Fruit Varieties Journal 41(3):111-114 1987

Cultivar Sensitivity of Grapevines to 2,4-D[1]

EDWARD W. HELLMAN[2]

Abstract

Fifty grape cultivars and advanced breeding lines were evaluated for 2,4-D injury at 3 locations in Kansas. Variable sensitivity of cultivars was evident, with injury levels ranging from severe to none. Cultivars of related ancestry frequently demonstrated similar degrees of sensitivity, providing evidence for heritability of 2,4-D tolerance.

Introduction

Grapevines in many production regions are frequently injured by exposure to 2,4-Dichlorophenoxyacetic acid (2,4-D) from spray drift. Injury may be manifested as minor deformation of immature foliage or, in more severe cases, greatly reduced shoot growth, early defoliation, decreased yields, uneven ripening, and poor fruit quality (1, 2, 6).

Variable sensitivity to 2,4-D among grape cultivars is apparent. Abmeyer (1) catagorized cultivars as tolerant, moderately susceptible, or susceptible. Only cultivars rated tolerant produced quality fruit. Cultivars rated susceptible frequently defoliated prematurely, resulting in uneven ripening and poor fruit quality. Weaver et al. (6) reported that cultivars of *Vitis labrusca* L. origin (American grapes) as a group appeared much less sensitive than cultivars of *Vitis vinifera* L. origin. All 7 American grape cultivars examined (including 'Concord') had no visible injury, whereas 68 of 72 *V. vinifera* cultivars showed at least slight injury and many were severely injured. The apparent immunity of American grapes in this instance is difficult to explain, considering the well-known susceptibility of 'Concord' (1, 2, 3, 4, 5).

This report presents evaluations of the relative sensitivity to 2,4-D of grape cultivars and advanced breeding lines observed over 3 locations and several growing seasons in Kansas.

Materials and Methods

Fifty grape cultivars and advanced breeding lines have been evaluated for 2,4-D injury in Kansas since Abmeyer's (1) earlier report. A broad genetic diversity is represented in this group, since most cultivars are of interspecific hybrid origin. Several French Hybrid cultivars were evaluated, as were numerous cultivars of primarily *V. labrusca* origin, and others with considerable *V. vinifera* in their pedigrees.

Testing was conducted at 1 or more locations; duration of evaluation periods varied among cultivars and locations because of replacement of extremely 2,4-D sensitive, poorly adapted, or otherwise unsuitable cultivars. Testing locations, years, and evaluators are given in Table 1. All vines in Manhattan were 2 years old, with the exception of first year vines of 'Remaily Seedless' and 'Vanessa.' Breeding lines from the University of Arkansas Agricultural Experiment Station (designated by numbers with the A prefix) and the cultivars 'Venus' and 'Mars' were 2 years old at Wichita. All other vines were at least 4 years old.

Injury from 2,4-D (or related compounds) spray drift of unknown origin occurred annually to various degrees at all sites. An injury rating was assigned to each cultivar or breeding line at a location based on a single 2

[1]Contribution no. 87-260-T from the Kansas Agricultural Experiment Station.
[2]Assistant Professor, Department of Horticulture, Kansas State University, Manhattan, KS 66506.

year (Manhattan) or a consensus of multiple year evaluations of 3 to 12 vines. Injury was considered to be any degree of typical 2,4-D formative effects on the foliage or shoot, i.e., fan-like leaf shape, abnormal venation, stunting, cupping, blistering, or chlorosis. Because of unknown and variable rates of 2,4-D exposure among sites and years, a relative injury rating scale was employed. Values of 1,2,3, or 4 indicate, respectively: none to very slight, slight, moderate, or severe injury.

Results and Discussion

Considerable variability in 2,4-D sensitivity was apparent among the grape cultivars evaluated (Table 2.). The concentrations of 2,4-D in spray drift reaching the vineyards probably tended to be rather dilute, as indicated by the preponderance of cultivars with low injury ratings. More than two-thirds of the cultivars had mean relative injury ratings of none to very slight or slight. Only 6 cultivars received a severe injury rating, all at the Wathena location. Higher concentrations of 2,4-D would cause greater injury levels, but would not be expected to significantly alter the relative response of cultivars.

Contrary to the report of Weaver et al. (6), there was no evidence that cultivars with a strong *V. labrusca* background were generally more tolerant than cultivars containing significant *V. vinifera* germplasm. Some of the most severely injured cultivars, 'Fredonia,' 'Alwood,' 'Bath' and 'McCampbell,' are almost pure *V. labrusca*. No trends among species were apparent, which may be attributable to the complex hybrid origin of most of the cultivars.

Relative injury ratings of cultivars were fairly consistent when observed at more than one location and by different evaluators. This suggests that genotypic variability was a more significant cause of differential sensitivity than variable doses of 2,4-D or other uncontrolled factors. Furthermore, cultivars of related ancestry frequently demonstrated similar sensitivity to 2,4-D. Two progeny of 'Fredonia,' 'Alwood' and 'Bath,' exhibited severe injury similar to that of their common parent. The *V. vinifera* cultivar 'Muscat Hamburg' (not evaluated in this study) may be transmitting to its progeny ('Golden Muscat,' 'New York Muscat,' and 'Campbell's Early') moderate to severe sensitivity. Three full-sib cultivars, 'Romulus,' 'Himrod,' and 'Lakemont,' exhibited slight to very slight injury. Weaver et al. (6) cite similar evidence for heritability of 2,4-D sensitivity.

It is apparent that tolerance to 2,4-D could be included as a selection criterion together with yield and quality attributes in developing new grape cultivars. Elucidation of the mechanism for tolerance could improve the breeder's ability to select for this characteristic. A recent study demonstrated that 'Concord' vines metabolize 2,4-D, but more than 50% of the herbicide absorbed was still present in toxic form 3 weeks after exposure (2). No comparison of metabolic pathways or rate of metabolism has been made between sensitive and tolerant cultivars. The diversity in 2,4-D sensitivity among currently available grape cultivars enables the commercial pro-

Table 1. Grape cultivar evaluation sites, years, and evaluators.

Site	Years of evaluation	Evaluator
Manhattan	1986	E. W. Hellman
Wichita	1986	E. W. Hellman
Wichita	1975-1981	T. J. Schueneman
Wathena	1969-1977	E. Abmeyer

Table 2. Sensitivity of grape cultivars to 2,4-D injury in Kansas.

	Injury Rating[z]			
	Location			
Cultivar	Manhattan	Wichita	Wathena	Mean
Bailey	—	—	1	1
Beta	—	1	1	1.0
Buffalo	—	1	1	1.0
Extra	—	—	1	1
Romulus	—	1	—	1
Rosette	—	—	1	1
Venus	1	1	—	1.0
A-1660	1	1	—	1.0
A-1844	1	1	—	1.0
Baco Noir	1	2	1	1.3
Seyval Blanc	1	2	1	1.3
Canadice	1	2	—	1.5
Cascade	—	2	1	1.5
Delaware	—	2	1	1.5
Himrod	—	2	1	1.5
Cayuga White	—	2	—	2
Chancellor	—	2	—	2
Chelois	—	2	2	2.0
Dechaunac	—	2	2	2.0
Lakemont	—	2	—	2
Mars	2	2	—	2.0
Price	—	2	—	2
Reliance	2	2	—	2.0
Remaily Seedless	2	2	—	2.0
Suffolk Red	—	2	—	2
VeeBlanc	2	—	—	2
Ventura	2	2	—	2.0
Vidal Blanc	—	2	—	2
Vignoles	2	2	—	2.0
Villard Blanc	—	2	—	2
Vivant	2	—	—	2
A-1335	2	2	—	2.0
A-1448	2	2	—	2.0
A-1675	2	—	—	2
Marechal Foch	2	3	3	2.7
Aurore	—	3	—	3
Catawba	—	3	3	3.0
Concord	3	—	3	3.0
Golden Muscat	—	—	3	3
Niagara	—	3	3	3.0
New York Muscat	—	—	3	3
Rougeon	—	3	3	3.0
Steuben	—	—	3	3
Vanessa	3	—	—	3
Alwood	—	3	4	3.5
Fredonia	—	3	4	3.5
Bath	—	—	4	4
Campbell's Early	—	—	4	4
McCampbell	—	—	4	4
Sheridan	—	—	4	4

[z]Relative injury rating scale: 1 = none to very slight, 2 = slight, 3 = moderate, 4 = severe.

ducer to consider this factor when selecting cultivars to grow. Tolerant cultivars may have a distinct advantage in growing regions where 2,4-D spray drift is a frequent hazard.

Literature Cited

1. Abmeyer, E. 1969. Tolerance of several grape cultivars to injury from atmospheric contaminations of 2,4-D. Fruit Var. Hort. Dig. 23:53.
2. Ahmedullah, M., L. Marquis, C. Yang and A. Kawakami. 1985. Metabolism of 2,4-D in grape. J. Amer. Soc. Hort. Sci. 110: 480-484.
3. Clore, W. J. and V. F. Bruns. 1953. The sensitivity of the Concord grape to 2,4-D. Proc. Amer. Soc. Hort. Sci. 61: 125-134.
4. Ogg, A. G., Jr., M. Ahmedullah, G. Wright and G. Graf. 1982. Response of Concord grapes to repeated applications of 2,4-D. In: *32nd Annual Weed Conference.* (Washington State Weed Assoc.), Prosser, WA.
5. Shaulis, N. J. 1950. A progress report on the use of fortified oil emulsions in weeding grapes. Proc. Amer. Soc. Hort. Sci. 56:203-209.
6. Weaver, R. J., A. J. Winkler and S. B. McCune. 1958. Some effects of 2,4-Dichlorophenoxy acetic acid and related compounds on the grapevine. Amer. J. Enol. Vitic. 9:126-138.

Fruit Varieties Journal 41(3):114-128 1987

Current Trends in Stone Fruit Growing in Europe

S. SANSAVINI[1]

In assessing stone fruit growing trends in Europe, it is necessary to distinguish between acreage and production. According to the official 1977-1982 EEC survey, the combined acreage of peach, apricot, plum and prunes for the 12-member Community exceeds 310,000 hectares. This figure excludes cherries, for which no data were available in that period. Up to 1982 there was a decrease in total area amounting to 7,000 hectares, although there were marked differences from country to country (Table 1). In the four-years since 1982, that trend has reversed itself, with acreage, especially peach, increasing by more than 20 thousand hectares.

By contrast, over the same period and for the same species, production rose from 3.8 to 4.7 million metric tonnes. This upturn is conspicuously linked to orchard renewal and improved efficiency, especially in the southern countries where new plantings tend to be larger than the old and yield per hectare is relatively higher (Tables 1 and 2, Fig. 1) This situation has also clearly been influenced, at least as far as France and Italy are concerned, by the EEC's economic policy and various market regulatory measures and by farm and market restructuring initiatives implemented by individual countries acting at times unilaterally.

Let me just mention one of the consequences of these actions as an example. The peach is the main species to benefit currently from EEC price support subsidies. From 1981 to 1985, market withdraws of peaches from the 10-member Community amounted to 250-300 thousand tonnes yearly. With the exception of 1976, this figure is higher than the total for the preceding 15 years.

The relationship between supply and demand has been affected. Although better organised and seasonally distributed and of better quality, peach and prune supplies are already at surplus levels, while demand is essen-

[1]Instituto di Coltivazioni Arbore—Universita di Bologna Via Filippo Re 6, 40126 Italia.