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Forest Management Guidelines for Controlling Wild Grapevines

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Abstract

Grapevines (*Vitis* spp.) are becoming a major problem for forest managers in the Appalachians, especially when clearcutting is done on highly productive hardwood sites. Grapevines can reduce tree quality and growth, and eventually kill the tree. Silvical characteristics of grapevines are discussed. Forest management guidelines are given for controlling growth of grapevines. The control guidelines are applied to mature and immature stands using herbicides and mechanical treatments. The grapevine-arbor concept is suggested as a means of regulating the control treatments for timber and wildlife interests.

Forest Management Guidelines for Controlling Wild Grapevines

Contents

Figure 1.—(A) Grapevines in a young immature hardwood stand. (B) Grapevines and snow combined to bend, break, and uproot trees in this young immature hardwood stand.

Introduction

Wild grapevines (*Vitis* spp.) are becoming a major problem for the forest manager in many areas of the Appalachians. A few years after clearcutting, it is not unusual to find large numbers of grapevines growing in young stands on good to excellent hardwood sites—where the faster growing, more valuable timber exists. Often the reproduction in hardwood stands is excellent, but the presence of grapevines can convert portions of these excellent stands to a mass of grapevines.

Grapevines damage hardwood trees by breaking tops and limbs, twisting and bending the tree bole, and uprooting trees, thus reducing tree quality and eventually killing the tree (Fig. 1). Once grapevines get into the tree crowns, especially in young stands, the potential for future production of quality timber products is severely reduced. No tree damage information related to grapevines has been reported; however, as the number of grapevines per acre increases, more trees have grapevines in crowns, and thus, a higher risk in loss of quality. Many forest managers are concerned about grapevines and want information on growth control.

Wildlife managers are also concerned about measures to control grapevines because the vines produce food and cover for many species of wildlife. The U.S. Fish and Wildlife Service indicates that at least 80 species of birds and a large number of animals eat grape berries (Shutts 1968). Martin and others (1951) report that black bear, raccoon, quail, grouse, turkey, and a host of songbirds eat grapes. Deer browse foliage and stems in the spring and early summer and eat fallen leaves during the winter months (Massey 1961). Birds often use the stringy bark for nest construction, and squirrels build leaf nests in trees with grapevines in the crowns (Martin et al. 1951, Sanderson et al. 1980). Grapevines grow quickly in clearcut openings and, according to Crawford (1971), often produce the only dependable food for wildlife during the early years after a tree regeneration cutting practice. Also, during the summer, grapevines provide excellent escape and nesting habitat for songbirds.

Thus, because of the importance of grapevines to wildlife and because of concern that grapevines reduce tree quality, the control of grapevines growing in a forest stand is highly controversial. However, considerable research has been done on grapevine control, and we know much about grapevine characteristics and response to control treatments. We review the research and provide recommendations for controlling the development of grapevines in given conditions. Users must decide how or what portion of these guidelines to implement.

Considerable research information is available for two species of wild grape, summer grape (*V. aestivalis* Michx.) and its variety silverleaf grape (*Var. argentifolia* Munson). Although wild grapes range throughout most of the Eastern United States, Shutts (1974) indicated that grapes are not common in the northern part of the range.

Growing Sites

Wild grapevines grow on a wide range of soil and site conditions. Often grapevines grow best under moderately moist conditions in dense ravines on southeastern slopes where organic matter has accumulated (Shutts 1968). In West Virginia, grapevines were directly related to site quality, that is, as the site quality increased, grapevines became more abundant (Trimble and Tryon 1979). In Virginia, Shutts (1968) reported six grapevines on every good site compared to one on every poor site. In a later report, Shutts (1974) stated that vines are less resistant to disease on the good moist sites.

Growth and Reproductive Characteristics

Growth

Grapevines in the Appalachians are similar to other woody plants in that each year a growth ring is added to the ring-porous stem (Trimble and Tryon 1979, Stiles 1980). Also, vines if wounded just before or during the growing season, characteristically bleed sap. In West Virginia, this bleeding occurs from early spring to about mid-September.

Wild grapevines sprout prolifically when cut, the stems produce epicormic branches when exposed to sunlight, and the vines root or layer easily. Grapevines are intolerant of shade; prolonged shade reduces growth and will kill the vines.

Grapevines are supported by tendrils that enable the vines to climb

and advance on vegetation. Trimble and Tryon (1979) suggest that most grapevines become attached to the tree crown when the trees are young. Grapevine shoot growth begins later in the growing season than that for other plants, and shoot elongation starts slowly for several weeks, followed by periods of rapid growth. Shutts (1968) reported that while shoot growth is rapid, diameter growth is slow. A 50-year-old vine may have a diameter at ground line of only 1.5 inches. Normally sprout shoot growth is rapid. Annual shoot growth of some young stump sprouts was 15 feet or more (Trimble and Tryon 1979). However, grapevine seedlings grew slower than many tree species. Two growing seasons after clearcutting, grapevine seedlings averaged 0.5 feet tall, yellow-poplar 1.1 feet, and black cherry 2.2. However, the grapevine seedlings grew about as fast as yellow-poplar the first year, but during the winter, many grapevine tops had died. Other vegetation such as blackberries outgrew young grapevine shoots. Trimble and Tryon (1979) observed 70,000 grapevine seedlings per acre the first year after clearcutting, and 5 years later 1,975 grapevines per acre survived competition of other plants. Of the survivors, 139 per acre were climbing the forest vegetation, but not causing any major damage to the tree boles or crowns.

Flowering

Wild grapes normally produce male and female flowers on separate vines from mid-May to early July (Fernald 1950). Some vines also produce perfect flowers which means that a single vine may produce seed—thus even "male" vines are capable of bearing seed (Strausbaugh and Core 1952). The flower pollen is disseminated by wind, rain, insects, and animals. In North Carolina, Della-Bianca (1978) observed that flowers bloomed and were pollinated during the first 2 weeks in June, and tiny grape berries were seen in late June. Frosts did not seem to have any effect on flowering.

Seed Production

Grape seed crops are variable and fluctuate from year to year, but moderate seed crops occur in most years. Grapevines can produce seed the third year after establishment (Shutts 1968), and the seed normally ripens to a dark purple in September and October (Massey 1961). Overhead shading of grapevines results in poor grapevine seed production. Grape seed can remain on the vine throughout the winter, but Shutts (1968) and Della-Bianca (1978) found the greatest amount of seed on the ground about mid-November. Dispersion of seed is largely by wind, animals, and gravity; however, inclement weather, such as high winds accompanied by rain and snow, can increase seed dispersion (Della-Bianca 1978). Periodically, large quantities of seed are produced and the seed can remain viable in the soil duff for many years. Wendel (1981) reported that about 3 percent of the grape seed stored in the soil had the potential to germinate annually and this percent was consistent throughout the years for at least an 11-year period.

Della-Bianca (1978) reported that an average of 96 vines per acre, with an expected 50:50 male to female vine ratio, produced about 1,012 grape clusters per acre per year for 2 years. If the average cluster had 42 berries, about 42,500 berries per acre would be produced (Fig. 2). Also, if each berry contained 3 seeds (range normally 2 to 6), 127,500 seeds per acre could be produced annually. In another study, Shutts (1968) found that six female vines produced about 9,350 grape berries or 28,050 seeds in one season. Shutts further reported that the number of grape clusters per vine increased with the diameter of the vine. However, wild grape seed is susceptible to insect and disease damage. A common disease, black rot (*Guignardia bidwellii*), destroyed 40 percent of the seed crop (Shutts 1968). Also, Curculio beetles (*Craponius inaequalis*) destroyed more than 50 percent of the seed crop (Della-Bianca 1978, 1979). Thus, of the total seed produced in a poor year, we might expect less than 10 percent of the seed production to be available for seed germination. However, 10 percent of an estimated average seed crop could still yield 12,750 available grape seeds per acre.

Although frost does not have much effect on flowering, excessive moisture (rain or high humidity) leads to the development of fungal diseases that destroy the fruit (Shutts 1974). The shoots of the grapevine are subject to both cold and heat injury. A sudden rise in temperature in late spring may result in damage to the shoot tip. Spring frosts often damage foliage if warm weather and rapid growth precede a sudden drop in temperature (Shutts 1974). Overhead shading minimizes the production of grape berries (Della-Bianca 1978).

Figure 2.—Clusters of grape berries.

Grapevine Control in Forest Management

Grapevine control must be consistent with management objectives. If the objective is to grow only high-quality timber, then elimination of all grapevines could be the control treatment. If wildlife development is the sole management objective, then grapevine growth and reproduction could be maintained or stimulated. However, in most situations forest managers want to grow good-quality timber and at the same time encourage wildlife. To meet this objective, grapevines should be controlled by treatments that provide enough grapevines for recommended wildlife purposes, while trying to keep grapevines out of the crown of trees designated for the production of quality timber. Thus, forest managers must consider a number of situations when controlling grapevines.

Usually, most grapevine problems exist on the better sites (oak site index 70 and higher). Grapevines also become a more serious problem to forest managers when silvicultural practices such as clearcutting are used instead of partial-cutting practices such as individual-tree selection or a commercial thinning (Smith 1981). The keys to grapevine control are herbicides or canopy shading. Herbicides usually are highly successful in killing vines. Likewise, since the intolerant grapevines need light, shade from the overstory canopy also effectively controls grapevines especially stump sprouts.

Herbicides

Herbicides are often used to control wild grapevines and some are very effective. Presently, the best grapevine herbicide treatments are those applied to the foliage or at the base of the vine trunks. However, grapevine foliage is often beyond reach of mistblowers, and aerial application is not justified because there is no available herbicide selective for grapevines alone. Therefore, an herbicide treatment such as basal spraying the root collar and base of the vine is the more realistic application technique (Fig. 3). In many instances, a recommended herbicide treatment for individual grapevines allows forest managers to choose the number of grapevines to treat. Hamel (1983) lists herbicide treatments to control grapevine growth.

Figure 3.—Basal spraying grapevines with herbicides.

Several herbicides, treatment techniques, and results that have been used for grapevine control by the USDA Forest Service in cooperation with Dow Chemical Company,[1] Monsanto Company, Monongahela National Forest, Jefferson National Forest, and West Virginia Department of Natural Resources follow:

1. Weedone 170 (2,4-D; 2,4-DP)
   a. Mixed herbicide with fuel oil following the label instructions and applied as a basal spray to the base and lower 12 to 18 inches of uncut stems in mid-April, mid-August, mid-September and early March.

   b. Mixed herbicide with fuel oil following the label instructions and applied as a basal spray to cut grapevine stumps and surfaces in mid-September (stumps not bleeding sap).

[1]The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such use does not constitute an official endorsement or approval by the U.S. Department of Agriculture or the Forest Service of any product or service to the exclusion of others that may be suitable.

Results

Grapevines are readily susceptible to 2,4-D herbicides in fuel oil when applied as a basal spray to the base and lower 12 to 18 inches of an uncut vine. Applying herbicides in fuel oil to the stem and cut surface of the grapevine was also successful in killing vines when applied in mid-September. For best results, both vine ends of a layered grapevine should be treated (Fig. 4) when a clearcutting practice is planned within 4 years after the herbicide treatment.

2. 2,4,5-T
   Herbicide mixed in fuel oil following the label instructions and applied as a basal spray to the base of uncut grapevine stems and 12 to 18 inches of lower stem. Herbicide applied to cut grapevine stumps and surfaces in mid-September (stumps not bleeding sap).

Results

Currently, 2,4,5-T cannot be recommended, but the chemical was very effective.

3. Tordon 101; 101R
   Tordon 101 mixed as a 50 percent solution of chemical and water and applied as a basal spray to cut grapevine stump surfaces in April (stumps bleeding sap).

   Tordon 101R applied undiluted as a basal spray to cut surfaces of grapevine stumps in early March and mid-September (stumps not bleeding sap).

Figure 4.—Basal spraying both ends of a layered grapevine.

Results

Tordon 101R applied to the cut surface of a grapevine stump during early March and mid-September effectively killed grapevines. Tordon 101 applied in April did not consistently kill vines.

4. Roundup (Glyphosate)
   Roundup mixed as a 20 percent solution of chemical and water and applied as a basal spray to the cut surface of grapevine stumps in early March (stumps not bleeding sap), mid-August (stumps bleeding sap), and mid-September (stumps not bleeding sap).

Results

Roundup effectively killed the grapevines in early March and mid-September, but results were poor in mid-August.

5. Frill technique
   Roundup, Weedone 170, Tordon 101R, and 2,4,5-T were applied using a frill technique. Herbicides were applied only to the frill cut using the oil and water herbicide solutions mentioned. This frill application was done in mid-September (vines not bleeding sap).

Results

Frilling grapevines and treating the frills with herbicides was not effective.

6. Mistblowing technique
   Grapevine foliage was mistblown with 2,4-D and Tordon 101 (Smith 1977) and Tordon 10K pellets (80 lbs per acre) were applied to grapevine arbor areas. All herbicides were applied in mid-July.

Results

Ground mistblowing of the grapevine foliage with 2,4-D and Tordon 10K was effective but limited to contact with foliage. Aerial spraying would be better, but no herbicide is selective for grapevines only. Therefore, other woody vegetation would be killed also. Tordon 10K pellets were successful in killing the grapevines, but other nearby vegetation was killed too.

Finally, in a hydrology study on the Fernow Experimental Forest, herbicides were applied to a 60-acre area periodically throughout the growing season for 7 years. The objective was to kill all vegetation for the 7-year period. Several different kinds of herbicides were used (primarily 2,4,5-T; 2,4-D; Dalapon) (Kochenderfer and Wendel 1983). All grapevine stems were killed during the herbicide treatment. After 7 years, the herbicide application was stopped and the stand was allowed to regrow naturally. Initially, the vegetation development was sparse, but 13 years after the last herbicide treatment, seedling grapevines are in the tree crowns of many trees in the 60-acre stand.

To summarize, herbicides kill grapevines and minimize grapevine sprouting, but herbicide treatments applied before an even-age cutting practice will not control seedling-origin vines that germinate after cutting. The success of spraying vine stumps seems to vary with the time of application and success of stump spraying seems to be related to the occurrence of stump bleeding. The tests were done in August, mid-September, early March, and April. Profuse bleeding occurred during the August and April stump treatments. No bleeding was observed at the September or March treatments. Success in killing vines was best during mid-September and early March.

Grapevine Arbors

In stands where grapevines are found, openings often develop in the crown canopy. In these openings, the vines become matted, overtop the trees, and develop an entanglement that primarily is dominated by grapevines. We call these open areas wild grapevine arbors or grapevine clumps (Fig. 5). To my knowledge, there is no practical way to eliminate grapevine arbors. However, grapevines in the trees bordering the openings can be cut to keep the arbor from enlarging. If the grapevine arbors are small enough, the crown canopy from the overstory border trees may eventually close, thus shading the grapevines. In large arbors, crown encroachment from border trees will not occur. Generally, in established grapevine arbors, it is not possible to grow quality hardwood timber for many years.

No doubt it is difficult to control the growth of grapevines within an arbor by using existing techniques. Practical herbicide applications will not prevent the emergence of grape seedlings, and cutting the vines will simply stimulate sprouting. Where the forest management policy is to maintain some grapevines for wildlife purposes, arbors seem to be the logical places to grow vines while the rest of the stand is subject to grapevine control treatments. However, even after designating a desired number of arbors, additional arbors may be present.

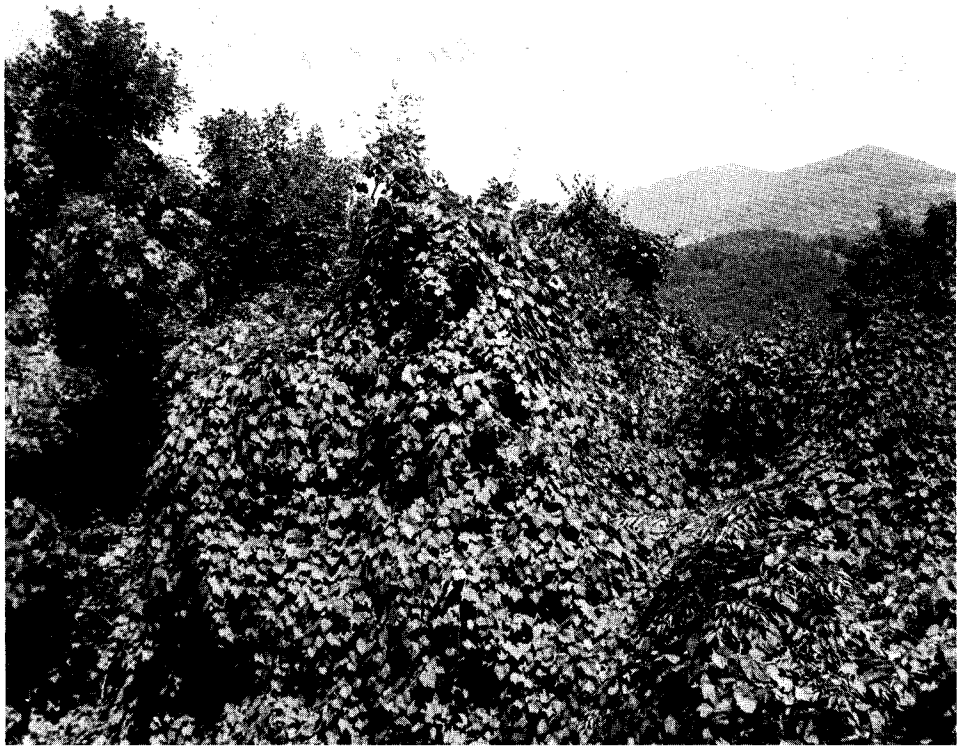

Figure 5.—Grapevines dominating the stands—a wild grapevine arbor.

Stand Silvicultural Treatments

Mature Stands—Uneven-age Management (other partial cuts)

Normally, partial cuts such as individual-tree selection, improvement cuts, and some diameter limits result in residual stands with considerable shading of the understory. Grapevines do not grow well under dense shading. Grapevines can be controlled in mature stands by severing or cutting the vines that grow in trees. Vines are severed near ground line before, during, or after logging by using blades, hatchets or chain saws depending on vine size. The cut vine stump will sprout, but the sprouts will die within a few years and barring any drastic overstory removal or natural disaster, the vines will not become a problem in the future.

Large vines are hard to cut, and it may be easier and not as expensive to basal spray the vines with an herbicide-oil solution. Spray the base of the vines and root collar of only those vines attached to the tree crown. No other portion of the vines needs to be treated in this instance. Though we have not basal sprayed vines during all months of the year, we have found that in every instance (early March, mid-April, mid-August, mid-September) the vines died.

Thus, presence of grapevines in mature stands where partial cuts are planned should not present any major control problems to the forest manager. In fact, in some of these stands there may not be enough grapevines to satisfy wildlife management objectives. Thus, depending on forest management objectives, grapevine arbors may need to be established artificially. Seedling-origin grapevines are not a problem under the shade of partially cut stands unless the stands are suddenly opened up due to heavy logging or a windstorm, ice storm, and so on.

Mature Stands—Even-age Management

Although grapevines are easier to control in partially cut, mature stands by simply severing or applying an herbicide basal spray, control is more complicated when any type of even-age harvest cutting practice (clearcuts, shelterwoods) is planned for these stands. Control measures must be considered for both sprout- and seedling-origin vines. A basic assumption is that if grapevines are present before an even-age harvest cut, grapevines will be abundant in the next stand regardless of the pre-harvest techniques applied to control tne grapevines. If time and money permit, the grapevines in the trees could be severed near ground line at least 4 to 5 years before the stand is clearcut. The cut grapevine stumps will produce sprouts, but the sprouts will die within a few years from overstory shading. Of course, the vines could be basal sprayed with an herbicide-oil treatment if desired. Grapevine sprouting should not be a problem after clearcutting, but seed-origin vines will be.

If an even-age harvest cut is planned within 4 years or vine cutting is not permitted, grapevines can be controlled by basal spraying each vine near ground line. It is also advisable to spray the vine layers when a harvest cut is planned within 4 years. The 2,4-D; 2,4-DP herbicide-oil mixture applied as a basal spray on uncut vines and vine layers is an effective grapevine control treatment. However, any herbicide-oil basal spray mixture should work well if grapevines are listed as a target species on the label. After applying the herbicide basal spray treatment, the stand could be harvested. Usually, the new developing stand will still have a serious grapevine problem from seedling-origin vines, and a grapevine control treatment will be necessary after the new stand has developed a closed overstory canopy. This canopy development usually occurs when the codominant trees average 15 feet tall.

When mature stands are scheduled for clearcutting within a few years and forest managers want to control grapevines but do not want to use herbicides, the grapevines should not be cut before, during, or after logging. If the grapevines are cut, the stumps will simply produce more sprouts, and make the situation worse. After clearcutting, some of the uncut vine stems will produce epicormic branches and roots along the stem, a source for sprouting and layering. Thus, when clearcutting, there is no easy, inexpensive way to control the vines in the mature stands before cutting that will eliminate the application of a grapevine control treatment in the regenerated stand. For thinnings, vine control methods are similar to recommendations for partial cuts in mature stands.

Costs to sever vines. Costs to sever grapevines in mature stands were summarized by Smith and Smithson (1975). Since 1975, more data have been collected, and a prediction equation was determined to summarize the data based on 11 areas. However, results varied from the 1975 data. We estimated that mature stands with 10 grapevines per acre required about 0.67 man-hours to sever grapevines while stands with 50 grapevines per acre required about 1.33 man-hours and stands with 200 grapevine stems per acre required about 3.80 man-hours (Table 1). Thus, at $7.00 a man-hour it cost about $9.30 per acre to cut 50 grapevines and $26.60 to cut 200 grapevines. These man-hour estimates include periodic breaks (about 10 minutes per man-hour) for the cutting crew, but travel to and from the

Table 1.—Number of man-hours per acre to cut or basal spray grapevines and gallons of basal spray mixture used per acre (mature stands).

Number treated vines	Man-hours/acre to—		
	Cut[a] vines	Basal spray[b] vines	Herbicide-oil mixture
			Gallons
10	0.67	0.47	0.02
25	.92	.54	.18
50	1.33	.67	.46
100	2.20	.92	1.01
150	3.00	1.17	1.56
200	3.80	1.42	2.11
300	—	1.92	3.21
500	—	2.92	5.41

[a]Man-hour estimates include a 10 minute per man-hour allowance for periodic crew breaks—each crew member cut vines.
[b]Man-hour estimates include a 10 minute per man-hour allowance for periodic breaks—two-man basal spray crew.

grapevine cutting control area and a lunch break were not included in the cost. One factor not evaluated was size of grapevines. It is difficult to cut large vines with hand tools. Sometimes vines are so large that it would be easier to girdle than cut the vine.

Cost to basal spray vines. Costs to basal spray grapevines in mature hardwood stands were also determined. Knowing the number of grapevine stems sprayed per acre and the man-hours required to do the spraying, an equation was developed from the data that accounted for most of the variation (97 percent). Eight treatment areas were evaluated. A 2-man crew did the basal spraying—one crew member sprayed and the other mixed and hauled the herbicide. Slopes ranged from 15 to 35 percent. The treatment areas used to collect this basal spray cost data were small, less than 2 acres. These areas were much smaller than the cut-vine areas of nearly 100 acres. Mixing, hauling, and supplying the basal spray applicator with herbicides could not be adequately evaluated in our basal spray test areas. Thus, basal spraying of vines in this instance is a minimum cost estimate.

Areas with 10 sprayed grapevine stems per acre required about 0.47 man-hours; 50 vines per acre, 0.67 man-hours; and to basal spray 200 grapevine stems per acre, 1.42 man-hours were necessary (Table 1). Man-hours for basal spraying include the spraying of vine layers. Each basal sprayed vine end was counted as a vine though often because of layering the same vine was basal sprayed more than once. Also, if the mature stand is going to be clearcut at least 4 to 5 years after the herbicide treatment, it is not necessary to basal spray the grapevine layers.

Grapevine diameters at ground line for the basal sprayed vines averaged about 1.6 inches and ranged from 0.4 to 5.7 inches with about 25 percent of the vines 2.0 inches in diameter and larger. This vine size is typical in many mature stands regardless of whether the vines were cut or basal sprayed. We used an herbicide-fuel oil mixture that cost $1.47 per gallon ($15.00 per gallon for herbicide, $1.00 per gallon for fuel oil). The basic mixture was 3.5 gallons of herbicide added to 100 gallons of fuel oil. The grapevine stems were basal sprayed using a backpack sprayer and soaking at least the lower 12 to 18 inches of the grapevine stem and the root collar. An average of 1.35 fluid ounces was used per grapevine stem.

Using data in Table 1, we found that the herbicide-fuel oil and labor cost to basal spray 200 grapevine stems (including layers) per acre in a typical second-growth stand was:

1.42 man-hours to basal spray vines @ $7.00 per man-hour	= $ 9.94
2.11 gallons of herbicide mixture @ $1.47 per gallon	= 3.10
	$13.04

Thus, with 200 grapevine stems per acre, it cost a minimum of about $13 an acre to basal spray grapevines in a mature stand. It cost $26.60 per acre to cut 200 vines per acre.

Young Immature Stands—Even-age Management

Of major interest to forest managers is grapevine management in stands after clearcutting practices. If grapevines are present before clearcutting, a grapevine treatment usually will be needed in the regenerated stand during the first 10-year period after clearcutting. In my opinion, any herbicide or mechanical grapevine control measure applied before clearcutting will not eliminate post-clearcutting treatments, though the regenerated stand will have fewer vines as a result of a prelogging treatment. We have not evaluated the influence of the prescribed burning.

Number of grapevines per acre in young immature stands was related to number of man-hours to cut grapevines, number of trees per acre with grapevines present in tree crowns, and percent of the stand with grapevines (Table 2). These data were summarized from surveys of even-aged hardwood stands 10 to 15 years after clearcutting, and the stands had never received a previous grapevine control treatment. Young stands averaging 10 grapevines per acre had about 60 trees per acre with grapevines in the crowns. These 60 trees represent about 3 percent of the stand based on 1,900 stems per acre 1.0 inch dbh and larger. Young stands with 300 grapevines per acre averaged about 480 trees with grapevines in crowns, indicating that about 25 percent of the stand is vulnerable to some reduction in tree quality due to grapevines. Of course, not all trees with grapevines in the crowns will be appreciably damaged and conversely, grapevine damage could be so severe that the tree dies.

It is difficult to determine the minimum amount of vines per acre that creates a significant problem in the reduction of timber quality. However, I suggest that forest managers use the grapevines per acre/grapevines-crown relationship summarized in Table 2. For example, a forest manager may decide that all areas would need grapevine control treatment if more than 5 percent of the trees (40 grapevines per acre) had grapevines in the crowns.

Table 2.—Number of man-hours per acre to cut grapevines and trees with grapevines in the crowns (immature stands).

Grapevines per acre	Man-hours/acre to cut grapevines	Trees with grapevines in crown	
		No./acre	*Percent of stand*[a]
10	0.70	60	3
25	.78	81	4
50	.90	117	6
100	1.15	189	10
150	1.40	262	14
200	1.65	334	18
250	1.90	406	21
300	2.15	478	25
400	2.65	623	33
500	3.15	767	40
600	3.65	912	48
700	4.15	1,056	56
800	4.65	1,200	63
900	5.15	1,345	71
1,000	5.65	1,489	78
1,100	6.15	1,634	86
1,200	6.65	1,778	94

[a]Stand data at the time of the grapevine cutting treatment indicated an average of about 1,900 trees per acre 1.0 inch dbh and larger.

Few options exist when applying grapevine control measures to young stands. Also, because grapevines can quickly become a problem when associated with other factors such as snow and ice, it is important that the grapevine control measures be used in these stands as early as possible. Though herbicides can be used successfully, basal spraying individual vines with herbicides may be more costly than cutting, and herbicide movement in the soil could be more risky to residual trees in the stand. Also, in immature stands, the diameters of the vines are much smaller, there are more vines, and usually vines are cut with one swing. Thus, cutting the grapevines near ground level with a tool such as a Woodsman's Pal or Swedish brush axe is the recommended practice (Fig. 6). This cutting should be done when the codominant trees in the stand are at least 15 feet tall and a well-developed closed canopy is present because shading is the key to successful grapevine control.

Figure 6.—Cutting grapevines in a young immature stand.

The cut grapevine stumps will sprout, but the majority of the sprouts will die within a few years. Usually, the grapevine cutting can be done in the stand less than 10 years after clearcutting. Also, if the codominant trees average 15 feet tall, it is easier for the cutters to walk through the stand to locate and treat the grapevines. It is easy to miss grapevines, and a few inches of snow on the ground aids the crew. When treating the vines, the crew should work across the slope contour and crew members should have overlapping lines. In cutting grapevines under ideal conditions, a good cutting crew will cut about 95 percent of the grapevines.

Cost to sever vines. Time required to sever grapevines in young, immature stands has been determined using regression techniques (Smith and McCay 1979). More data were added since 1979, and all available data were combined (Table 2). A total of 15 young, even-aged stands were used to develop a regression. In the regression, number of grapevines per acre accounted for about 95 percent of the variation. Immature stands with 100 grapevines per acre require about 1.15 man-hours to cut grapevines while stands with 1,000 grapevines per acre should take about 5.65 man-hours to cut the grapevines. Thus, at $7.00 per man-hour, the cost to cut 100 grapevines per acre would be about $8.00 while cutting 1,000 grapevines per acre cost about $39.50 an acre.

Summary and Management Recommendations

In many instances, grapevines are highly desirable, particularly where wildlife is the only concern of the forest manager. However, where quality timber production is the primary objective or where the multiple-use concept is applied, the uncontrolled growth of grapevines often conflicts with growing quality timber and mast-bearing trees. Forest managers need to determine management objectives before deciding what measures to use to control grapevines. For example, if wildlife is the sole management objective, then grapevines may not be controlled or treatments may be used to increase grapevines. Also, the sole wildlife objective could be to grow as many grapevines and produce as many mast-bearing trees as desirable. Grapevine control treatments would be considered in this instance. Where production of quality timber is the sole objective, then an effort could be made to eliminate all grapevines in the managed stand.

However, in practice forest managers usually want to manage stands to produce quality timber and maintain an abundance of wildlife at the same time. A multiple-use management approach is the retention of wild grapevine arbors. The arbor concept provides opportunities for wildlife food and cover while simultaneously allowing the remaining stand to be managed for quality hardwood timber as well as other resource uses.

The research recommendation to manage or control vines in arbors is to confine the vines to the arbors. If grapevines in an arbor are cut, the vines will sprout and thus increase drastically. If the grapevines in an arbor are treated with herbicides, the vines will die, but the grapevine seed in the soil duff will germinate and grapevines will continue to thrive.

Controlling growth of grapevines where overstory shading is present involves cutting the vines and/or spraying them with herbicides. Because grapevines are intolerant of shade, severing the vines is usually an effective control. Recommended guidelines for controlling grapevine development for given stands and silvicultural management situations are as follows:

1. Grapevine control practices should be applied in areas with an oak site index 60 or higher.

2. *Mature Stands Using Even-Age Silviculture and Management Practices*

   a. Stands to be harvested within 3 years. Retain wild grapevine arbors.

      Basal spray herbicides (2,4-D; 2,4-DP) on the lower 12 to 18 inches and the root collar of uncut grapevines attached to the tree crowns. Apply herbicide-oil mixture to the layered vines along the ground surface. Do not treat grapevines inside arbors. Also, basal spray grapevines attached to the crowns of trees surrounding the arbor openings.

      If a basal spray herbicide cannot be used, sever grapevines during the late winter, early spring, or fall and spray the cut stump surface with Roundup (20 percent solution) or Tordon 101R. Herbicides should be applied when sap is not bleeding from the cut stump.

   b. Stands to be harvested in 4 or more years. Retain wild grapevine arbors.

      For the remaining grapevines in the area, sever all vines near ground line that are attached to the tree crowns other than those inside the arbors. Also, cut grapevines in the crowns of trees surrounding the arbor openings.

      Herbicide applications as suggested for stands where a harvest cut is planned in 4 or more years are effective control treatments; however, it is not necessary to apply herbicide to vine layers.

3. *Young Immature Stands Using Even-Age Silviculture and Management Practices*

If a forest manager decided to apply a grapevine control treatment to a stand when 5 percent of the trees had grapevines in the crowns (managers can use any percent so desired as discussed in Table 2), then about 40 grapevines per acre would indicate a grapevine control treatment is needed. Thus, using 40 grapevines per acre, the following would be applicable.

a. Commercial-size stands to be thinned.
   Stands with less than 40 grapevines per acre.
   Retain wild grapevine arbors.
   Do not apply grapevine control methods.

   Stands with 40 or more grapevines per acre.
   Retain wild grapevine arbors.
   Cut all grapevines near ground line that are attached to the tree crown other than those vines inside the arbor. Herbicide applications are not necessary because overstory crown shading will control the sprouting grapevine stumps.

b. Precommercial-size stands.
   Stands with less than 40 grapevines per acre.
   Retain wild grapevine arbors.
   Do not apply grapevine control methods.

   Stands with 40 or more grapevines per acre.
   Delay any grapevine control treatments until the stands have developed a fully closed canopy. Shading is the key to controlling the grapevines. Usually grapevine control treatment can begin when the codominant trees in the fully stocked stand are at least 15 feet tall, approximately 8 to 10 years after the harvest cut—when one can easily walk under the tree crowns.

   Retain wild grapevine arbors.
   Cut all grapevines near ground line that are attached to the tree crowns other than those vines inside the arbors. Also, sever all grapevines in the crowns of trees surrounding the arbor openings. Try to apply the grapevine cutting control measures during the dormant season and ideally with a few inches of snow on the ground. If done at this time, a good cutting crew will miss only about 5 percent of the vines.

   Application of herbicides is not necessary because crown shading will control the vines.

c. Grapevines in stand, but no distinguishable arbor.
   Stands with 40 grapevines per acre or less.
   Apply no grapevine control measures.

   Stands with 40 or more grapevines per acre.
   Select concentrated groups of grapevines in tree crowns representing a desired percent of the area (example 5 percent). Do not treat these selected vines during application of a grapevine control treatment to the rest of the stand. Trees could be felled to speed up arbor development.

   Cut all remaining grapevines in the stand near ground line where the vines are attached to the tree crown using the cutting technique described in 3b. Herbicides are effective but not necessary.

d. Crop-tree release.
   In precommercial-size stands with grapevine problems, delay crop-tree release about 4 to 5 years after a grapevine control treatment. Shading kills the grapevine stump sprouts and if a heavy release and grapevine control cutting are done simultaneously, grapevine sprouting could be stimulated by the treatment. This recommendation also depends on the average height of the trees in the stand or whether herbicides are used. As trees become taller and shading increases, the delay of releasing crop trees after a grapevine treatment becomes less important. Also, herbicides could be applied to the grapevines during a crop-tree release treatment; however, an herbicide control treatment could risk mortality to some of the crop trees.

4. *Uneven-Age Silviculture and Management Practices*

   a. Individual-tree selection and other partial cuts.
      Retain wild grapevine arbors.
      Because tolerant species will eventually dominate the stand, grapevine control measures are optional and can be examined on a stand-by-stand basis. Other than in the arbors, once the grapevines are cut near ground level in a stand managed with the selection cutting practice, the vines will not return.

b. Group selection

Zero to 3 years before the harvest cut.

Retain wild grapevine arbors within the stand. For the proposed group openings, basal spray herbicides on the lower 12 to 18 inches of the grapevine stem and root collar on uncut grapevines attached to the tree crowns before cutting. Also, apply herbicide to the layered vines along the ground surface. Do not treat grapevines inside arbors. Basal spraying with 2,4-D; 2,4-DP in oil provides good results. If a basal spray cannot be used, cut grapevines and spray the cut stump surface with Roundup (20-percent solution) or Tordon 101R as purchased. Roundup and Tordon 101R are effective primarily when the grapevines are not bleeding sap (late winter, early spring, fall).

For the remaining stand, sever or basal spray the grapevines.

Four or more years before the harvest cut.

Retain wild grapevine arbors.
For the remaining stand including any designated group openings, sever or basal spray vines near ground line that are attached to the tree crowns. This includes all vines in tree crowns other than those trees inside grapevine arbors.

These guidelines will help the forest managers make decisions on controlling growth of wild grapevines and at the same time satisfy wildlife and timber objectives in a managed stand or forest.

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Caution

Pesticides used improperly can be injurious to man, animals, and plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the Environmental Protection Agency, consult your local forest pathologist, county agricultural agent, or State Extension specialist to be sure the intended use is still registered.

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Grapevines (*Vitis* spp.) are becoming a major problem to forest managers in the Appalachians, especially when clearcutting is done on highly productive hardwood sites. Where present, grapevines can reduce tree quality and growth, and eventually kill the tree. Silvical characteristics of grapevines are discussed as background for grapevine control. Forest management guidelines are given for controlling growth of grapevines.

441 6 176.1 (*Vitis;* Central Appalachian hardwoods)

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