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Grape Cultivar by Management System Trial Performance in 2006

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Abstract
To identify grape cultivars adapted to Iowa, a cultivar by management system trial was established in 2002 at the ISU Horticulture Research Station (HRS) and the ISU Armstrong Research Farm (ARF) with the help of a grant from the Leopold Center of Sustainable Agriculture. Fifteen cultivars, including 10 wine and 5 seedless table cultivars, are being evaluated under 1) a conventional management system that relies on herbicides for weed control and 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 a straw mulch for weed control and use of organic-approved pest control strategies. This report summarizes the results for the 2006 growing season.

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Introduction

To identify grape cultivars adapted to Iowa, a cultivar by management system trial was established in 2002 at the ISU Horticulture Research Station (HRS) and the ISU Armstrong Research Farm (ARF) with the help of a grant from the Leopold Center of Sustainable Agriculture. Fifteen cultivars, including 10 wine and 5 seedless table cultivars, are being evaluated under 1) a conventional management system that relies on herbicides for weed control and 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 a straw mulch for weed control and use of organic-approved pest control strategies. This report summarizes the results for the 2006 growing season.

Materials and Methods

The vines were spaced 8 ft × 10 ft apart (545 vines/acre) with three vines/replication. Treatments were replicated five times at HRS and three times at ARF. The vines were trained to the bilateral cordon system on a two-wire trellis with wires at 3.5 ft and 6.0 ft above the ground. Vines with a procumbent (trailing) growth habit were trained to the top wire, while those with a semi-upright to upright growth habit were trained to the vertical shoot positioning (VSP) system.

In late September 2005, shoots were rated for periderm formation (when shoots become lignified and turn brown) based on the amount of development that had occurred on the primary shoots. Prior to pruning in the spring, cane samples were collected and assessed for primary bud injury, and retention of buds was adjusted when needed. The vines were pruned, the 1-year-old trimmings were weighed, and the amount of established 2-year-old cordon was measured. During the growing season, vines at both sites were exposed to 2,4-D herbicide drift and were rated for the severity of injury. Following *veraison* (when the grape berry changes color), berry samples were collected from the mid-cluster position to test for maturity based on percentage soluble solids (SS), pH, and titratable acids (TA). Time of harvest was based upon these measurements and either local winery requirements or fruit condition. At harvest, the number of clusters per vine were counted and weighed.

Results and Discussion

During the study, several significant freezes occurred and influenced the vine establishment and productivity (Table 1). During the past dormant period, frosts or freezing events were recorded on October 8, on December 7 or 9, 2005, February 18, and April 26, 2006. During each event, lower temperatures were recorded at HRS.

Periderm formation is an indicator of shoot maturation. At the end of September 2005, differences between sites and cultivars at the sites were evident (Table 2). Generally, vines at ARF, which had been exposed to less severe freezing episodes in early fall and winter, had greater periderm formation than at HRS. This was particularly evident on some cultivars considered to be moderately hardy such as Traminette, Marquis, Jupiter, Cynthiana, Seyval Blanc, and Chambourcin. Between management

systems, vines in the organic-approved plots, where straw mulch was used for weed control, exhibited less periderm formation than in the conventional and IPM best management treatments at HRS. A similar, but not significant, trend was evident at ARF. In previous years, a paler mid-summer leaf color and cooler soil temperatures were observed, and lower petiole nitrogen was reported to be associated with the straw mulch. A delayed residual nitrogen release under the mulch could account for the delay in periderm formation.

An assessment of bud injury prior to pruning revealed greater injury at HRS than at ARF (Table 2). Adjustments in the number of buds retained per pound of 1-yr-old trimmings was made when the bud injury exceeded 15% for American cultivars and 20% for French-American hybrid cultivars. Pruning weights and feet of established cordon per vine were a reflection of exposure to low temperatures and the extent of periderm formation between site and management system and cultivar hardiness within site (Table 2). Vines under organic-approved management had the lowest pruning weights at both sites and the fewest feet of established cordon at HRS but not at ARF. Based upon the feet of established cordon, Traminette, Jupiter, Chambourcin, Marquis, Seyval Blanc, and Vanessa have not adapted to the climatic conditions at HRS.

Vines at both sites were exposed to 2,4-D herbicide drift during the growing season (Table 2). The injury was more severe at ARF than at HRS. Among cultivars, the severity of injury observed followed a similar trend as reported in previous years, with Vanessa and Cynthiana vines at both sites and Marquis at ARF exhibiting the greatest injury, while Frontenac, La Crosse, Seyval Blanc, Vignole, and Chambourcin vines exhibited little or no injury.

The 2006 growing season was characterized by above normal temperatures in July and frequent rains during the harvest period. When testing for maturity on a weekly basis, SS often exhibited little change while TA declined. As a result, some harvest dates varied considerably between sites (Table 3). Based on TA, Cynthiana did not mature at either site. Because of greater winter bud injury and exposure to a spring frost, yields were lower at HRS than at ARF (Table 3). At ARF, organic-approved vines had lowest yields and cluster weighs, but not at HRS. At both sites, Mars, Frontenac, La Crosse, and St. Croix had high yields.

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Table 1. Significant minimum temperatures (^{o}F) recorded at the ISU Horticulture Research Station and Armstrong Research Farm during the study.

Date	HRS	ARF
Oct. 7, '02	26	31
Oct. 13 '02	28	29
Jan. 23, '03	-10	-14
Feb. 7, '03	-12	-9
Feb. 25, '03	-7	-7
Oct. 2, '03	26	30
Jan. 6, '04	-5	-11
Jan. 27-Feb. 1, '04	-12	-11
May 3,'04	28	32
Oct. 4, '04	29	28
Dec. 23, '05	-12	-9
Jan. 16, '05	-14	-11
Mar. 13, '05	10	12
Apr. 30-May 3, '05	24	29
Oct. 8, '05	26	28
Dec. 7-9, '05	-16	-10
Feb. 18, '06	-15	-10
Apr. 26, '06	28	38

Table 2. Periderm formation rating for 2005, 2006 Pruning weights, cordon establishment after pruning, primary bud survival, and 2,4-D injury rating for 15 grape cultivars in the 2002 grape cultivar by management system trial planted at the Horticulture Research Station (HRS) and the Armstrong Research Farm (ARF).

	2005		2006							
	Periderm formation[z]		% Primary bud injury		Pruning weight (lb)		Ft of Cordon per vine		2,4-D injury[y]	
Treatment	HRS	ARF	HRS	ARF	HRS	ARF	HRS	ARF	HRS	ARF
Management system										
Conventional	4.0	4.8	34	13	1.8	2.2	5.9	7.6	1.8	2.7
IPM/best mgmt	4.0	4.8	35	17	1.6	2.2	5.7	7.3	1.8	2.8
Organic-approved	3.0	4.6	34	13	1.2	2.0	4.9	7.3	1.6	2.5
LSD, P<.05	.18	ns	ns	ns	.2	.1	.4	ns	ns	.1
Cultivar										
Maréchal Foch	4.7	4.0	10	2	.7	.9	6.9	5.9	2.0	3.7
Frontenac	4.9	5.0	3	1	2.2	2.1	7.8	7.9	1.0	1.0
Cynthiana	3.2	4.8	45	3	1.9	1.8	6.5	7.1	3.4	4.0
St. Croix	4.8	5.0	13	9	2.3	2.5	7.7	7.9	1.0	1.9
Chambourcin[x]	3.5	4.9	93	57	1.2	2.7	2.2	7.3	1.0	1.0
Seyval Blanc[x]	3.3	4.6	84	34	1.4	2.3	4.7	7.4	1.0	1.0
La Crosse[x]	5.0	5.0	22	5	2.7	3.8	8.0	7.9	1.0	1.0
Vignole[x]	4.4	5.0	27	4	1.3	2.4	6.5	7.9	1.0	1.0
Traminette[x]	1.4	5.0	40	2	.6	3.0	.8	7.6	1.4	2.9
Edelweiss	4.4	5.0	21	2	1.9	2.8	7.6	7.9	1.3	3.1
Marquis	2.8	4.6	78	31	.9	1.6	2.4	6.6	2.1	4.1
Vanessa	4.5	4.6	99	12	.6	1.1	5.2	7.2	3.5	4.5
Reliance	4.4	4.4	72	19	1.7	1.7	7.4	7.0	1.6	3.2
Mars	4.8	4.9	42	10	2.8	2.6	7.2	8.0	2.1	3.2
Jupiter[w]	2.9	4.2	.	18	.9	1.1	1.0	7.1	2.4	2.9
LSD, P<.05	.3	.2	21	17	.3	.4	1.2	1.0	.4	.3

[z]Periderm rating scale 0–5: 0=none of the primary shoot was lignified; 1=1 to 20% of the shoot length was lignified; 2=21 to 40% lignified; 3=41 to 60% was lignified; 4=61 to 80% lignified; 5=81 to 100% lignified.

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

[x]Trained to VSP. [w]Planted in 2003.

Table 3. Fruit yield and harvest characteristics in 2006 for 15 grape cultivars in the 2002 grape cultivar by management system trial planted at the Horticulture Research Station (HRS) and the Armstrong Research Farm (ARF).

	ISU Horticulture Research Station						ISU Armstrong Research Farm					
Treatment	Harvest Date	% SS	pH	TA[z]	Yield (lb)	Cluster wt (lb)	Harvest Date	% SS	pH	TA[z]	Yield (lb)	Cluster wt (lb)
Management System												
Conventional					7.9	.32					19.9	.35
IPM/best mgmt					7.9	.30					20.5	.36
Organic-approved					6.5	.29					17.1	.33
LSD, P<.05					ns	ns					2.5	.02
Cultivar												
Maréchal Foch	8.24	19.0	3.45	10.6	9.2	.18	8.28	20.1	3.70	9.9	12.2	.17
Frontenac	9.19	22.4	3.26	10.5	21.3	.24	9.4	20.4	3.54	13.1	28.5	.24
Cynthiana	10.13	22.5	3.08	16.3	7.2	.15	10.9	23.0	3.81	17.1	10.5	.14
St. Croix	8.30	17.5	3.68	8.9	14.6	.26	8.25	17.2	3.52	9.3	23.0	.21
Chambourcin	10.4	22.0	.	.	.8	.53	10.9	22.6	3.81	12.8	14.9	.58
Seyval Blanc	8.30	19.5	3.40	7.1	3.0	.63	8.30	17.4	3.68	9.2	21.7	.51
La Crosse	9.13	17.8	3.26	8.0	16.9	.27	10.2	20.5	4.16	9.8	23.2	.18
Vignole	9.19	22.4	3.13	10.4	3.4	.17	9.25	23.1	3.56	13.4	10.2	.20
Traminette	9.13	18.4	3.33	8.6	.2	.19	9.25	19.3	3.61	8.4	22.3	.32
Edelweiss	8.16	14.0	3.21	10.0	8.1	.43	8.17	13.2	3.42	14.1	18.8	.32
Marquis	9.13	17.3	3.52	3.8	.7	.45	9.25	16.4	3.81	5.1	15.5	.49
Vanessa	8.24	20.0	3.56	3.9	.7	.25	8.24	19.0	3.77	5.4	11.2	.36
Reliance	8.16	18.0	3.30	7.0	4.5	.39	8.17	16.4	3.44	10.0	19.0	.48
Mars	8.28	15.7	3.23	6.6	18.9	.36	9.13	16.7	3.56	6.7	39.8	.46
Jupiter[x]	8.24	19.0	3.68	4.7	.7	.48	8.24	18.1	3.79	5.4	17.1	.61
LSD, P<.05					2.1	.10					4.5	.04

[z]Titratable acids reported in grams/liter.
[x]Planted in 2003.