

Grape Growing in Ohio



Fig. 1.—A vineyard scene in Northern Ohio just before growth starts. Notice the cover crop of rye is just starting its spring growth. This is the proper time for fertilizing

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GRAPE GROWING IN OHIO

Grapes, one of the important fruit crops of Ohio, are easily grown throughout the entire state and are commercially important in the region along Lake Erie, where they are singularly free from attacks of fungous diseases. As a home-grown fruit the grape is very popular. The vine drapes itself over an arbor, furnishing both shade and fruit, and in many cases forms a pleasing part of the landscape around the dooryard.

SOIL

Grapes do well on a wide range of soils, but they prefer a well-drained gravelly loam. They require good drainage and will suffer far more from wet feet than from lack of a fertile soil. The subsoil should not be so heavy that it will hold the water. For best results it should be light and porous, such as a gravelly loam.

The vines will grow on soils too poor for any other crop, but that does not mean that they thrive best under such conditions. It merely means that they do better than other crops. On very poor soils the vines make such poor growth that they cannot produce good crops and require constant fertilization or the yield drops very greatly.

SITE

The location of a vineyard often has a lot to do with the quantity of the grapes produced. In a hilly country low spots should be avoided, because they do not provide either the air or the water drainage that is necessary. Pick out the high spots, and the vineyards will not be so apt to suffer from frost damage. In level sections this point is not so marked, but even there the higher spots are more desirable.

Near large bodies of water the temperature does not change rapidly and such sections are usually well adapted to fruit growing because of less damage from late frosts in the spring, and early frosts in the fall.

GRAPES SUITED TO OHIO CONDITIONS

VARIETIES FOR COMMERCIAL USE

The Concord, the grape of main importance in Ohio, is blue. The vine is hardy and productive on a wide range of soils and conditions. The yield is large, and the fruit ripens evenly, is firm enough to stand shipment and is well suited for grape juice.

Moore Early.—Another blue grape, probably second in importance to the Concord. It ripens ahead of the Concord and is sometimes planted in order to lengthen out the harvesting and marketing season.

Catawba.—A red grape, grown in a few favored sections where it can be matured. It ripens after the Concord and follows that variety on the market.

Niagara.—The Niagara is without question the leading green or white grape. It has a large berry and bunch and the vines will yield about as well as Concord. The time of ripening fits well with the Moore Early and Concord. Usually the fruit ripens after the Moore Early and just before or with Concord.

Delaware.—This is of Ohio origin and is the highest quality grape that can be grown in this state. It is a red grape with such a small berry and bunch that the yield is usually low. The vines are much smaller than

Concord vines and should be pruned so as to leave less wood. On some markets this little red grape commands a premium over other sorts, but where the variety is unknown it may be discriminated against because of small size.

Brighton.—This is a red grape of good quality but is not quite in the class with the Delaware. The bunches and berries of the Brighton are as large as the Concord. The vines are vigorous and the yields good. The fruit is of excellent quality but for commercial use it deteriorates too rapidly to be shipped very far. The vine, too, has a commercial fault as it is self-sterile to a marked degree and must be planted close to other sorts, if it is to set a good crop. The fruit ripens a little before Concord.

VARIETIES FOR HOME USE

In addition to the above varieties mentioned for commercial planting, the following kinds may be planted for home use.

Worden.—This is a blue grape of high quality, much like Concord in appearance. It ripens just ahead of the Concord and would be a leading commercial variety if the berries did not crack or shell from the bunch in shipment.

Diamond.—The Diamond is a green or white grape that ranks next to the Niagara among the white grapes. It is of better quality than the Niagara but is not so productive. In the "Grapes of New York," the Diamond is highly praised for its quality and spoken of as being of great value in the home vineyard.

Agawam.—The Agawam is a dull purplish red grape of good quality. It ripens after Concord and will keep much longer.

PLANTING

KIND OF VINES TO PLANT

In setting out the new vineyard, get a good grade of plants. Set only those that are thrifty and vigorous. Discard the weak ones because they are not profitable. One-year-old plants of the first grade seem to give best results. Two-year-old plants are too apt to be those that were too small at the end of their first year's growth and were left to be sold as two-year-olds.

Excessive top growth is not necessary but the vines should have a strong root system and a good top growth. The root system seems so important to some nurseries that they grow their grape plants only in a section that will produce large roots.

Buy from a reliable nursery and there will usually be little difficulty in securing the correct varieties. There is little excuse for mixing varieties of grapes because grapes are propagated from cuttings and so do not have to go through the steps of budding and grafting.

PLANTING DISTANCES

The grape vine, as commonly grown, needs at least 8 feet of space each way. The vines are set commercially 8 feet apart in the row and the rows 10 feet apart, so that wagons, sprayers, and cultivating tools may pass between the rows without damage to the vines.

For home use where only a small number of vines are set, 8 feet each way is enough. If the vines are to be trained on an arbor, it may be desirable to increase this distance, but it is never best to decrease it.

SETTING THE VINES

When the vines are received from the nursery they should be heeled in by breaking and spreading the bundles and covering the roots with dirt till everything is ready for planting. If they are put into the field as soon as they are received so much the better.

Any injured or broken roots must be cut off and the top cut back to one cane. Since some of the buds may be damaged in planting, it is well to leave this cane as it is found until after the growth has started, at which time it may be cut back to two buds.

For the commercial vineyard, the field can be lined out with a plow deep enough so that very little additional digging will be necessary. Set the plants so they are about an inch deeper than they were in the nursery as indicated by the color line. Throw a few shovelfuls of dirt around the plant and tramp so that the soil is solid.

In planting the vines for home use the same practices hold good.

THE TRELLIS

In commercial vineyards a wire trellis composed of two or three wires is used to support the vines. The number of wires used depends on the system of training. The first wire is put up $2\frac{1}{2}$ or 3 feet from the ground and the top one about 2 or $2\frac{1}{2}$ feet higher. If a third wire is to be used it is put half way between the other two. Common heights for a two-wire trellis are 30 and 50 inches from the ground or 36 and 60 inches. When three wires are used the heights may be 30, 48, and 60 inches.

Strong, durable posts should be used. Sometimes steel posts are preferred. They are more expensive but are so easily installed that they compare very favorably with wood posts when the vineyard is completely laid out. The posts are usually set 16 feet in the row so that there is a post for every second vine. When heavy wire and posts are used the posts may be set farther apart.

End posts must always be much heavier and stronger than any of the other posts. They may be so set that the slack of the wire can be taken up with them. To allow for the contraction of the wire in the winter it is a good practice to go through the vineyard in the fall and loosen the wires.

If the end posts are set with this in mind the wires can be easily loosened. Against the end post set a stay post that is 6 feet long and extends from the ground to a point on the post about 4 feet high. Attach this stay post temporarily and in the fall loosening will merely consist of raising the end of the stay post next to the end post. Next spring before the vines are tied but after they are pruned the wires can be tightened by putting the stay post back in place and by using a common wire stretcher.

At the end of the first or second season a trellis should be started by putting up the posts and the lower wire. The following year the job may be completed by stringing the other wires that are to be used. The wires are attached to all posts except the end posts by means of staples which are not driven in tight, allowing the wires to slip. This precaution is necessary so that the weight of the vines during harvest will not put all the pull on the two posts adjacent but will distribute it throughout the whole line. Frequently, No. 11 galvanized wire is used.

PRUNING

There are a few general principles connected with the growth of the grapevine that the grower should remember when he prunes the vineyard.

1. The fruit is produced on shoots which spring from the 1-year-old wood and therefore the pruning of the vine is primarily a renewal proposition. A certain amount of wood of the previous year's growth must be saved for fruiting purposes. It is never desirable to have more old wood than is necessary to shape the vine.

2. The vigor of growth of the coming season is to a certain extent influenced by the amount of pruning. If too much new wood is left, so many bunches are produced that they are small and scraggly. Weak growth results from such pruning and the yield drops. On the other hand if too little wood

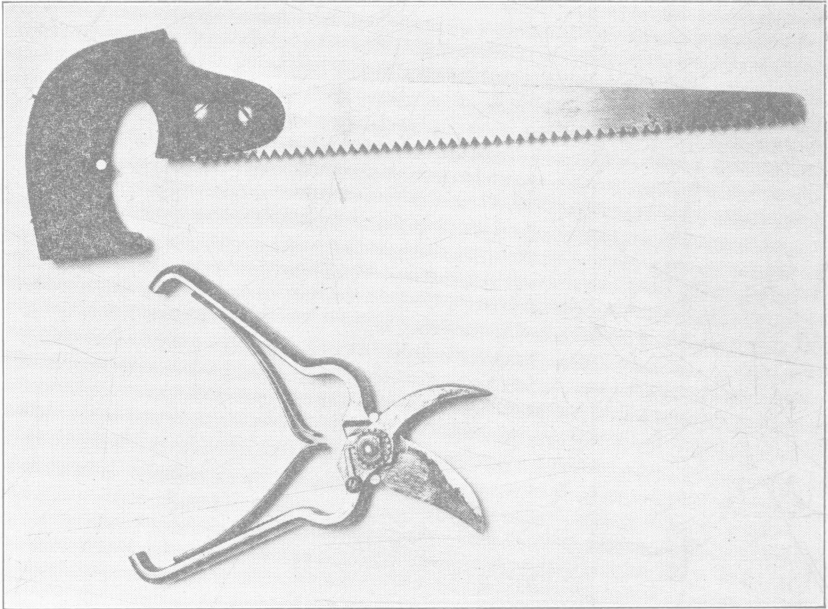


Fig. 2.—A small pointed saw and a pruning shears are the necessary pruning tools

is left after pruning the growth becomes excessive at the expense of fruitfulness.

A wise pruner recognizes these principles and regulates the amount of fruiting wood according to the new growth when he starts to prune the vine. Very vigorous vines can carry more fruiting wood than can weak plants.

TIME OF PRUNING

Grapes can be pruned any time during the dormant season except when it is cold enough to freeze the wood, at which time the vines are very brittle and will easily snap off if they are handled. They should not be pruned after the sap starts to flow in the spring or they will bleed at every place they are cut. Probably the bleeding causes no damage to the vine, but it is rather disagreeable to the man who is doing the pruning, and certainly it is not beneficial to the vine.

Usually, vineyards are pruned in the late winter, so that the vines may be tied and in place by the time the spring work starts.

Summer pruning is sometimes practiced in vineyards where the growth is rather heavy. The object of such pruning seems to be the removal of growth that would interfere with cultivation. Another object, often given, is to allow the fruit to ripen more evenly than it would if the heavy growth was left on. Whatever may be the reason for summer pruning of bearing vines, it has never proved to be a profitable practice.

If the vines are in the way of cultivation, they can best be tied up off the ground. If a more even ripening is desired, summer pruning will not bring it about. Where comparisons have been made in vineyards of very heavy growth there was no difference shown between the ripening of fruit on the vines that *had* been summer pruned and those that had not.

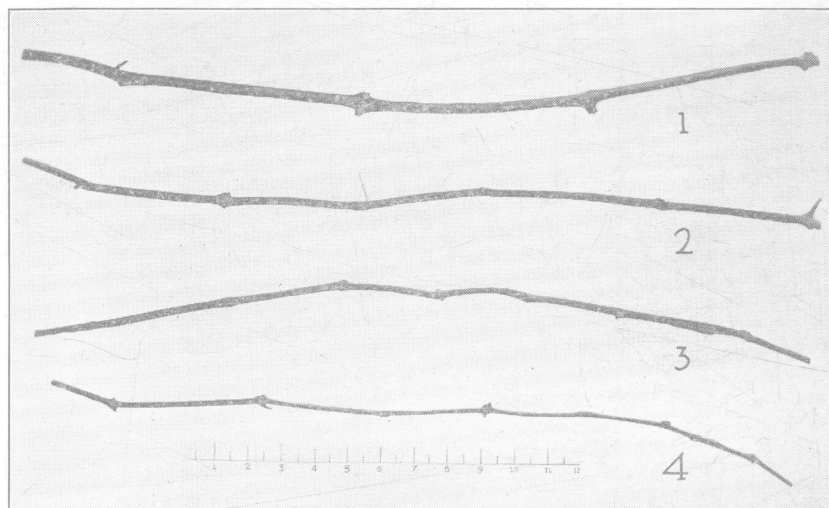


Fig. 3.—Fruiting canes. No. 1 is too large; buds are far apart and are usually small. Nos. 2 and 3 are canes of the intermediate size and type. No. 3 is especially good. Notice the short distance between buds, while bud itself is large and plump. No. 4 is too small.

There is, however, a place for a little pruning in the summer time. On young vines it is desirable. On mature vines suckers that come up from around the base of the plant may be removed to good advantage.

DEFINITION OF PRUNING TERMS

Pruning and training are often confused with each other but each is a distinct operation and should be treated as such.

Pruning consists of removing portions of the plant, so that the remaining parts function and grow properly.

Training consists of shaping the plant into any desired form. This may be done without any cutting but is helped by the manner in which the plant is pruned.

The **trunk** is the stem of the vine consisting of old wood. Sometimes old wood arising from the trunk to extend the vine laterally is spoken of as an **arm**.

The cane is a 1-year-old branch of an arm or trunk. It carries the buds that put out new wood and fruit.

A shoot is a leafy branch of the current season's growth.

SELECTION OF THE FRUIT CANES

Canes the size of a lead pencil with the nodes rather short and buds close together will be the best fruiting canes. These canes are about average in growth, being neither excessively small nor excessively large. (See Fig. 3.)

According to experiments in Michigan, canes $\frac{1}{4}$ -inch in diameter measured between the fifth and sixth bud proved to be the highest yielders. A number of measurements of canes from $\frac{1}{8}$ - to $\frac{3}{8}$ -inch in diameter were taken

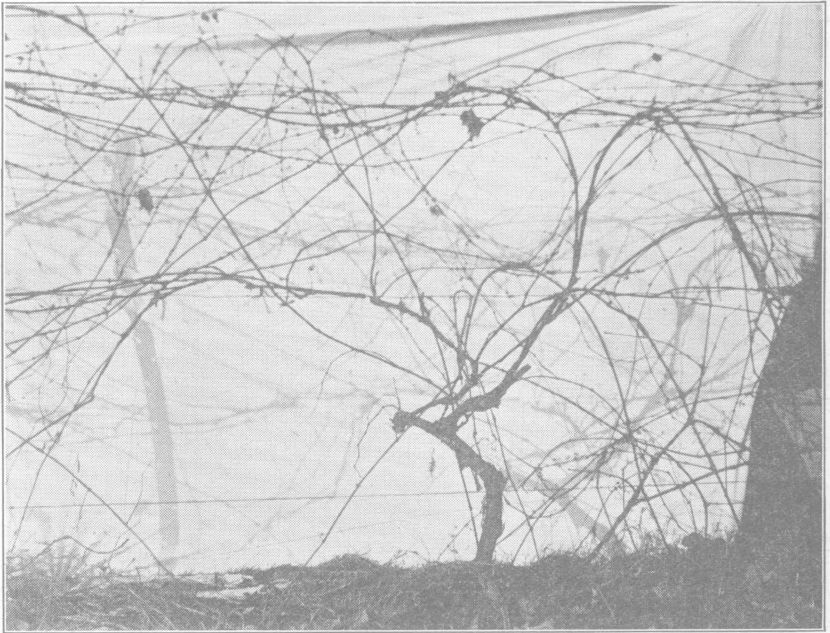


Fig. 4.—Grapevine before pruning. See Fig. 5 for same vine, pruned.

and the yield from each cane was secured. On all types of soil the $\frac{1}{4}$ -inch canes proved best. If it becomes necessary to use different sized canes, select those that are a little larger rather than smaller than $\frac{1}{4}$ inch.

Excessively large canes have usually spent their entire strength in the production of wood rather than in the production of buds, and consequently are very poor fruit producers. They are called by some grape growers "Bull Canes" and are spoken of as being barren. Usually their buds are small and a long distance apart. Frequently "Bull Canes" will produce laterals at some of the joints, and these laterals are a very desirable type of cane for fruiting purposes.

If it becomes necessary to use large canes, it is best to cut them off just above such a lateral and depend on the buds of the lateral for the production of the crop.

AMOUNT OF PRUNING

The amount of pruning of a grapevine can be more definitely decided than on most any other plant. One writer has figured it out as follows:

"Each vine should yield 15 pounds of grapes. Each bunch should weigh from $\frac{1}{4}$ to $\frac{1}{2}$ pound. To produce 15 pounds a vine will, therefore, require from thirty to sixty bunches. As each shoot will bear from two to three bunches, from fifteen to thirty buds must be left on the canes of the preceding year. In essence pruning is thinning."



Fig. 5.—Vine pruned and trained to the modified Fan system. Note that the trunk goes only as high as the first wire. One-year-old canes extend from the lower to the top wire. These canes will bear the coming season's fruit.

Experience has shown that the most desirable number of buds on the whole vine will range from twenty to thirty-five. These buds should be distributed over about four or five canes, each carrying from eight to ten buds. Perhaps the most universal practice is to leave four canes of eight buds each, totaling thirty-two buds for the vine. This amount should not be set down quite so definitely, because in every vineyard there are weak and strong vines. The weak vines should not carry as much as thirty buds, while the strong ones may possibly carry more.

The length of these canes has quite a lot to do with the fruit production because all the buds on a cane do not produce a like amount. Usually the

first two or three buds are very poor producers. The fifth, sixth, and seventh are usually conceded to be the most fruitful. Under some conditions this is true. Under other conditions the longer the canes the more fruitful they will be. For practical purposes an eight- to ten-bud cane is about the best of all.

Often it is hard to find canes much longer than that unless weak buds are left on the ends. On extremely strong growing vines it may be best to increase the amount of wood by increasing the length of the canes rather than increasing the number. Under the systems of training which are most in use, excessively long canes are hardly practical.

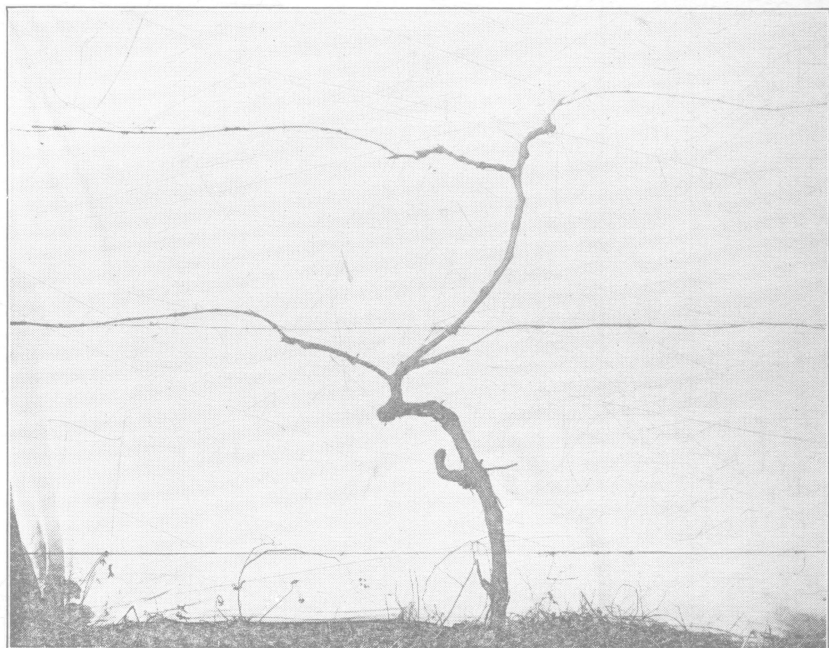


Fig. 6.—Vine pruned and trained to the Kniffen system. Note that the fruiting canes are trained horizontally along the wires.

TRAINING THE VINES

There are two systems most commonly in use in training grapevines, namely, the fan system and the Kniffen system. The first of these is most frequently used in Ohio, but at the New York Experiment Station the authorities advise the use of the Kniffen system for varieties like the Concord. However, the advantages of one system over the other are not very great.

The Fan System.—This is a system of training the vine to the shape of a fan. It is commonly modified into many forms, but the most common treatment is to carry the trunk of the vine up to the height of the first wire. From close to this point four 1-year-old canes are selected. All the rest of the vine is pruned away. These canes are cut back to eight or ten buds and tied in an upright manner to the top wire. They should be spread out like a fan so

that their growth will not interfere with one another, and so that a circulation of air may take place throughout the vine. (See Fig. 5.)

The Kniffen System.—This system consists of having the trunk extend from the ground to the top wire. From about the point where the trunk and the first wire meet two canes of one year's growth are selected and trained along the wire horizontally in opposite directions from the trunk. This arrangement might be figured in your mind thus: if a man were to stand and hold his hands out horizontally his body would then represent the trunk of the vine, while his arms would correspond to the 1-year-old canes. At the top wire two other 1-year-old canes are selected and trained horizontally like the two on the first wire. (See Fig. 6.)

Training on the Arbors.—Sometimes the grape is trained on arbors where the shade is as desirable as the fruit. Usually both can be secured with a little care. Select four or five canes just as is done in the commercial vineyard. Pick them out at different places from those in the commercial vineyard. If the fruit and leaves are desired overhead select these 1-year-old canes off the trunk or old wood about 5 or 6 feet from the ground. Then train them over the arbor in any manner desired so long as each cane has plenty of room.

Sometimes in arbors vines have long been neglected, and it is very hard to find the types of canes desired. Hunt them out and use them if possible. If not, a year's fruitfulness may be sacrificed for the sake of getting the vine back into proper shape and proper fruiting. In such a case cut the old vine back to the height that is desired. Cut it to 1-year-old canes if possible, but if they can't be found just cut. A wonderful growth will be made the next year but no fruit will be produced.

The following year the vine can be put back into a fruiting condition, because the vigorous 1-year-old canes can be selected in the desired places.

Tying the Vines.—Tying is sometimes as important as any of the other practices. When using the fan system, the ends of the canes are tied tight to the top wire, while the trunk and some of the canes are tied loosely to the lower wire. This precaution is necessary because the canes grow in size and will be girdled by tightly tied string. Usually a coarse twine is used for the tying, although light wires and willow shoots are sometimes employed for vines trained to the fan system.

Tying for the Kniffen system usually requires four ties, one at the end of each of the four canes. Sometimes it is necessary to tie the trunk to the first wire but not often. Summer tying of the shoots is practically unnecessary for the Kniffen system, but, for the fan system, it is an annual operation requiring much time and expense.

PRUNING THE YOUNG VINES

First Year.—When the vines are set out, all canes but the strongest should be removed and this should be cut back to two buds. During the summer all but two shoots should be rubbed off.

Second Year.—After 1 year's growth, the pruning will vary with the amount of growth made. All canes but one are removed. If this cane is vigorous, it may be left long enough to reach the first wire for fan system training, or the second wire for the Kniffen system training.

If growth is weak, remove all but two buds on one cane, as was done the first season.

Third Year.—This year the vine can stand about twenty to twenty-five buds. If the trunk was brought up the year before, two canes can be carried up from the lower wire to the top one and start the fan system. For the Kniffen system take four shorter canes off the trunk. Select two at the lower wire and two at the top wire. Tie these out horizontally in opposite directions along the wire.

Fourth and Succeeding Years.—Prune as described for mature vines.

CULTIVATION

Thorough cultivation is as necessary in the vineyard as it is in any of our field crops. In fact a grape vineyard will not be profitable for any length of time if it is neglected as to its culture. Most of the growth is made in the early spring, and this is the period when culture must be at its height.

At first in the spring a narrow strip close to the vines is plowed to prevent an excessive growth of the grass that was used as a cover crop. If this is not done the cover crop may make such a growth that it will be difficult to manage during the coming season. At this time it is not desirable to plow the rest of the land, because such a practice may cause early growth and result in damage from spring frosts. A little later, as soon as the spring has opened, the entire vineyard should be plowed and kept cultivated until late summer, at which time the cover crop may be planted.

Deep plowing is often dangerous because it cuts many roots. The plowing should be shallow so as to reduce the amount of root cutting to a minimum. Where possible, disking would be better than plowing. The feeding roots usually stay under the layer of cultivated earth, and for this reason it is desirable to cultivate the same depth from year to year. In a neglected vineyard the roots come up close to the surface of the soil and in renovating practice shallow cultivation is necessary.

COVER CROPS

Cover crops are employed for several purposes. They are used primarily to check the growth late in the season so as to harden up the wood and thus prevent winter killing. Whether they accomplish this purpose is hard to say. It is doubtful that they do as much good in this way as they are given credit for. However, they do furnish the soil with a large amount of humus, which is very beneficial to growth and yields.

Probably the most common grass used for this purpose is rye, but buckwheat, oats, rape, and vetch are sometimes used in varying combinations with rye. What will prove to be the best can only be learned by experience, because each soil and each locality has a little different problem.

FERTILIZERS

There has been very little experimental work in Ohio on the fertilization of the grape. In experiments in New York state some very good results have been secured from the use of fertilizers. It is certain that some of our grape sections have a very low yield due to poor growth. Sometimes this poor growth can be corrected by other means than fertilization. Drainage is often at fault and reduces growth. Sometimes ravages from insects result in poor growth.

Where small, weak canes are grown, it is very probable that fertilizers can be used to a good advantage. Nitrates are often needed. Phosphates can usually be used profitably to induce a better growth of cover crops.

For general recommendations, the best fertilizer for grapes is nitrogen. It may be applied in the form of nitrate of soda or as ammonium sulphate in combination with acid phosphate. Mix the nitrate of soda with the acid phosphate in equal parts and apply at the rate of about $\frac{3}{4}$ -pound to a vine. If the nitrate of soda is applied alone it may be used at the rate of about 250 pounds to the acre for mature vines.

Often with increased fertility it is necessary to increase slightly the amount of wood left on the vines after pruning, but this will be naturally taken care of if the pruner leaves more wood on the vigorous vines than he does on the weak ones.

All fertilizers are best applied in the early spring just as growth is starting. If only nitrogen is applied it is best put on by hand, but, if a mixture is used, it can be applied by means of a drill.

GRAPE INSECTS AND DISEASES

The grape is attacked in Ohio by a number of insects and a few diseases which are capable of causing heavy loss. However, on the average farmstead, grapes of fair quality are sometimes grown without any spraying treatment being given them. This is especially true where judicious yearly pruning is practiced to remove superfluous wood growth and permit the entrance of sunshine.

In considering the spraying of the vineyard, it seems desirable to consider the crop previously produced and the type of insect or disease injury, if any, which the berries have suffered. This may be due to a single insect or disease which results in a definite type of damage to the fruit or vine. If one or more of these troubles persist in appearing each year, the spray or sprays designed to reach that trouble are the ones to be considered. A thorough application will usually result in producing grapes of good quality at a minimum expense and trouble to the owner.

Aside from the condition of the fruit produced as a guide in determining the spray to use, there is one insect known as the grape root-worm whose presence is detected by unthriftiness of vine throughout the year, and the presence of chain-like feeding marks on the upper surfaces of the leaves in midsummer. These feeding marks are caused by the root-beetles which are the adults of the root-worms or larvae feeding below ground. The larvae devour the fibrous roots of the grape and girdle the main root by producing spiral grooves around it.

Small blue flea-beetles sometimes appear in early spring to devour the opening buds on the canes. Later, during June, long-legged brown beetles known as rose-chafers may appear to devour the blossoms and newly set berries. These insects are readily observed and when present require prompt application of the spray recommended. They are periodical in their appearance and not confined to the grape for their food, as is the berry-moth, root-worm, and some of the diseases.

The insect and disease calendar (pages 14-15) aims to cover the principal insects and disease enemies of the grape. Not all of these pests will appear in one vineyard during one or a series of years. A few of them appear each year in the commercial grape area in northern Ohio, where the extensive grape

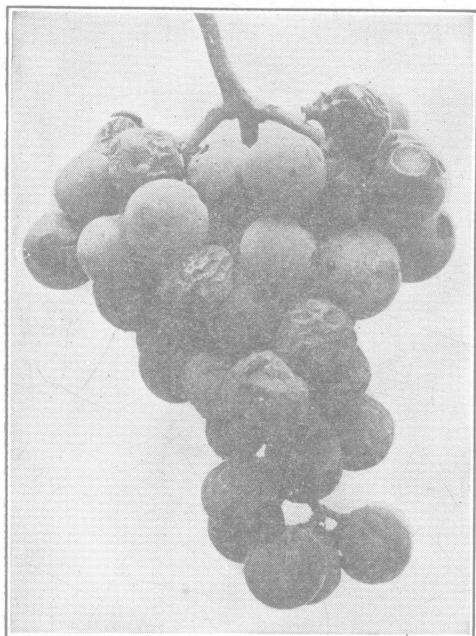


Fig. 7.—Grapes injured by grape-berry moth larvae

culture promotes their continuation as a pest. For such vineyards the likelihood of disease and insect injury is known, and a special spray service is recommended to fit the area involved.

At the western end of the Lake Erie grape belt, black rot, berry-moth (wormy berries), and leaf-hoppers constitute the usual pests. In northeastern Ohio, leaf-hoppers and root-worms determine the spraying program used. In southern counties, black rot and berry-moth furnish probably the outstanding requirements of spraying needs, and it is against one or both of these troubles that the home vineyardist should direct his efforts.

The vineyard owner is advised to study this calendar of insects and diseases, and from their description will probably

be able to pick out the spray or sprays needed to control his existing trouble, if any.

Calendar of Grape Pests and Diseases, with Control

Insect or Disease	Damage	Remedy
<p>Grape flea-beetle Small steel-blue or greenish beetles, about 1/5 inch in length. Insect jumps from the vine when disturbed.</p>	<p>Eats out the buds as they are ready to open in spring.</p>	<p>Spray vines thoroughly with 2 pounds of arsenate of lead in 50 gals. of water as soon as beetles are first noticed. (In applying small quantities, Note 3 should be consulted.)</p>
<p>Rose Chafer Rather large and elongated spiny-legged awkward brown beetles which appear suddenly on the vine about time of bloom.</p>	<p>Feeds at first on blossom buds and young fruit, devouring them. Later attacks the larger fruit and leaves.</p>	<p>Spray as soon as noticed with 4 pounds of powdered arsenate of lead and 1 gallon of cheap molasses in 50 gallons of bordeaux mixture or lime water. (See Note 1.)</p>
<p>Black Rot Reddish-brown spots on leaf. Small black dots in center of spot. Soft brown spots of rot on berries, which later become shriveled or mummied.</p>	<p>Injures foliage, new cane growth, and makes fruit unfit for market.</p>	<p>Spray with bordeaux mixture 4-6-50 about 1 week before blossoms open. Repeat with bordeaux 3-4-50 in from 3 to 5 days after blossoming and again 3 to 4 weeks after bloom.</p>

Insect or Disease	Damage	Remedy
<p>Downy Mildew Disease attacks leaves and fruit. Greenish-yellow spots on upper surface of leaves. Under surface and fruit covered with gray, downy growth. Berries later become wrinkled and fall off at slightest touch.</p>	<p>Checks growth of foliage and destroys the berry before mature.</p>	<p>Spray with bordeaux mixture same as for black-rot.</p>
<p>Berry-Moth Small, active caterpillars which feed in webbed retreats, eating young blossom buds and newly set berries. Live inside larger berries and cause red or purple spot on side of immature berry.</p>	<p>Injures the berries causing them to become wormy.</p>	<p>Spray fruit clusters with arsenate of lead 1½ pounds to 50 gallons of water in which 2 pounds hydrated lime or bordeaux has been added. Spray just after bloom falls and again 1 month later when grapes touch in cluster. Last spray is most important. (See Note 1).</p>
<p>Leaf-Hoppers Small, active, light yellow, sucking insects on the undersides of the leaves. Size, about ½-inch long when full grown. Adults fly away rapidly when disturbed. Young are wingless and move about freely over underside of leaf.</p>	<p>Cause leaves to become reddish or rusty looking and to prematurely die and drop off. Cause berries to be pale and under developed.</p>	<p>Spray the undersides of the leaves while the insects are young and without wings. Use nicotine sulfate 1/3 pint to 50 gallons (1 teaspoon to 1 gallon) of water or bordeaux mixture. Strike the insects with the spray delivered with good pressure. (See Note 4).</p>
<p>Root-Worms Small white grubs which feed on grape roots, girdling them. Adults are grayish-brown beetles which feed on the leaves making chainlike feeding marks.</p>	<p>Cause the vines to make poor growth and fail to produce crop. When sickly canes are pulled up the roots are found to be girdled.</p>	<p>Spray the upper side of foliage with arsenate of lead, 2 pounds plus 2 pounds of hydrated lime in 50 gallons of water or bordeaux mixture in midsummer when beetles first appear and feed.</p>

Note 1.—In applying the arsenate of lead where bordeaux is not used, add hydrated lime to the water at the rate of 2 pounds to 50 gallons of water. This prevents possible injury to grape foliage. It is advisable to use bordeaux as a carrier for arsenate of lead when vines are in foliage.

Note 2.—Bordeaux mixture is spoken of as 3-4-50 or 4-6-50. This means 3 pounds of blue vitriol and 4 pounds of good hydrated lime used in 50 gallons of water. Prepared bordeaux mixture can be purchased on the market. Do not apply bordeaux mixture to the Ives variety of grapes.

Note 3.—Two pounds of arsenate of lead to 50 gallons of water is equivalent to 7 heaping tablespoons to 5 gallons; 2½ heaping tablespoons or 8 level tablespoons of powdered arsenate of lead will weigh approximately 1 ounce.

Note 4.—One pound of soft soap or dissolved laundry soap in 50 gallons of spray (1 cu. in. in 1 gallon) is an advantage in spraying for leaf-hoppers and berry-moth. This causes the spray to spread and stick well.

Note 5.—Properly sprayed grapes which show some spray residue at picking time are not unfit for food.

HARVESTING AND PACKING

Grapes can be harvested over a rather long period but like most fruits are best if they are picked at just the right time. The shipper must have solid fruit that travels well and for that reason should have his fruit picked soon after it has thoroughly colored. The sugar content gets greater the longer the fruit hangs and grapes destined for juice should not be picked until the fruit is sweet and well ripened. Experience will soon teach the proper stage of ripening that is necessary for best results.

Methods of harvesting vary in different sections but most all growers use small shears to remove the bunches from the vines. They lay the bunches into crates or baskets to be hauled from the field. When the fruit is to be sold in small packages it is usually repacked at a packing house. When they are to be sold by the ton for use in a grape juice factory they are hauled directly from the field to the factory in field containers.

Packing for table grape market requires care. The common package for shipping is the climax basket holding 4, 6, 8, or 12 pounds when filled. Of these, the 6-pound package seems to be most popular.

Each bunch must be gone over to see that all small green, cracked, or damaged berries are removed. They are placed in the basket starting at one end and filling so that each bunch fits snugly against the others to insure a solid pack. Slanting the basket on an incline and starting at the lower end serves to make the pack solid.

The top of the package should be faced off so that no stems show. This can usually be accomplished by packing from one end to the other and filling the basket as you go. Each bunch must then be laid so that the most attractive side is up. No stems ought to be seen in the upper layer.

When the basket is packed it should be weighed to make sure it comes up to the required amount. If it is shy in weight, more grapes must be added by inserting your hand at one end and gently pushing all the grapes together. In this space fill with more fruit.