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Grape Cultivar by Management System Trial Performance in 2007

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Abstract
To identify grape cultivars adapted to Iowa, a cultivar by management system trial was established in 2002 at the Iowa State University (ISU) Horticulture Research Station (HRS) and the ISU Armstrong Research Farm (ARF) with a grant from the Leopold Center of Sustainable Agriculture. Fifteen cultivars, including ten wine and five 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 2007 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 Iowa State University (ISU) Horticulture Research Station (HRS) and the ISU Armstrong Research Farm (ARF) with a grant from the Leopold Center of Sustainable Agriculture. Fifteen cultivars, including ten wine and five 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 2007 growing season.

Materials and Methods

The vines were spaced 8 × 10 ft apart (545 vines/A) with three vines/replication. Treatments were replicated five times at HRS and three times at ARF. 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 growth habit were being trained to the top wire, while those with a semi-upright to upright growth habit were trained to the mid-level wire with vertical shoot positioning (VSP) being practiced.

In mid March, five proximal (basal) buds on two to three canes per replication (10 to 15 buds) were dissected and examined for injury to determine if adjustments in pruning were needed. Following an April 7 freeze (Table 1) that occurred when bud development ranged from "scale crack" to "full swell," the procedure was repeated. Vines were pruned and the 1-year-old trimmings were weighed. Bud retention was based on pruning weight and adjusted for primary bud mortality when injury exceeded 15% for American cultivars and 20% for French-American hybrid cultivars. The length of established 2-year-old cordon was measured. Following bud break, shoots originating from primary buds were counted. During the growing season, vines at both sites were exposed to volatile (growth regulator) 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), initial pH, and titratable acids (TA). Time of harvest was based on these measurements, and fruit condition. At harvest, the number of clusters per vine were counted and weighed.

Results and Discussion

During the 2006–07 winter and spring, vines were exposed to three significant freezes (Table 1). Prior to the April freeze, injury was similar at both sites and was most severe on Chambourcin which is the least cold hardy cultivar in the trial (data not shown). Generally, the trend was for less bud injury on the hardier cultivars than those classified as being "moderately hardy." Following the April freeze, there was a trend for earlier bud breaking cultivars to exhibit greater injury than the later bud breaking ones (Table 2). Within cultivars, greatest injury most often occurred at ARF, which had been exposed to warmer

temperatures based on growing degree day accumulations since March 1 (Table 1). The number of primary shoots per foot of cordon, for which the optimum range is 4 to 6, tended to reflect the extent of primary bud injury recorded at the sites (Table 2). No differences between management systems were evident for bud injury or primary shoot development.

Based on pruning weights, vines grew better at ARF than HRS in 2006 (Table 2). Cultivars that appear to be very vigorous at both sites include La Crosse, Mars, and Edelweiss. Chambourcin, Vignole, and Traminette exhibited high vigor at ARF but not at HRS. This is attributed to differences in cultivar adaptation between the sites, and is reflected by differences in the amount of cordon establishment for these cultivars (Table 2). Over the duration of this study, vines at HRS have been exposed to earlier first fall frosts and colder temperatures, and these cultivars, as well as Marquis, Vanessa, and Jupiter have experienced the greatest injury. Between management systems, vines in the organic-approved system had the lowest pruning weights and established cordon lengths at HRS but not at ARF.

Vines at both sites were exposed to growth regulator herbicide drift during the growing season (Table 2). The injury was most severe at ARF and occurred earlier in the season than in previous years (*See the report on the Wine Grape Cultivar Trial*). Between cultivars, Maréchal Foch and Cynthiana exhibited the greatest injury at both sites. The severity of injury among cultivars followed a similar trend as in previous years with the exception of Frontenac and St. Croix at ARF. In previous years, these two cultivars had exhibited little or no injury. Symptoms of dicamba injury were present in the plot, and a similar trend was observed in the wine grape cultivar trial at the ISU Northeast Research Farm, Nashua.

The 2007 growing season was characterized by above normal temperatures and frequent rains during the harvest period. The ARF site accumulated more growing degree days and number of days when the temperature was above 86^{o}F than HRS (Table 1). With differences in temperatures and condition of the grapes, harvest dates varied some between sites (Tables 3). Often the determining factor to harvest at ARF was the high initial pH of the juice. Yields per vine and average cluster weight were generally lower than recorded in 2006 and reflected the bud injury associated with the freezes. With the exception of the less cold hardy cultivars, yields per vine were generally higher at HRS. For an American-type cultivar, Mars exhibited an exceptional ability to produce a crop on shoots derived from secondary buds. At both sites, the lowest yields and average cluster weights occurred in the organic-approved management system.

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Table 1. Significant minimum temperatures (°F) recorded during the 2006–07 winter and spring at the ISU Horticulture Research Station and Armstrong Research Farm, and accumulated growing degree days prior to the April 7 (Julian day 97) freeze and for the growing season.

Date	HRS	ARF
Minimum temperatures (°F):		
Jan. 16–17	-13.5	-12.0
Feb. 4–14	-10.9	-8.5
April 7	12.0	14.5
Growing degree days (base 50 °F, cap 86 °F)		
Mar. 1 to Apr. 7	131	183
May 1 to Oct 1[z]	3086	3148
Departure from Avg.	+255	+293
Days above 86 °F	33	37

[z]From the ISU Ag Climate Network.

Table 2. Primary bud survival, pruning weight, feet of established cordon, primary shoot density, and growth regulator herbicide injury ratings in 2007 for 15 grape cultivars in the ISU 2002 grape cultivar by management system trial planted at the Horticulture Research Station (HRS) and the Armstrong Research Farm (ARF).

	% Primary bud injury		Pruning wt (lb)		Ft of cordon per vine		Primary shoots/ft		Bud break	Herbicide injury rating[y]	
Treatment	HRS	ARF	HRS	ARF	HRS	ARF	HRS	ARF	at HRS[z]	HRS	ARF
Management system											
Conventional	45	67	2.2	2.4	4.8	7.6	1.9	2.7	118	1.4	3.4
IPM/best mgmt	44	62	2.0	2.6	4.8	7.4	1.9	2.5	118	1.3	3.4
Organic-approved	50	69	1.4	2.6	4.3	7.2	1.8	2.3	118	1.3	3.4
LSD, P <. 05	ns	ns	.3	.1	.3	ns	ns	ns	ns	ns	ns
Cultivar											
Maréchal Foch	86	93	.9	1.0	5.7	6.7	.9	1.5	114	2.1	5.0
Frontenac	6	22	1.3	1.6	7.7	7.8	3.9	5.1	116	1.0	3.0
Cynthiana	29	31	2.0	3.2	6.3	7.2	3.2	3.6	120	2.7	5.0
St. Croix	53	90	2.0	2.6	7.4	8.0	2.7	2.4	117	1.0	3.5
Chambourcin[x]	90	89	2.4	4.0	.7	7.2	.3	.9	124	1.0	2.1
Seyval Blanc[x]	76	94	2.2	2.6	2.6	7.0	1.2	3.0	119	1.0	2.0
La Crosse[x]	27	35	2.7	3.5	7.8	7.9	3.3	4.1	116	1.0	2.4
Vignole[x]	18	31	1.7	4.0	5.7	7.9	2.2	3.7	120	1.0	2.0
Traminette[x]	25	51	1.2	3.4	.6	6.9	1.0	2.6	121	1.3	3.6
Edelweiss	80	97	2.4	2.7	7.2	7.6	1.4	1.0	114	1.8	3.3
Marquis	73	80	1.5	1.3	1.1	7.0	1.0	1.3	119	1.4	4.3
Vanessa	67	83	1.7	1.3	1.7	6.7	.6	1.4	120	1.7	4.6
Reliance	58	60	1.9	1.7	6.7	7.7	2.1	2.6	118	1.1	3.6
Mars	35	70	2.5	2.8	6.7	7.8	2.5	2.3	117	1.4	3.1
Jupiter[w]	.	78	1.3	2.2	.4	7.6	.5	2.1	119	1.5	4.1
LSD, P <. 05	19	12	.5	.6	1.0	1.0	.4	.4	.8	.2	.3

[z]Julian date; 114 = April 24, 2007

[y]Herbicide injury scale 1-6: 1=no apparent injury; 2=slight symptoms of abnormal venation; 3=moderate; 4=severe; 5=very severe; 6=extremely severe.

[x]Trained to VSP.

[w]Planted in 2003.

Table 3. Fruit yield and harvest characteristics in 2007 for 15 grape cultivars in the ISU 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[y]	TA[z]	Yield (lb)	Cluster wt (lb)	Harvest date	% SS	pH	TA[z]	Yield (lb)	Cluster wt (lb)
Management System												
Conventional					12.3	.35					13.4	.27
IPM/best mgmt					11.3	.33					13.2	.29
Organic-approved					9.1	.31					9.4	.24
LSD, P <. 05					.9	.02					1.5	.02
Cultivar												
Maréchal Foch	8/21	20.2	3.54	8.9	8.6	.18	8/28	20.5	3.75	9.3	5.2	.10
Frontenac	9/6	22.2	.	12.2	20.2	.25	9/5	23.6	3.63	12.6	17.7	.19
Cynthiana	10/1	21.0	.	13.2	14.5	.16	9/24	22.5	3.37	16.4	10.4	.10
St. Croix	8/21	17.0	3.49	9.0	17.0	.23	8/28	17.1	3.84	7.7	7.4	.17
Chambourcin	9/27	22.0	.	10.6	3.2	.36	9/24	21.0	3.41	11.1	12.4	.62
Seyval Blanc	8/21	19.8	3.36	7.9	9.8	.52	8/19	19.0	3.56	8.7	18.9	.46
La Crosse	9/6	17.1	.	9.3	23.2	.26	8/30	15.1	3.63	10.1	26.0	.24
Vignole	9/4	20.0	.	12.0	10.6	.19	8/30	18.1	3.33	1.1	16.6	.20
Traminette	9/11	18.0	3.41	7.9	1.5	.18	9/17	20.5	3.61	7.9	15.1	.29
Edelweiss	8/16	14.6	3.22	10.1	11.0	.41	8/19	14.5	3.63	8.9	4.7	.28
Marquis	8/29	17.1	.	.	8.5	.65	9/5	17.1	3.76	5.9	9.1	.33
Vanessa	8/7	17.5	.	.	2.6	.23	8/14	18.1	3.52	6.9	4.2	.16
Reliance	8/7	16.2	.	.	9.2	.51	8/13	20.0	3.56	9.5	4.4	.23
Mars	8/29	17.7	.	.	19.1	.48	9/5	18.5	3.59	7.1	12.7	.32
Jupiter[x]	8/7	16.8	.	.	2.6	.33	8.15	18.1	3.72	6.3	15.0	.34
LSD, P < .05					2.8	.05					2.6	.04

[z]Titratable acids reported in grams/liter.
[y]Missing data for the wine cultivars occurred when the auto temperature compensator on the pH meter malfunctioned.
[x]Planted in 2003.