides were required in 2004.

The vines were pruned in the spring to either 1/4-inch-diameter spurs or to what appeared to be live tissue in the canes, and pruning weights were recorded (Table 1). Because of drought conditions that prevailed during the previous two years, vine growth as reflected by pruning weights was less at the Armstrong Farm than at the Hort Station. At both sites, vines in the organic-approved management system tended to have lower pruning weights. Among cultivars at the Hort Station, Frontenac and Edelweiss had the highest pruning weights whereas Traminette, Vignole, Marquis, Vanessa, and Cynthiana had the lowest weights. At the Armstrong Farm, La Crosse, Seyval Blanc, Edelweiss, Chambourcin, Mars, and St. Croix had the highest pruning weights, while Vanessa, Maréchal Foch, Cynthiana, Vignole, and Traminette had the

lowest weights. Because of considerable cane dieback from October 2, 2003, freeze (26°F) at the Hort Station, pruning weights were not a good indicator of vine growth in 2003. Following bud break, the percentage of dieback of the remaining canes was estimated (Table 1). At the Armstrong Farm where the first killing frost came on November 1 (28°F), little cane dieback occurred and no differences existed among cultivars. At the Hort Station, Marquis and Traminette followed by Seyval Blanc, Chambourcin, and Vignole exhibited the greatest cane dieback. Due to the extent of dieback that occurred during 2002–2003 winter at both sites and the past winter at the Hort Station, and poor vine growth associated with two years of drought at the Armstrong Farm, the vines in both plantings were not cropped in 2004.

During the growing season, a high incidence of crown gall (*Agrobacterium tumefaciens*) was observed in the Hort Station planting (Table 2). When rated on a scale of 0 (no crown gall) to 1 (crown gall present), vines in the organic-approved management system had a higher incidence of crown gall than vines in the conventional system with the IPM/best management system not being different from either. Among cultivars, Chambourcin vines had the highest incidence of crown gall. Although not statistically different from the other cultivars, a moderate incidence of crown gall was observed on Traminette, Maréchal Foch, and Vignole vines. The incidence of crown gall in vines at the Armstrong Farm was very low and no differences between cultivars or management system were found. Differences in the incidence of crown gall between the sites can be attributed to the October 2, 2003, freeze that occurred at the Hort Station but not at the Armstrong Farm. Also, the Hort Station site was previously planted with apples, which are also susceptible to crown gall.

The Armstrong Farm vines were again exposed to 2,4-D herbicide drift in 2004 (Table 2). When

rated for severity of injury, Vanessa and Cynthiana vines exhibited the greatest injury as in previous years. Frontenac, La Crosse, Seyval Blanc, Vignole and Chambourcin vines exhibited little or no injury. Injury from 2,4-D at the Hort Station was minimal in 2004.

Vines in each of the plantings were rated for the incidence and severity of anthracnose (*Elsinoe ampelina*), powdery mildew (*Uncinula necator*), and downy mildew (*Plasmopara viticola*) (Table 3). At the Hort Station, a higher incidence of anthracnose was detected on vines in the organic-approved management system than in the conventional or IPM/best management system, while no differences between management systems was found at the Armstrong Farm. Among cultivars, Marquis and Reliance exhibited the highest incidence of anthracnose at both sites. The incidence of powdery mildew infection was high at the Armstrong Farm, but not at the Hort Station where fungicide sprays were applied more frequently. At the Armstrong Farm, the fixed copper fungicide plus hydrated lime applied in the organic-approved management system effectively controlled powdery mildew. Two applications of Captan were not effective in controlling the disease. Among cultivars, Marquis followed by Reliance, La Crosse, Vignole, and Vanessa exhibited severest symptoms of powdery mildew infection, whereas Cynthiana, St. Croix, Seyval Blanc, and Edelweiss exhibited the least severe symptoms. At both sites, Marquis and Jupiter exhibited a higher incidence of downy mildew than did the other cultivars. No differences associated with management systems were detected for downy mildew.

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Table 1. Pruning weights and percentage of cane dieback of 15 cultivars in the ISU 2002 grape cultivar by management system trial for 2004.^z

Treatment	Pruning weight (lb)		% Cane die-back ^y	
	Hort Station	Armstrong	Hort Farm	Armstrong
Management System:				
Conventional	1.3 ab	.60 ab	22.4 a	1.0
IPM/best mgmt	1.5 a	.78 a	23.8 a	.7
Organic approved	1.1 b	.40 b	17.3 a	.5
Cultivar:				
Maréchal Foch	1.6 bc	.32 ef	3.3 d	.0
Frontenac	2.1 a	.57 bcde	.4 d	.0
Cynthiana	.9 def	.43 ef	9.7 cd	.0
St. Croix	1.5 b	.64 abcde	.0 d	.0
Chambourcin	1.3 cde	.81 abcde	46.3 b	6.0
Seyval Blanc	1.3 cde	.90 ab	48.5 b	2.0
La Crosse	1.6 bc	.98 a	.4 d	.0
Vignole	.7 f	.45 def	26.9 c	.0
Traminette	.6 f	.47 cdef	60.5 ab	.0
Edelweiss	1.8 ab	.82 abc	2.8 d	.0
Marquis	.8 f	.55 bcdef	70.5 a	2.0
Vanessa	.9 ef	.21 f	17.3 cd	2.0
Reliance	1.6 bc	.52 bcdef	4.3 d	.0
Mars	1.4 bcd	.66 abcde	5.5 d	.0
Jupiter*	(.1)	(.07)	(92.2)	(4.0)

^z Mean separation within each group by Tukey's HSD (P=0.05). Values with the same letter do not differ.

^y After pruning to green tissue in the canes.

* Planted in 2003.

Table 2. Crown gall and 2,4-D herbicide injury ratings for 15 cultivars in the ISU 2002 grape cultivar by management system trial for 2004.^z

Treatment	Hort Station	Armstrong Farm	
	Crown Gall rating ^y	Crown Gall rating ^y	2,4-D rating ^x
Management System:			
Conventional	.12 b	.01	2.5 a
IPM/best mgmt	.13 ab	.03	2.4 a
Organic approved	.20 a	.02	2.3 a
Cultivar:			
Maréchal Foch	.22 bc	.00	2.7 cd
Frontenac	.02 bc	.00	1.0 f
Cynthiana	.07 bc	.00	4.1 a
St. Croix	.03 bc	.00	2.0 e
Chambourcin	.83 a	.07	1.3 f
Seyval Blanc	.20 bc	.00	1.1 f
La Crosse	.02 bc	.00	1.0 f
Vignole	.23 bc	.00	1.2 f
Traminette	.32 b	.00	2.4 de
Edelweiss	.04 bc	.00	2.1 e
Marquis	.11 bc	.00	3.3 b
Vanessa	.11 bc	.00	4.2 a
Reliance	.00 c	.00	3.3 b
Mars	.02 bc	.00	3.2 b
Jupiter	.01 bc	.06	3.1 bc

^z Mean separation within each group by Tukey's HSD (P=0.05). Values with the same letter do not differ.

^y Crown gall rating scale 0–1: 0=no crown gall; 1=crown gall present.

^x Herbicide injury scale 1–5: 1=no apparent injury; 2=slight symptoms of abnormal venation; 3=moderate; 4=severe; 5=very severe.

Table 3. Disease ratings for anthracnose, powdery mildew and downy mildew on 15 cultivars in the ISU 2002 grape cultivar by management system trial for 2004. ^{z, y}

Treatment	Armstrong Farm			Hort Station		
	Anthracnose	Powdery mildew	Downy mildew	Anthracnose	Powdery mildew	Downy mildew
Management System:						
Conventional	1.1 a	2.7 a	1.2 a	1.2 b	1.0	1.2 a
IPM/best mgmt	1.2 a	2.7 a	1.2 a	1.2 b	1.0	1.1 a
Organic approved	1.2 a	1.3 b	1.2 a	1.4 a	1.0	1.2 a
Cultivar:						
Maréchal Foch	1.0 b	2.1 cde	1.1 c	1.0 b	1.0	1.0 c
Frontenac	1.0 b	1.9 def	1.0 c	1.0 b	1.0	1.0 c
Cynthiana	1.0 b	1.4 f	1.6 b	1.1 b	1.0	1.0 c
St. Croix	1.0 b	1.7 ef	1.0 c	1.0 b	1.0	1.0 c
Chambourcin	1.0 b	2.1 cde	1.0 c	1.0 b	1.0	1.0 c
Seyval Blanc	1.0 b	1.8 ef	1.0 c	1.0 b	1.0	1.1 c
La Crosse	1.0 b	2.6 bc	1.0 c	1.0 b	1.0	1.0 c
Vignole	1.0 b	2.3 bcde	1.0 c	1.1 b	1.0	1.0 c
Traminette	1.0 b	2.0 cd	1.0 c	1.3 b	1.0	1.0 c
Edelweiss	1.0 b	1.8 ef	1.0 c	1.2 b	1.0	1.2 bc
Marquis	2.2 a	4.3 a	2.1 a	2.8 a	1.0	1.5 b
Vanessa	1.0 b	2.2 bcde	1.0 c	1.0 b	1.0	1.0 c
Reliance	2.1 a	2.9 b	1.0 c	2.8 a	1.0	1.2 bc
Mars	1.0 b	2.4 bcd	1.0 c	1.1 b	1.0	1.2 bc
Jupiter*	1.0 b	2.1 cde	1.8 ab	1.2 b	1.0	2.0 a

^z Mean separation within each group by Tukey's HSD (P=0.05).

^y Disease injury scale 1-5: 1=no apparent injury; 2=slight symptoms; 3=moderate; 4=severe; 5=very severe.

* Planted in 2003.