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'Corot noir'TM Grape

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'Corot noir'TM (pronounced "kor-oh nwahr") is a mid to late season red wine grape suitable for either blending or the production of varietal wines. The wine has a deep red color and attractive cherry and berry fruit aromas. Its tannin structure is complete from the front of the mouth to the back, with big soft tannins. The vine is moderately winter hardy and moderately resistant to fungal diseases.



ORIGIN

'Corot noir'TM was developed by the grape breeding program at Cornell University, New York State Agricultural Experiment Station. It is a complex interspecific hybrid red wine grape resulting from a cross made in 1970 between Seyve Villard 18-307 and 'Steuben' (**Fig. 1**). From 250 seeds, 160 seedlings were grown in a nursery then transplanted to a seedling vineyard in 1975. Thirty-three seedlings were fermented for evaluation of wine characteristics, and about fifteen were propagated for further testing. Since its initial test for wine characteristics in 1978, it has been identified as test selection NY70.0809.10. 'Corot noir' has been available for testing by growers and research cooperators since 1994.

DESCRIPTION

Own-rooted vines grown in phylloxera (*Daktulosphaira vitifoliae* Fitch) infested soils have been long-lived and vigorous. To date, there have been no indications that grafting onto rootstocks is necessary, but caution should be exercised in soils where phylloxera is more of a problem than in the Finger Lakes of New York.

Vines of 'Corot noir' have been observed in plantings at the New York State Agricultural Experiment Station and information on productivity, diseases, pests, and viticultural traits has been recorded. In comparison with two other varieties grown in this region ('Concord' and 'GR 7'), 'Corot noir' is very productive. Vine size is smaller but still acceptable (**Table 1**). Cold damage

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Table 1. Observations of vines grown at Geneva, New York, 1996-2005.

Cultivar	Cane pruning weight (lbs/vine)	Cluster weight (lbs.)	Berry weight (gm)	Fruit yield (lbs/vine)
Corot noir	3.1	0.41	2.09	19.1
Noiret	3.3	0.35	3.25	12.4
GR 7	4.2	0.31	1.54	33.4
Concord	4.5	0.25	3.19	16.7

resulted in slightly reduced 'Corot noir'TM fruit yields in 2004 and 2005, but 'Concord' and 'GR 7' were unaffected. 'Corot noir' produced 18 and 15 lbs. fruit/vine in 2004 and 2005, respectively. Between 2001 and 2003 (years during which cold damage was negligible), fruit yields of 'Corot noir' exceeded 'Concord' yields, measuring more than 25 lbs./vine each year. 'Corot noir' avoids crop reduction due to both the hardiness of buds and trunks, as well as its ability to produce crop on secondary shoots. However, crop production from secondary shoots also necessitates cluster thinning in most years. The berries are comparable to 'Concord' in weight, but the clusters are larger (**Table 1**). The vine growth habit ranges from semi-upright to semi-trailing.

Powdery mildew (*Uncinula necator*) is only a problem when conditions are highly conducive to disease development, and Botrytis is rare. Downy mildew (*Plasmopara viticola*) on leaves can be an occasional problem when disease pressure is severe. 'Corot noir' is rated as slightly susceptible to powdery mildew, black rot (*Guignardia bidwellii*), and Botrytis, and moderately susceptible to downy mildew. Sulfur can be used for powdery mildew control, but should be alternated with other materials. Sulfur phytotoxicity has not been observed, however, sulfur applications should be avoided in hot weather. The overall level of disease observed is less than other interspecific hybrid grapes, and

much less than observed with European grapes (*V. vinifera*). Under a disease control program usually used for interspecific hybrid grapes, there should be no special disease concerns, though additional sprays for downy mildew may be needed on occasion.

Budbreak usually takes place late relative to many other cultivars, following 'Concord' and 'GR 7'. Spring frost is not usually a problem. Bloom also takes place late, 3–7 days after 'Concord'. Fruit are harvested between early and mid October in the Finger Lakes region. Growers have had no special problems with machine harvesting, though more force is needed for berry removal than for 'Noiret'.

Vines are moderately winter hardy, ranking 'Corot noir' among the better French-American hybrids. At Geneva, some trunks have been killed or show symptoms of crown gall disease after very cold winters, but most trunks have not been damaged. Though considered to be hardier than *V. vinifera* varieties, 'Corot noir' is hardier than some interspecific hybrid cultivars ('Chambourcin' and 'Cayuga White'), but not as hardy as riparia-based cultivars like 'Marechal Foch' and 'Frontenac'. Between 1996 and 2005, mid-winter primary bud cold hardiness was measured by differential thermal analysis (Pool et al. 1990). The predicted temperature of 50% primary bud kill (LTE₅₀) for 'Corot noir' was –15.1 F. During the same period, the LTE₅₀ for 'Concord', 'GR 7' and 'Cayuga

Figure 1. Pedigree of Corot noir grape.

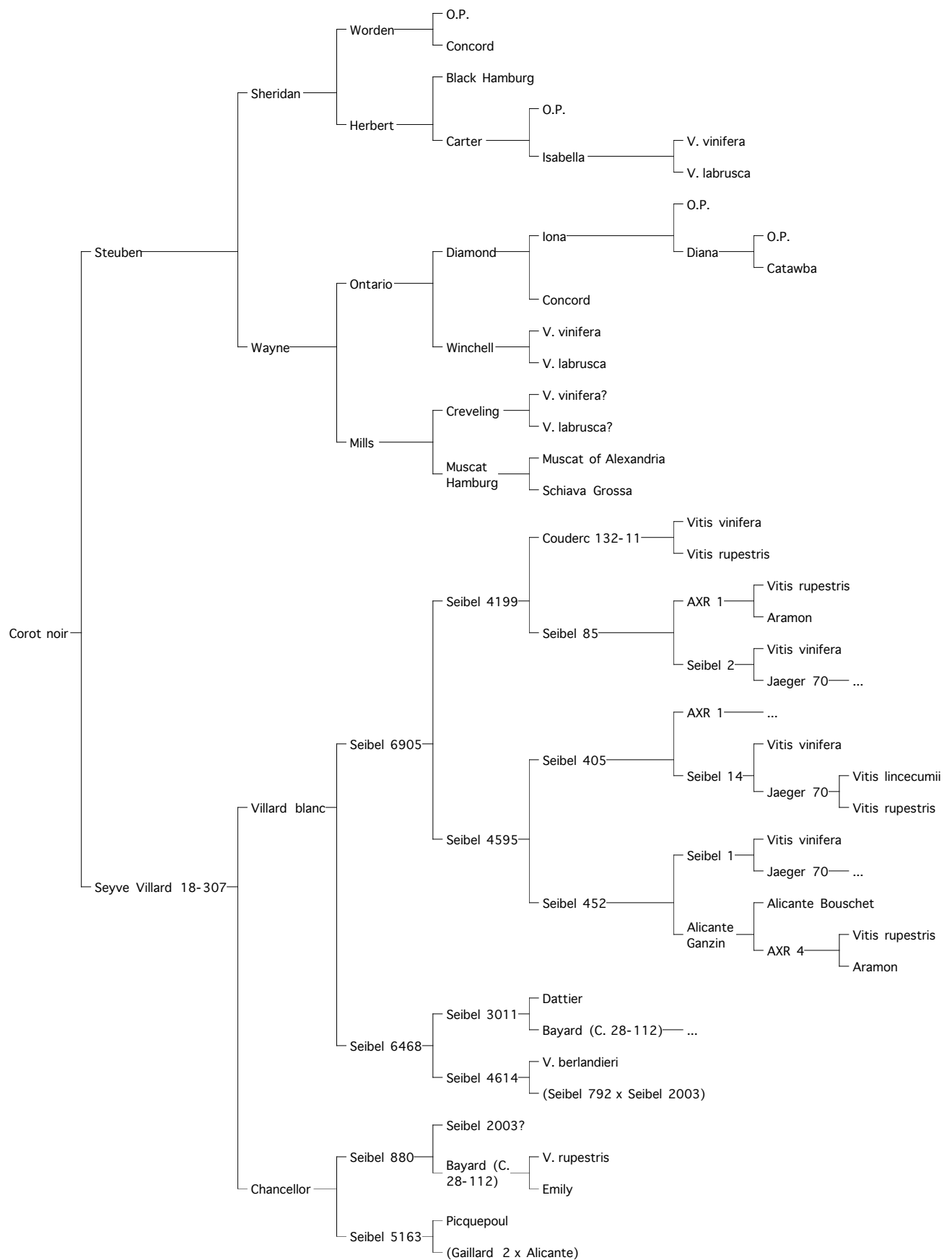


Table 2. Wine and juice analyses for Corot noir™, Noiret™, and additional red wine varieties, 1999-2005.

Variety	Yeast / Treatment	Date of Harvest	JUICE ANALYSES					WINE ANALYSES (after ML & cold stb., before TA adjustments)			
			Brix	pH	TA g/L	Tartrate g/L	Malate g/L	pH	TA g/L	Tartrate g/L	Malate g/L
Noiret	GRE/20°C constant/ML Alpha	4-Oct-05	19.0	3.52	9.2	6.4	3.9	3.63	5.9	3.4	-0.1
Corot noir	GRE/Std. Curve/ML Alpha	19-Oct-05	19.3	3.51	7.4	4.8	2.8	3.82	5.2	3.2	-0.1
GR 7	HP/EC118/ML Alpha	14-Sep-05	18.7	3.17	14.7	7.2	6.9	3.80	6.1	3.7	0.2
Cabernet Franc	BM45/Modified Std/ML Alpha	19-Oct-05	21.4	3.36	9.0	4.8	3.9	3.48	6.5	3.2	***
Lemberger	GRE Std. Temp.	19-Sep-05	20.5	3.08	8.7	5.2	2.2	3.22	6.9	3.7	-0.9
Pinot noir Cl. 667	L2056/Std. curve /ML Alpha	23-Sep-05	21.7	3.45	8.6	4.5	3.6	3.96	5.4	2.7	0.1
Corot noir	GRE/std. temps/Alpha	11-Oct-04	16.6	3.41	8.4	***	***	3.73	5.7	2.9	0.3
Noiret	HP/GRE/ML Alpha	28-Sep-04	16.6	3.30	12.8	***	***	3.46	6.4	3.9	-0.8
Noiret	GRE/std. temp/Alpha	11-Oct-04	18.7	3.31	10.7	***	***	3.57	7.4	4.3	-0.2
GR 7	HP/GRE/ML Alpha	28-Sep-04	17.4	3.11	12.1	***	***	3.84	5.5	3.9	0.4
Cabernet Franc	GRE/Std. temp/Alpha	13-Oct-04	20.3	3.31	8.6	***	***	3.68	5.3	3.1	-0.3
Corot noir	EC118/HP	14-Oct-03	16.8	3.10	9.1	***	***	***	10.2	3.2	4.3
Corot noir	EC118/HP/ML Alpha	14-Oct-03	16.8	3.10	9.1	***	***	3.63	6.7	***	***
Corot noir	EC118/HP	4-Nov-03	16.5	3.31	14.1	***	***	***	9.7	3.5	4.5
Corot noir	EC118/HP/ML Alpha	4-Nov-03	16.5	3.31	14.1	***	***	3.66	6.0	***	***
Noiret	EC118/FS/ML Alpha	21-Oct-03	18.4	3.12	13.4	***	***	3.33	9.0	***	***
Noiret	EC118/FS	21-Oct-03	18.4	3.12	13.4	***	***	3.10	13.0	***	***
Noiret	EC118/HP/ML Alpha	21-Oct-03	18.4	3.12	13.4	***	***	3.47	8.3	***	***
Noiret	EC118/HP	21-Oct-03	18.4	3.12	13.4	***	***	***	12.8	4.3	5.5
Pinot Noir (clone mix)	GRE/FS/ML Alpha	1-Oct-03	21.4	3.27	13.8	***	***	3.76	6.4	3.9	0.0
Cabernet Sauvignon	BRL97/FS/ML Alpha	14-Oct-03	19.4	3.08	9.7	***	***	3.20	***	***	***
Noiret	EC118/FS/ML Alpha	8-Oct-02	20.0	3.14	7.8	***	***	3.36	7.4	***	***
Noiret	EC118/FS	8-Oct-02	20.0	3.14	7.8	***	***	3.26	8.6	***	***
Noiret	EC118/HP/ML Alpha	8-Oct-02	20.0	3.14	7.8	***	***	3.55	6.2	***	***
Noiret	EC118/HP	8-Oct-02	20.0	3.14	7.8	***	***	3.42	7.6	***	***
Corot noir	EC118/HP	15-Oct-02	19.0	3.22	7.2	***	***	3.58	6.9	***	***
Corot noir	EC118/HP/ML Alpha	15-Oct-02	19.0	3.22	7.2	***	***	3.70	5.4	***	***
Lemberger	BRL97/FS/ML Alpha	15-Oct-02	22.8	3.36	6.5	***	***	3.64	6.9	***	***
Pinot noir clone blend	AMH/FS@25 C/ML Alpha	24-Sep-02	22.0	3.34	8.0	***	***	3.86	5.0	***	***
Corot noir	EC118/FS	3-Oct-01	17.8	3.33	8.9	2.7	1.4	3.58	7.1	1.6	0.2
Corot noir	EC118/FS/ML	3-Oct-01	17.8	3.33	8.9	2.7	1.4	3.55	6.9	3.9	0.3
Corot noir	EC118/FS	18-Oct-01	18.4	3.45	7.3	5.8	2.8	3.49	7.4	2.2	1.0
Corot noir	EC118/FS/ML	18-Oct-01	18.4	3.45	7.3	5.8	2.8	***	***	***	***
Noiret	EC118/FS	2-Oct-01	19.8	3.27	9.5	4.9	2.0	3.26	10.2	3.8	2.4
Noiret	EC118/FS/ML	2-Oct-01	19.8	3.27	9.5	4.9	2.0	3.45	7.9	5.4	0.2
GR7	EC118/HP	18-Sep-01	20.8	3.38	12.7	5.5	3.5	3.64	10.9	2.6	5.2
Cabernet Franc	GRE/FS/ML	22-24-Oct-01	***	***	***	***	***	3.46	6.9	4.4	0.8
Pinot noir cl. 113	AMH/FS/ML	9-Oct-01	23.8	3.49	7.7	6.8	2.8	3.66	5.7	3.2	<0.1
Pinot noir cl. 115	AMH/FS/ML	9-Oct-01	21.8	3.52	7.4	6.6	2.9	3.71	5.5	3.0	<0.1
Lemberger	Syrah/FS/ML	17-Oct-01	23.4	3.43	7.5	6.1	2.3	3.54	6.2	3.9	<0.1
Corot noir	EC118/FS	31-Oct-00	18.0	3.14	8.7	5.9	3.9	3.48	9.0	2.7	3.9
Corot noir	EC118/HP	31-Oct-00	18.0	3.14	8.7	5.9	3.9	3.43	9.3	3.8	3.4
Noiret	EC118/FS	19-Oct-00	19.2	2.89	11.6	***	***	3.13	12.6	3.2	4.3
Lemberger	Syrah/ML	31-Oct-00	20.8	3.03	8.7	7.3	3.3	3.67	5.6	2.1	0.2
Cabernet Franc	AMH/FS/ML	24-Oct-00	19.4	3.10	10.0	6.8	4.8	3.61	6.1	1.3	0.2
Pinot noir clone blend	RC212/FS/ML	17-Oct-00	22.2	3.03	10.7	7.4	5.3	3.64	6.1	1.1	0.2
Corot noir	AMH/FS/ML-M	5-Oct-99	19.0	3.17	5.9	***	***	3.53	6.5	1.9	>0.05
Corot noir	AMH/HP/ML-M	5-Oct-99	19.0	3.17	5.9	***	***	3.69	5.3	2.2	0.1
Noiret	AMH/FS/ML-EQ54	27-Sep-99	20.4	2.91	7.5	***	***	3.20	8.0	2.6	<0.01
GR7	EC118/HP	9-Sep-99	19.6	3.11	10.4	***	***	3.58	8.8	2.3	4.2
Pinot noir clone 115	AMH/FS/ML-M	20-Sep-99	21.0	3.54	7.0	6.1	1.5	3.40	5.7	1.7	0.0
Pinot Noir clone blend	AMH/FS/ML-M	24-Sep-99	~22	3.23	7.8	***	***	3.83	4.6	1.0	0.0
Lemberger	AMH/FS/ML-EQ54	6-Oct-99	23.0	3.09	7.9	***	***	3.57	5.5	1.8	>0.05
Cab. Franc	GRE/FS/ML-EQ54	12-Oct-99	23.0	3.13	7.3	***	***	3.30	6.3	2.4	<0.20

Abbreviations used: HP = hot pressed at 65 C, 20 min; FS = fermented on the skins; ML = malolactic fermentation.

White' were -17.9 F, -16.7 F, and -11.8 F, respectively. Following severe winter temperatures (-14 to -17 F) in 2003/04 and 2004/05, Geneva grown own rooted vines remained productive, with only 25 to 30% shootless nodes.

To explore the potential wine flavors of 'Corot noir', it was vinified with various fermentation temperature profiles and with several different yeasts. All fermentations were carried out in 120L stainless steel tanks with automatic temperature control. The fruit were crushed into the tanks and inoculated with selected yeast starter cultures. After completion of alcoholic fermentation the wines were pressed and inoculated for malolactic fermentation with the same ML culture (Alpha) and allowed to complete MLF in 18L and in 12L glass carboys. Fermentation temperature profiles explored over the past 5 years:

- (i) Standard temperature profile started at 20 C with a rapid increase to a maximum of 35 C by day 3 and subsequent slow cooling to 30, then 25, and finally 20 C by the end of fermentation.
- (ii) Late heat spike in which the fermentations was started at 20 C and slowly allowed to warm to 30 C at the end of fermentation at which time the wine was heated to 40 C and held at this temperature for 2 days.
- (iii) Constant fermentation temperature of 25 C.
- (iv) Constant fermentation temperature of 20 C.

Several wine yeasts, including GRE, D254, BM45, AMH, and RC212 were compared at either a constant 25 C fermentation temperature (i) or at the standard fermentation temperature profile (ii).

In 2004 (a cool year), the ripest fruit flavors (absence of unripe, green flavors) and good tannins and mouthfeel were found in the version with the late heat spike, second in the version with constant 25 C and

the yeast GRE. The other yeasts and other temperatures produced thinner, greener, less preferred wines. A careful analysis of these results shows how important it is to match the wine processing technique to the cultivar (and the year). Among the fermentation temperatures evaluated, the preferred wines were from either the standard fermentation temperature profile (i) or from the late heat spike (ii). 'Corot noir' tends to have big round tannins, somewhat lumpy, with a shorter aftertaste than 'Noiret'. The aroma profile of 'Corot noir' tends to exhibit strong cherry and some plum aromas.

'Corot noir' also makes attractive soft red wines when the grapes are hot pressed (destemmed and heated to 65 C for 15 minutes with slow cooling, then pressed and inoculated with a selected yeast culture). These wines have attractive berry and cherry fruit aromas and a soft, round mouthfeel.

VITICULTURAL PERFORMANCE IN INDIANA

As an indication of performance outside New York State, we include here some information about the performance of 'Corot noir' in trials run by Purdue University. 'Corot noir' has been tested at 3 locations in Indiana; Vincennes (Southwest), Butlerville (Southeast) and West Lafayette (West Central). Vines were planted between 1994 and 1996. 'Corot noir' has performed very well at all locations (**Tables 3 - 5**). Vine size tends to be a bit small, but is acceptable. Yields have been moderately high. It produces large clusters of moderately sized berries. Fruit quality has been very good. Unlike many commonly grown red hybrids, 'Corot noir'TM tends to have low acidity and low pH. Titratable acidity levels at harvest are about 2 g/L less than other red hybrids. Wines lack the pronounced hybrid character of reds such as 'Foch' and 'Chancellor'. Fruit are normally harvested in early September in Southwest

Indiana and mid September in West Central Indiana.

On deep fertile soils, 'Corot noir'TM can be excessively vegetative, leading to the production of abundant secondary and tertiary clusters.

Disease resistance of 'Corot noir' is good. It is only slightly susceptible to black rot and powdery mildew. It is, however, susceptible to downy mildew, and when conditions are conducive, downy mildew can lead to severe defoliation. Fruit rots have not been a problem with 'Corot noir'.

'Corot noir' is moderately cold hardy under Indiana conditions. Following -15 F low in 2003, 'Corot noir' had 58% live buds, while 'Concord' had 81%, and 'Noiret' had 93% live buds. Fall dieback of canes has been noted in some years. 'Corot noir' buds out relatively late and spring frost damage has not been a problem.

OVERALL RECOMMENDATION

'Corot noir' represents a distinct improvement in the red wine varietal options available to cold climate grape growers. Wines are free of the hybrid aromas typical of many other red hybrid grapes, and can be used for either varietal wine production or for blending.

AVAILABILITY

Vines of 'Corot noir' are available from licensed commercial nurseries; contact B.I. Reisch <bir1@nysaes.cornell.edu> for a list of sources. Commercial nurseries should contact Cornell Research Foundation, 20 Thornwood Drive, Suite 105, Ithaca New York 14850 (phone: 607-257-1081; fax: 607-257-1015; email <des33@cornell.edu>; internet: <<http://www.cctec.cornell.edu/>>) for a license to propagate and distribute 'Corot noir'. Virus-tested cuttings may be obtained from Foundation Plant Services, University of California, One Shields Avenue, Davis, California 95616-8600 (phone: 530-752-3590; fax: 530-752-2132; email <fps@ucdavis.edu>; internet: <<http://fps.ucdavis.edu/>>).

Table 3. Performance of grape cultivars at Vincennes, IN (SW), 2000-2005.

Cultivar	Cane pruning weight (lbs./vine)	Cluster weight (lbs.)	Berry weight (gm)	Fruit yield (lbs./vine)
Corot noir	1.3	0.45	2.4	20.1
Noiret	2.7	0.43	2.0	20.2
Concord	3.8	0.31	3.6	26.6
Chancellor	1.9	0.27	1.7	18.3
Foch	2.1	0.21	1.2	25.3
Norton	3.1	0.19	1.1	17.8

Table 4. Performance of grape cultivars at Butlerville, IN (SE), 2001-2004.

Cultivar	Cane pruning weight (lbs./vine)	Cluster weight (lbs.)	Berry weight (gm)	Fruit yield (lbs./vine)
Corot noir	0.9	0.24	1.8	11.3
Concord	5.4	0.26	3.2	37.0
Foch	1.1	0.16	1.1	14.8
Norton	3.3	0.18	1.0	15.1

Table 5. Performance of grape cultivars at West Lafayette, IN (WC), 1996-2005.

Cultivar	Cane pruning weight (lbs./vine)	Cluster weight (lbs.)	Berry weight (gm)	Fruit yield (lbs./vine)
Corot noir	1.1	0.29	2.2	16.3
Noiret	2.2	0.34	2.1	14.1
GR 7	0.8	0.17	1.4	13.3
Concord	2.0	0.19	3.0	24.5

LITERATURE CITED

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1990. Use of differential thermal analysis to quantify bud cold hardiness of grape selections and clones. *Vitis* (special issue) Proc. 5th Int. Symp. Grape Breeding 318-329.

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