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Performance of Selected Grape Cultivars Under Marginal Climatic Conditions in Tennessee. II. American Type.

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Twelve American type *(Vitis labrusca, L.)* cultivars were evaluated concurrently with the French hybrid cultivars. Climatic and cultural data were the same as given in part I.

In previous studies in Tennessee, American type cultivars excluding seedless ones were more productive and had higher yields than did French hybrid cultivars (3). Those recommended for production in Tennessee are Concord, Fredonia, Niagara, and Delaware; all American type (5).

Concord is reported to account for 80 to 90% of all production of American type cultivars (6). Although several other American type cultivars have desirable fruit characteristics, Concord is reported as most popular as it is widely adapted, vigorous, hardy, and easily trained (1). Only American type cultivars are recommended for areas having 140 to 150 frost free days in Washington (6). However, 150 to 170 frost free days are optimum for American type cultivars (6).

Oberle (4) released four American type cultivars, Alwood, Moored, Monticello, and Price, which he found to be hardy in the mountainous areas of Virginia. These cultivars had not been tested extensively when this study was initiated and were so included.

PROCEDURE

One year old plants were set at the University of Tennessee Plateau Experiment Station at Crossville in the spring of 1973. Plot design was a randomized complete block with four replications of three vine plots. Cultivars tested were Concord, Moored, Alwood, Van Buren, Niagara, Catawba, Bath, Fredonia, Moore's Early, Monticello, Yates, and Price. Plants were set 2.4 m apart in 3.0 m rows.

The training system used was a modification of the four cane Kniffin system. The modification consisted of two main trunks for each plant to help offset potential winter damage. Pruning was generally to 10 buds per cane with 12 buds per cane on more vigorous hardy plants. The less hardy vines had more severe pruning as some of the fruiting canes had considerable cane die-back. Balanced pruning was not attempted but, perhaps, the more hardy cultivars would have benefited if pruned to this concept.

At harvest, fruit color, flavor, the degree of insect damage, and firmness and other physical conditions of the

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berries were recorded. Clusters were counted and weighed. A cluster was considered to consist of two or more berries. Flavor ratings were made for each cultivar on a 1 to 5 scale. The field staff evaluated each cultivar as it was harvested in the field. Injury ratings were attempted but it was difficult to assess the extent of winter damage visually and relate it to yields so these data are not reported.

RESULTS

Concord was the highest yielding cultivar tested averaging 10.8 MT/ha (Table 1). Concord was reported to be the highest yielding cultivar in other eastern trials, but yield levels in those trials were generally higher than 10.8 MT/ha (2). Although uneven ripening is often a problem with Concord grown in warm sites (1), it was not evident in this test. Moored and Alwood produced almost as well as Concord. The nine other cultivars had lower yields. Van Buren, Niagara, and Catawba produced an average yield of 7.6 MT/ha. Vines of Bath, Fredonia, Moore's Early, Monticello, Yates, and Price yielded less than 6.7 MT/ha. Monticello and Yates vines exhibited moderate, and Price vines exhibited severe, winter injury symptoms. They lacked vigor and were unproductive. Yields were highest in 1975, lowest in 1976, and intermediate in 1977 and 1978. Minimum winter temperatures did not correspond to mean annual yields for the 12 cultivars. Fluctuating temperatures and early fall freezes may have been more closely associated with yield.

Table 2 shows that the climatic conditions were quite different each year. The last spring freeze date varied from April 7 to May 4. Date of the first fall freeze varied from October 8 to November 13. The heat units varied from 2,445 to 3,210 with 159 to 214 freeze free days recorded within the four years. This was within the desirable range for American type grapes in Washington (6). With the wide climatic fluctuations, harvest date varied 13 days due to year. Most cultivars had six to seven weeks between harvest and the first fall freeze.

Average harvest date ranged from August 10 for Moore's Early and Price, to September 12 for Catawba. Yates

Table 1. Yield of 12 American type grape cultivars, Plateau Experiment Station, 1975 - 1978.

Cultivar	Year 1975	1976	1977	1978	Mean
			metric tons/hectare		
Concord	14.8 a[1]	7.6 a	10.1 ab	11.0 ab	10.8 a
Moored	13.4 b	4.7 bcd	9.6 abc	12.1 a	9.9 ab
Alwood	11.9 c	5.8 abc	11.0 a	10.1 abc	9.6 ab
Van Buren	13.0 b	2.5 ef	7.2 bcd	8.1 cde	7.6 bc
Niagara	13.0 b	2.7 def	6.3 cde	8.3 bcd	7.6 bc
Catawba	10.1 d	4.5 bcde	4.9 defg	10.5 abc	7.6 bc
Bath	8.5 e	6.7 ab	5.6 def	6.1 def	6.7 cd
Moore's Early	7.4 f	2.2 ef	7.0 bcd	4.5 fg	5.4 cde
Fredonia	6.1 g	2.2 ef	4.0 defg	8.7 bcd	5.4 cde
Monticello	8.3 e	3.4 cdef	2.0 fg	5.4 ef	4.7 defg
Yates	1.8 h	2.0 ef	1.3 g	5.4 ef	2.7 fg
Price	2.2 h	1.1 f	3.4 efg	1.8 g	2.2 g
Mean	9.2	3.8	6.1	7.6	6.7

[1]Mean separation within columns by Duncan's multiple range test, 5% level.

also matured in September with an average harvest date of September 7. It is suspected that Yates and Catawba might not have matured as well as the other cultivars since night temperatures would have been relatively low in September.

The number of clusters per vine varied from 112 for Concord to 25 for Price (Table 3). A linear correlation analysis was calculated and an r value of 0.98 was found between number of clusters per vine and yield per vine. Apparently yields of these cultivars would have been increased by any method that increased cluster number per vine. Although pruning to the balanced system might increase yields

Table 2. Characteristics of grape growing seasons, Plateau Experiment Station, 1975 - 1978.

Year	Last spring freeze date	°C.	First fall freeze date	°C.	Freeze free days	Heat units 50°F (10° C) base	Mean harvest date—all cultivars
1975	April 13	0	November 13	0	214	3,210	August 21
1976	May 4	−1	October 10	0	159	2,445	August 27
1977	April 7	−1	October 12	0	188	3,362	August 14
1978	April 22	0	October 8	0	169	2,963	August 24
Mean	April 19	0	October 15	0	182	2,995	August 22

Table 3. Effect of grape cultivar on fruit characteristics, Plateau Experiment Station, 1975 - 1978.

Cultivar	Mean harvest date	No. clusters/ plant	Wt./ cluster (g)	Flavor rating[1]	Black rot rating
Concord	Aug. 28	112 a[1]	73 ab	4.0 c	4.6 bc
Moored	Aug. 16	106 ab	68 abc	4.2 c	4.7 abc
Alwood	Aug. 17	98 ab	73 ab	4.8 ab	4.9 ab
Van Buren	Aug. 21	87 abc	64 abc	4.4 bc	4.7 abc
Niagara	Aug. 26	68 cd	82 a	5.0 a	3.7 d
Catawba	Sept. 12	80 bc	73 ab	3.0 d	4.4 c
Bath	Aug. 28	71 cd	73 ab	4.3 c	5.0 a
Moore's Early	Aug. 10	68 cd	59 bc	4.0 c	4.8 abc
Fredonia	Aug. 18	69 cd	54 c	4.4 bc	4.8 abc
Monticello	Aug. 19	45 de	73 ab	4.8 ab	3.6 d
Yates	Sept. 7	36 e	54 c	4.0 c	4.5 bc
Price	Aug. 10	25 e	64 abc	4.4 bc	4.8 abc
Mean	Aug. 22	72	68	4.3	4.5

[1]Flavor rating, 1 - 5: 1 = poor, 5 = excellent.
[2]Black rot rating, 1 - 5: 1 = severe rot, 5 = no rot.
[3]Mean separation within columns by Duncan's multiple range test, 5% level.

somewhat, it is difficult to determine optimum pruning level because of irregular bud break.

The cluster weight varied from 82 g for Catawba to 55 g for Yates and Fredonia (Table 3). Concord clusters averaged 73 g in this study and 114 g over seven years in Ohio studies (2). The small cluster size may have been partly due to failure of primary buds to develop due to winter injury.

All cultivars had acceptable fresh flavor (Table 3). On a rating scale of 1 to 5, Niagara was rated as the best in flavor with a rating of 5.0 Alwood and Monticello also had very good flavor ratings. All cultivars except Catawba averaged ratings of 4.0 or higher over the four years of the test. The ratings indicate that flavor was least desirable in 1975, and most desirable in 1977 and 1978.

Fruit black rot was more severe than expected and susceptibility varied with cultivar (Table 3). Monticello and Niagara were most susceptible. Concord, Van Buren, Moored, Catawba, and Yates had a moderate amount of black rot and Alwood, Moore's Early, Fredonia, and Price exhibited very little. Bath was not affected by the disease. The disease was quite serious in 1975. The spray schedule was improved afterward and less rot occurred the latter three years.

The results indicate that although winter injury was not highly visible with the American type cultivar, yields were lower than might be expected in major grape production areas. The lower yields were due to smaller clusters and fewer clusters per vine. Concord had the highest yields but Moored and Alwood also yielded well.

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