

OSU
Collection

GRAPES IN OKLAHOMA

FRANK B. CROSS and L. F. LOCKE

Circular 254

Revised, 1939



TABLE OF CONTENTS

	Page
Summary	3
Choosing the Vineyard	5
Pruning at Planting Time	8
Cultivation and Management	8
The Trellis	10
Pruning at End of First Year	10
Spraying Bearing Vines	20
Harvesting and Packing	22
Treatment of Old Vineyards	23
Variety Testing	26
Short Discussion of Varieties	31
Variety Recommendations	38

SUMMARY

Directions are given for the selection of soil; laying out the vineyard; planting; pruning and training.

Climatic conditions of Oklahoma are suitable for the commercial production of grapes.

The Concord, which has been so extensively planted in this state, has many faults, chief of which is uneven ripening.

There are many varieties of grapes which appear to bear heavier crops than the Concord.

Several of these varieties are suggested and recommended for trial as substitutes for the Concord in commercial work.

No particular varieties can yet be fully recommended as best because of limited experience with them.

Fall planting is recommended for the central and eastern parts of Oklahoma.

Spring planting is recommended for the western section of the state.

Prune the vines annually, leaving two or four canes, each of which should be from eight to fifteen buds in length, depending on the vigor of the variety and the strength of the individual plant.

Either one of two systems—Munson or Kniffin—may be chosen for training the vines.

Cultivation should be thorough and regular from early spring until September at which time a cover crop of wheat or rye should be sown.

Spraying is necessary for the control of insects and diseases.

There are many neglected vineyards in this state which may be made to yield good crops by proper methods of management.

GRAPES IN OKLAHOMA

This publication was undertaken because of the increasing interest in grape culture as shown by the large number of inquiries received at the Oklahoma State Experiment Station at Stillwater and the U. S. Southern Great Plains Field Station, Woodward, Oklahoma.

Experimental vineyards at both stations have shown that many of the varieties not commonly planted in Oklahoma may be grown profitably. The grape has not in the past been produced in large commercial quantities in Oklahoma. These tests, however, indicate that climatic and soil conditions are favorable for the production of many varieties of grapes on a commercial scale, and that other varieties not common commercially may be grown in home vineyards advantageously.

The object of this bulletin is to call attention to these varieties and to give directions for their selection and production.

CHOOSING THE VINEYARD

Moderately fertile, well drained soils are most suitable for the growing of grapes. A high percentage of sand is desirable in the surface with a sandy or gravelly clay subsoil underneath. There should not be so much clay in the subsoil that it will become water-logged or hinder drainage. However, experience has shown that, while clay is desirable underneath the surface, it is by no means essential to the successful production of good crops. The heavy clay soils which are usually characterized by poor drainage some time during the year are not suitable for the commercial production of grapes. A vineyard planted on such soil cannot yield the profits that could be expected from a vineyard planted on a good, well drained, sandy loam, and will always suffer from drought during hot, dry seasons. Soil with hard pan or bed rock within three, or four feet of the surface is undesirable. If the vineyard is located on a northerly slope having suitable soil conditions, better protection from wind will be afforded than if it is located on any other slope.

Laying Out the Vineyard

In laying out the vineyard the ideal direction for the rows would be to extend from the southwest to the northeast. This would allow the prevailing winds to pass between the rows with the least disturbance to the vines and give practically an even distribution of sunlight to both sides of the vines on the trellis. Because of the additional number of end posts required and the number of short rows, which make cultivation more difficult, this arrangement is seldom practical. The next best and probably usual arrangement is to run the rows north and south. The least desirable arrangement is to run rows from east to west, as this gives the poorest possible distribution of sunlight and the greatest damage by wind.

The distance between the rows should be 10 feet in a commercial vineyard. For the home vineyard this distance may be varied, to a certain extent, depending on the cultivation implements available. However, the rows should never be closer than eight feet. Many people make the mistake of planting the rows too close together. This is undesirable because it does not allow sufficient room for cultivation and also limits the moisture supply for each vine. It also may make it impossible to get between the rows with wagons and sprayers.

It is essential that the rows be straight because any plants which are out of line are very apt to be injured in cultivation. If the prospective vineyard is small the rows may be established by the use of a line and

stakes, but in planting a commercial vineyard it is customary to establish the row by means of a plow or a lister. The distance between the rows should be carefully measured so that the width will be uniform. This is important for ease of cultivation. The distance between the plants in the row may be established by a series of cross furrows. This method of establishing the rows and the position of the plants in the row will do away with a large amount of digging which would otherwise be necessary in getting the plants into the soil.

Age of Plants

One year old plants are more economical for starting a vineyard, although two year old plants, which are always more expensive, are sometimes used. Strong, vigorous one year old plants are satisfactory for general use. Small, weak plants are frequently offered for sale at a low price, but those who use such plants will find them to be the most expensive in the end.

Best Time for Planting

Over the western portion of the state spring planting usually gives better results than fall planting. The reason for this is that the precipitation during the fall and winter months is very limited. The dry condition of the soil and air, together with the colder temperature which often prevails over that portion of the state, make fall planting extremely hazardous. February or early March planting is desirable provided there is sufficient moisture in the soil. In the central and eastern part of the state fall planting usually gives better results than spring planting unless the soil is very dry. Planting during the months of November and early December is the most desirable practice. When there is a deficiency of moisture in the soil during the fall, planting should be delayed until the following February or March; or it may be done at any time during the winter when the soil is moist and not frozen. Late spring planting under any circumstances is not advisable.

Care in Handling and Planting

When the plants are received the box or bundle should be opened immediately and the plants heeled in unless it is possible to plant at once. In heeling in, a trench should be dug deep enough so that all of the roots may be covered to a depth of three or four inches. The roots should be separated and the soil worked down between them. The soil should be compacted after the roots have been covered. If the soil is dry the plants should always be thoroughly watered. Fill the ditch with water and let it settle, then finish filling the ditch with soil. Care should always be exercised to prevent the roots drying out while the plants are being handled.

The roots should never be exposed to the sun or wind, but should be protected with wet burlap or soil. The plants may be hauled to the field in a tub or barrel of thin mud. It is better not to immerse them in water, because this may wash off soil clinging to the roots.

A shovel, spade, or post hole digger may be used for digging the holes for the plants. The holes should be made deep enough so that after completely filling, the plants will be covered an inch or two deeper than they stood in the nursery row. The roots should be separated and spread out in transplanting and the soil worked well between them. After filling in with loose soil until the hole is about two-thirds full the soil should be thoroughly compacted by tramping with the feet or tamping with the shovel handle. This tamping or compacting of the soil is very important and should never be neglected because it helps to establish the moisture connection of the roots with the soil.

It is a good practice to water plants thoroughly even when the soil is moist, and is essential when it is dry. Thorough watering does more than add moisture; it settles the earth around the roots of the plants as no amount of packing can do. Where hired help is being used it insures against loss of plants, due to carelessness in thoroughly packing the soil about the roots. After watering has been done the hole should be filled level with the top of the ground and again compacted. Loose soil should then be thrown on top. Care should be exercised to get the plants in straight rows, which may be accomplished by sighting down the row. A little care at this time will save trouble and expense later on.

Parts of the Plant Explained

At this point it is well to define briefly a number of terms which may be unfamiliar to the reader and which are frequently used in the following discussions.

Trunk—main stem or permanent upright part of the plant.

Head—the portion of the trunk adjacent to the wire of the trellis.

Shoot—the immature growth of the season; becomes a cane at the end of the growing season.

Cane—one year old growth.

Fruit buds—buds which produce shoots upon which the fruit is formed; they develop during the summer at the bases of leaves; they are found on the cane during winter at pruning time.

Pruning—cutting out and removing the portion of the vine not required for fruit production.

Training—arrangement of the vine on the trellis.



Fig. 1.—One year old vine, pruned immediately after planting.

Pruning at Planting Time

When the plants are received from the nursery the tops will consist of one or more canes. Select the most erect and best of these canes, prune this back to two buds and remove all of the other canes. All that is left above the surface of the ground after planting is the stub with two buds. This type of pruning is necessary to establish a balance between the roots and the top of the plant. Many of the roots are broken off and lost when the plants are dug and if the top is not reduced, the root system will be unable to supply a sufficient amount of moisture to keep the plant growing. Unless the tops are pruned at transplanting time there will be danger of losing a large number of plants. This pruning of the young plants may be done at any one of several different times: (a) when unpacking and heeling in; (b) when taking them up for planting in the prospective vineyard; (c) as they are planted; or (d) after planting is completed. It is easier to establish straight rows when the plants are pruned before transplanting. Taking everything into consideration, it is perhaps best to prune the plants as they are being heeled in. There is less damage at this time from root exposure and drying. Transplanting will be more rapid if done at that time. It is more work to prune plants after they are set in the ground, and there is danger of getting crooked rows by sighting over unpruned plants.

CULTIVATION AND MANAGEMENT

Thorough cultivation should always be practiced. Its object is to aerate the soil and also to retain moisture by preventing weed growth. In commercial work special implements adapted to vineyard cultivation should be provided. In large vineyards cultivation is probably accomplished more economically by the use of a small tractor and tandem disc. In smaller vineyards an orchard disc of the reversible type is a desirable implement which may be handled with a team. Adaptations of the spring tooth harrow are sometimes used for summer cultivation. If the vineyard is small, effective cultivation may be accomplished by the use of one horse cultivators. A plow is frequently used for breaking the soil at the beginning of spring cultivation. This is especially true when a cover crop is grown when small implements are to be used later. The grape hoe is sometimes used for cleaning out the row between the plants. The frequency of cultivation will depend to a considerable extent upon the rainfall and upon the type of soil. If the soil is at all inclined to crust after rains the vineyard should always be cultivated as soon as the soil is dry enough and before the crust forms. This practice destroys many weeds before they grow large enough to do any damage. It is always desirable to cultivate after a rain. Cultivation should be continued until the crop is harvested or a cover crop planted.

Cultivation then will consist in plowing or thoroughly disking the soil in the spring before growth begins. If disking is practiced the disc harrow should be weighted if necessary to produce a good loose soil mulch. If a plow is used, harrowing should follow immediately in order to smooth down the surface thus preventing excessive evaporation and loss of soil moisture. Subsequent cultivation should consist of using the implements selected for the work frequently enough to keep down all weed growth and maintain a soil mulch two or three inches in depth. Cultivation should be continued until about the first of September or until fall rains put sufficient moisture in the soil to start a cover crop.

Cover Crop

It is desirable to sow a cover crop every year about the first of September or as soon thereafter as the soil contains sufficient moisture to germi-

nate seed and maintain growth. The cover crop is planted for the purpose of using any surplus moisture which may be in the soil during the fall. The humus content of any type of soil is rapidly depleted under continuous cultivation in Oklahoma. Depletion of the humus reduces soil fertility and at the same time lowers the capacity of the soil for holding moisture. Fall rains frequently add enough moisture to the soil to start a secondary growth of the vines. This growth starts from buds which should not under normal conditions start growth until the following spring. There are two objections to this type of growth. A portion of the growth is practically always killed during the winter, and such growth makes it difficult to prune the vines properly during the winter and get a proper distribution of fruit buds. If this secondary growth is very much in evidence it may greatly reduce the production of the vines the following year. If a cover crop is planted in time to take up the surplus moisture in the soil this secondary growth may be prevented. On light soils in the portions of the state where high winds are prevalent during the winter and spring months a well established cover crop serves the additional purpose of preventing soil blowing. Under these conditions it may be necessary to let the cover crop stand slightly later in the spring than would otherwise be desirable because of the protection it gives to the soil.

Either wheat or rye is commonly used as a cover crop and one or the other should be adaptable for all conditions in this state. The rate of seeding should be determined to some extent by the best practice for each of these crops in various localities of the state, using one or two pecks more per acre for starting a cover crop than would be used to produce a grain crop. This is especially desirable where there is danger of the soil blowing. The general practice is to use from three to five pecks of wheat or from four to six pecks of rye per acre. Oats is sometimes used as a cover crop and is generally seeded at the rate of eight or ten pecks per acre. Winter vetch or Austrian winter peas may be desirable in the eastern and central parts of the state. These are leguminous plants and have the advantage over the others mentioned of adding nitrogen to the soil. Either or both are sometimes used in combination with wheat or rye at the rate of 15 to 20 pounds per acre. When used in combination the amount of wheat or rye should be reduced one-third to one-half.

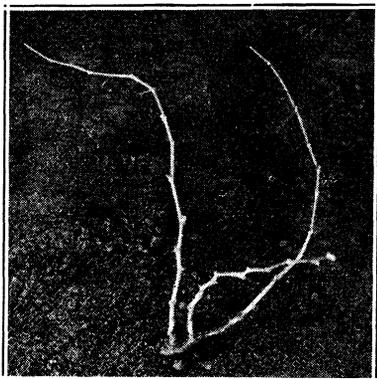


Fig. 2.—A young grapevine after one season of growth in the vineyard

Pruning at the End of the First Year of Growth

Except under unusual conditions the young plants will have been allowed to grow through the first season with no pruning or training since they were pruned at planting time.

At the end of the first year of growth the vines should consist of several canes, and the straightest one of good size should be selected and cut back to two buds. All other canes should be entirely removed with a single exception: one should be cut to a short stub on which there are no buds and to which twine may be tied for the future training. If this stub is not left it will be necessary to use a stake in training the vine.



Fig. 3.—Young plant pruned after first season of growth. The twine shows method of tying.

THE TRELLIS

How to Construct the Trellis

It will be necessary to construct the trellis on which the vines are to be trained, before the second season of growth starts. Before construction begins it will be necessary to select the type of trellis to be used. There are two types which are commonly used in Oklahoma, the Munson or Canopy system and the Four Cane Kniffin system. These two systems differ in the arrangement of the wires on the post and in the distribution and arrangement of the canes and shoots on the trellis, as shown in Figs. 4 and 5.

A special type of wire may be used in the construction of grape trellises. This is a smooth wire and is usually designated by the term self-tightening, or as coiled spring steel wire. This wire has long, easy kinks or waves. The vines cling to it better than they do to a straight wire. If this type is not used it will be necessary to tighten the wires each season to avoid sagging of the trellises, and end posts are likely to be loosened by the contraction of ordinary straight wire during the winter. This applies to both types of trellises.

The Munson or Canopy Trellis

The Munson trellis consists of three wires running parallel, the center wire running through holes in the posts at a distance of four feet above the surface of the ground. The other wires are outside of and above the wire which runs through the posts. These wires are supported by cross arms which are attached to the posts. The length of the posts will depend upon the depth that it is necessary to set them in the ground in order to have

them hold solidly. The posts should be of some durable wood. As mentioned above, the center wire should be four feet above the surface of the ground and four inches should be allowed above this for attaching the cross arm. The arm should be two feet in length and may consist of a one by four, or preferably two by four. There are various ways of attaching the cross arm. It may be bolted or nailed to the post or it may be wired to the post with a wire running around the center of the cross arm and the top of the post; brace wires must then be run from the end of the cross arm to a point lower down on the post. The advantage of fastening the cross arms to the posts with wires is that it makes them more flexible and not so easily broken when hit by horses or tillage implements. The disadvantages are that it is difficult to do and takes more time. Brace wires are also likely to interfere more or less with handling spray rods in spraying the vineyard and to be more or less in the way when moving around under the vines in picking.



Fig. 4.—Munson Trellis

Fastening the cross arms with nails is probably the cheapest and quickest method of attaching them to the posts, but they are likely to work loose rather easily. Attaching the cross arms with bolts require that holes be bored both through the post and the cross arms. Bolts of course are slightly more expensive than nails. Otherwise this method possesses the same advantages as fastening the cross arms with nails and the additional one that they can be very easily tightened up or replaced if necessary. Notching the post or placing a block under cross arm may be done to keep arms from tipping sideways instead of using brace wires. In erecting the

Munson trellis the holes in the post can be bored more easily before the posts are set in the ground. In setting the posts, however, care must be taken to place them so that the holes will run in the direction of the row. There are several methods of attaching the wires to the cross arms. Two of the best methods probably are running the outside wires through holes about one inch from the ends and one inch from the top of the cross arm, or merely running the wires over the top of the cross arm and loosely stapling them within about an inch of the ends. This latter method of course makes replacements much simpler. However attached, the upper wires should be about four inches above and 11 inches outside of the center wire. The center wire on the Munson trellis should be number nine or ten, preferably the heavier, especially on a long trellis. Number eleven wire should be satisfactory for the outside wires. The end posts should be set at least two and one-half feet deep, and should be well braced. The cross arms on the end posts should not be lighter than two by four material. These cross arms should be placed on the outside of the end posts so that the pull of the wires will be against the posts. The center wire should be wrapped around the posts and fastened securely. The wires are not fastened tightly on any but the end posts, except in long rows. Here it may be well to set a heavy post in the middle and wrap the center wire around it, and also to fasten the outside wires to the cross arm. This should relieve the end posts of some strain.

The Four-Cane Kniffin System

The Kniffin trellis consists of two wires supported by posts. The lower wire should be loosely stapled to the posts approximately 30 inches from the

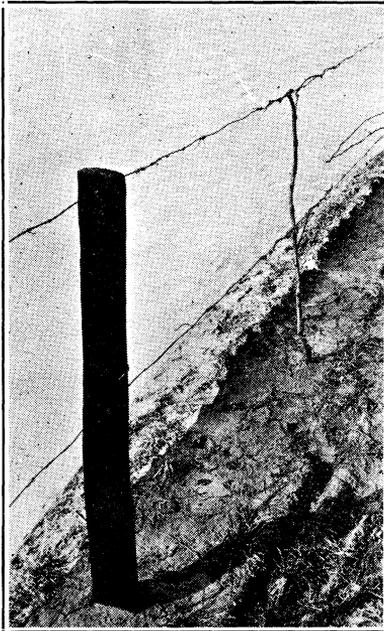


Fig. 5.—Kniffin Trellis

ground, and the upper wire about 24 inches above the lower wire. This places the top wires at approximately 54 inches from the ground, making it necessary to use six and one-half or seven foot posts for the construction of this trellis. The posts should be of durable wood and should be set in the ground a depth of one and one-half feet, or deeper if there is danger that the trellis will be blown down by storms. The end posts should be set about two and one-half feet in the ground, should be heavier material than the other posts, and should be well braced, in order to prevent sagging and consequent loosening of the wires. The wires should be firmly stapled to the end posts, and it is a good idea to bring the loose end entirely around, making a loop so that it will be impossible for it to pull loose. Two or three staples will be required for each wire in the end posts. In stapling the wire to any except end posts the staples should not be driven down tightly on the wires, but left loose enough so that the wire will pull through them when tightening becomes necessary. The wires should always be placed on the windward sides of the posts, or if the vineyard is constructed on a slope they should be placed on the uphill side; otherwise they will exert a direct pull on the staples which will loosen and pull out. Number nine wire should be used for the top. Number eleven is heavy enough for the bottom wire. For all wires on all types of trellises the coiled spring steel or self-tightening wire is suggested.

Choosing Type of Trellis

Some of the points to be considered in selecting the type of trellis are as follows: The Munson trellis provides better protection from the sun; the clusters are shaded practically all day and sunburn is seldom troublesome. On the other hand, when grapes are supported by the Kniffin trellis sunburn of some varieties is sometimes severe. In picking grapes on Munson trellis the clusters are all found at practically the same height, and hang beneath the wires on the trellis. On the Kniffin trellis the clusters are distributed over the canes supported by the two wires at different levels.

In pruning, the work is all performed at one level on the Munson trellis. With the Kniffin trellis the growth is distributed over the wires at two levels. On the Munson trellis the bearing canes are tied to the central wire. The bearing shoots which grow from the buds on the canes left in pruning extend out on both sides of the canes and naturally fall over and are supported by the outside wires, thus forming a canopy over the fruit. It is easier to pass from row to row through the vineyard when the grapes are trained on the Munson trellis than when they are trained on the Kniffin trellis. This makes it much easier to load the fruit after it is harvested. The Kniffin trellis is cheaper and easier to construct and keep in shape than the Munson.

If it is decided to use the Munson trellis it will only be necessary to set the posts and string the center wire before the second season of growth starts. The cross arms and outside wires may be added later, thus distributing both expense and labor of erecting the trellis over a two year period. If the Kniffin trellis is used, it will be necessary to construct the full trellis at the end of the first year.

Summer Training for Both Systems

Under the Munson system of training, twine should be tied to the stub which was left on the plant at pruning time and the other end tied to the center wire. If the Kniffin system is used the twine should likewise be tied to the stub and to both wires. The twine should be stretched tight. After the shoots from the two buds which were left on the spur have made a foot of growth it will be possible to select the stronger. As this growth proceeds this shoot should be twined around the string, the other shoot be-

ing removed. The shoot that is left, if being trained to the Munson system, should be allowed to grow until it reaches the wire. Growth in length should be encouraged by keeping side shoots and shoots from around the base of the plant rubbed off as they appear. If this shoot, which will later form the trunk of the vine, does not show any signs of branching by the time it reaches the wire it should be pinched back at that point or slightly below so as to form a head. As shoots develop they should be trained in each direction on the wire.

If the vines are to be trained according to the Kniffin system, the shoot should be allowed to grow until it reaches the top wire, where it should be pinched back. In many instances it will be necessary to remove shoots which develop from the base of the plant and perhaps in some instances from the sides of the plant, in order to get the length of growth necessary to reach the top wire. If any side shoots are removed care should be exercised to remove nothing which may be needed later. After the shoot has been pinched back at the top wire, side shoots should develop and be trained along the wires (top and bottom) on each side of the plant, thus making four shoots to each plant. All other growth should be removed.

Under either system of training care should always be exercised to remove all shoots from the base of the plant as soon as they appear.

Fruiting Habits of the Grape

The grape vine bears its fruit near the base of the shoots, or growth of the current season. The number of clusters per shoot varies with the variety but usually averages one or more. The bearing shoots arise from fruit buds on the canes. Attention should be called to the fact that a cane is one year old wood and that fruit buds will be found on no wood older than this. The most fruitful canes to be found on a plant are the medium sized ones which have a uniform diameter throughout their length. Practically every bud on a cane of this type should produce a fruit bearing shoot. Those of very small diameter or exceptionally large ones are not suitable for fruit production. A cane which tapers rapidly from the base toward the tip is usually not good for fruiting. Canes about the same diameter as a lead pencil are considered the most desirable although this will vary with the variety. In pruning, the proper number of buds for fruit production must be left on one year old wood. If all of the one year old wood is removed, the fruit buds will all be removed and the vine will therefore bear no fruit. If all of the one year old wood is left, the vine will overbear and will be unable to produce a sufficient amount of growth for a good crop the following year. The clusters on plants which are not pruned or on which too much bearing wood is left at pruning time will be small, sometimes ripen unevenly, and be otherwise undesirable. Pruning to the proper number of fruit buds is absolutely necessary if fruit of good quality and clusters of good size are desired.

Pruning at the End of the Second Season of Growth

Munson System. At the end of the second season of growth the vines if properly cared for should consist of a straight trunk extending from the surface of the ground to a point just below the wire, at which point the trunk should divide providing one or more canes for each side of the head. One cane should be selected to run in each direction, and the others removed. The remaining canes will require shortening to prevent the vine overbearing and thus weakening itself while young. The amount of pruning required will vary somewhat with the amount of growth which the vines have made the previous season. In general, however, from three to six buds on each cane will be a sufficient number to leave, the larger number of buds of course being left on the vines which made the greatest

growth and the smaller number on the weaker growing vines. It is important not to let the vines overbear at this time. After removing the canes which were cut off, the remaining canes should be coiled loosely around the center wire and tied tightly to it between the two buds at the outer end of each cane. If the vine needs any other support to hold it up to the trellis it may be tied very loosely at a point near the head, making due allowance for growth in diameter.

If the Munson trellis has been used, it will be necessary to finish erecting it sometime before growth starts. The trellis should at this time consist of a line of posts properly set and spaced, with number nine wire running through them at a distance of four feet above the ground. The cross arms should now be attached by one of the methods mentioned in the description of this type of trellis. The outside trellis wires should then be put up, running them through holes in the cross arms, stapling them loosely to the upper side near the ends, or fastening them in some other manner. This completes the erection of the Munson trellis.

During the following summer it will be necessary to remove all of the side and basal shoots which appear on the trunk.

Kniffin System. The same principles of pruning will apply to the Kniffin system. The only difference between the Munson and the Kniffin systems at this time is in the arrangement of the various parts of the vine on the trellis. Four canes having a diameter approximately the same as a lead pencil should be selected for fruit production. All other growth should be removed from the vine. The four canes selected for fruit production will

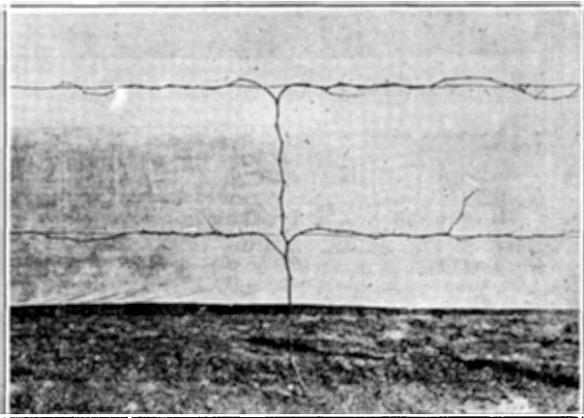


Fig. 6.—A young vine on the Kniffin trellis at the end of the second season of growth

extend along the wires on each side of the trunk. Each of these canes should be shortened to a length of two or three buds from the head of the plant. Weak vines should always be pruned more severely than strong ones. After pruning, the vine will consist of a trunk and four canes. One cane will extend in either direction along the top wire and one will extend in each direction along the bottom wire. Each cane should be tied around the wires between the two outer buds.

During the following summer it will be necessary to remove all side and basal shoots which appear on the trunk.

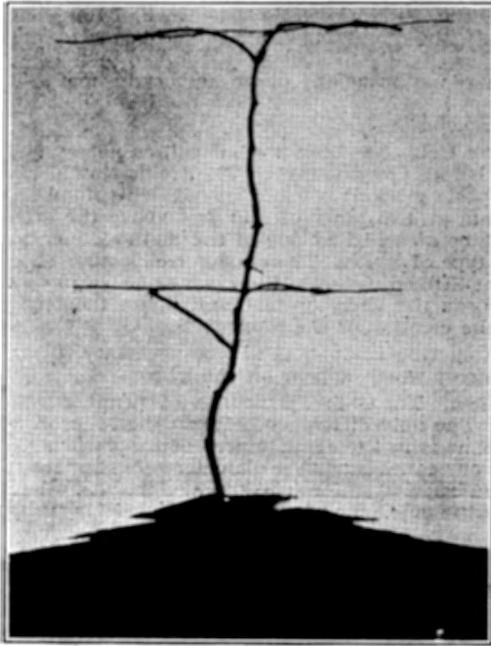


Fig. 7.—The same vine as shown in Fig. 6, after pruning

Pruning at End of the Third Season

Munson System. At the end of the third season the vine should have borne its first crop and should consist of one straight trunk from the surface of the ground to where it branches just below the center wire. The trellis at this time should be fairly well covered with a number of canes which grew during the preceding summer. The best of these canes, two to four in number, depending upon the vigor of the vine, should be selected, and left to bear the next crop. The best canes to leave are those which develop near the head of the plant and which have made a moderate amount of growth. Canes which are very weak or extra strong and vigorous are not as likely to bear as well as those which are intermediate in size. After selecting the canes which are to be left for bearing, all other growth with the exception of two spurs, should be cut off and removed from the trellis. The canes which are left should be shortened to the proper length. The length to leave these canes varies somewhat with different varieties. A total of from 30 to 60 buds should be left on each vine for the development of bearing shoots. The smaller number of buds should be left on the weaker, and the larger number on the more vigorous vines. Canes do not need to be of the same length or carry the same number of buds, just so the proper number of buds are left on each plant. Indeed, it is sometimes necessary to leave two short canes on one side and one long one on the other. In addition to the canes left for fruiting, two short spurs, consisting of two buds each, should be left. These spurs are for the purpose of

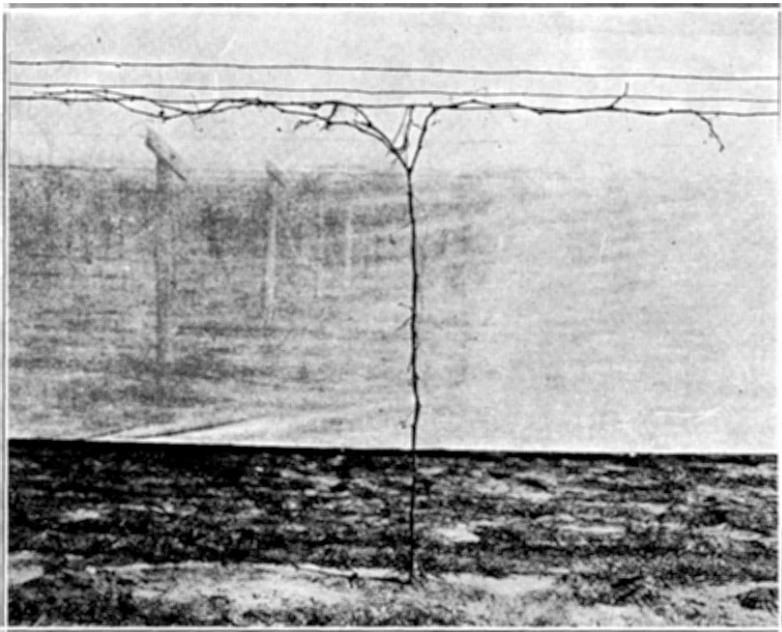


Fig. 8 (above)—A vine after two years of growth trained to the Munson system



Fig. 9 (left)—The same vine as shown in Fig. 8 after pruning for first year's crop

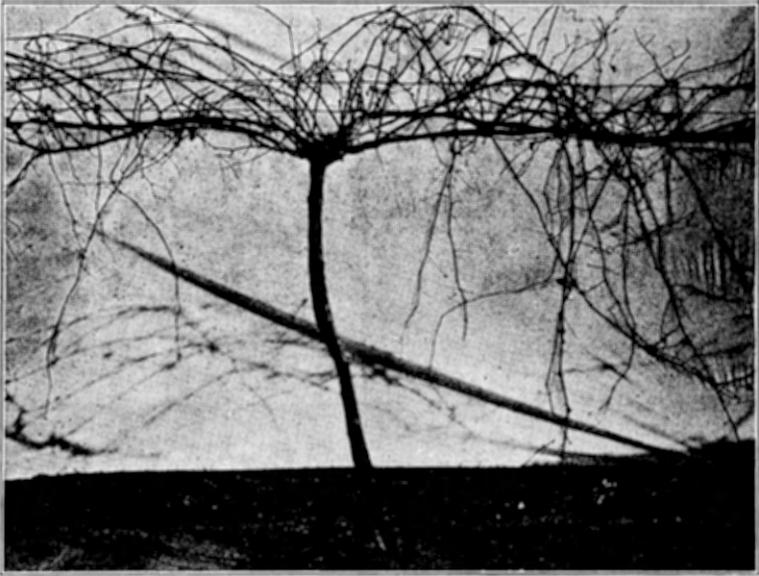


Fig. 10.—Mature vine on Munson trellis, before pruning

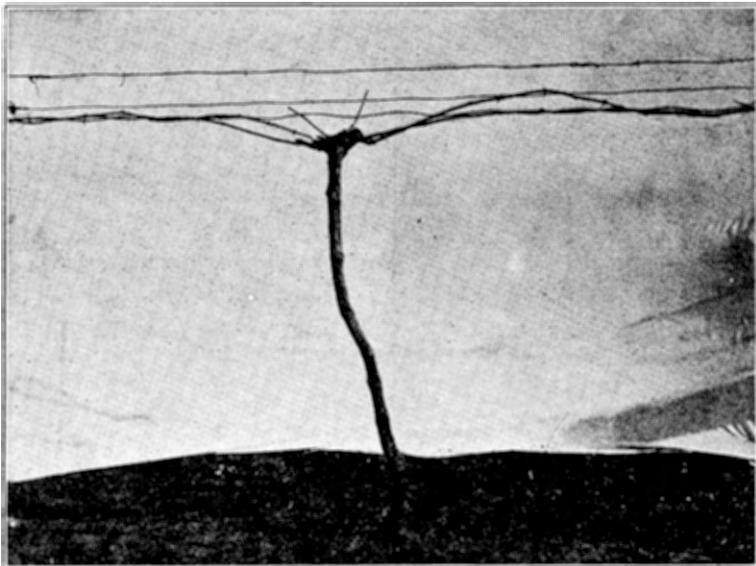


Fig. 11.—Mature vine on Munson trellis. Same as Fig. 10 after pruning

providing canes to bear the next crop. They should be on opposite sides of the plant and as near the head as it is possible to secure them. After pruning and removing the prunings from the trellis, the remaining canes should be tied. They should be twined carefully around the central wire and then tied tightly to this wire, tying between the two outer buds on each cane. With an ideal vine no more tying should be necessary. In practice, however, it may be necessary to tie loosely in one or more additional places to give support. In any additional tying, due allowance should be made for growth, or the part tied may be girdled.

Kniffin System. Plants trained to the Kniffin system consist of a trunk and four fruiting canes. Each of the fruiting canes should be eight to fifteen buds in length. In addition to the fruiting canes, four short spurs, two buds in length, should be left. One spur should be on each side of the trunk near each wire. The spurs are for the purpose of providing canes for the next crop, and should therefore be located if possible on opposite sides of the plant and near the wires. One spur should be on each side of the trunk near each wire. This spur should be as near the head of the plant as it is possible to secure suitable wood. The fruiting canes should be about the same diameter as a lead pencil or a little larger for some varieties. Under all circumstances canes of medium size should be selected, rather than very large or very small canes. All of the growth, with the exception of the four fruiting canes and the four two-bud spurs should be removed. Two canes, each extending along the wire on opposite sides of the trunk, are tied to the top wire, and two canes to the bottom wire. As soon as the plants are pruned, the canes should be twined around the wires and tied between the outer two buds.

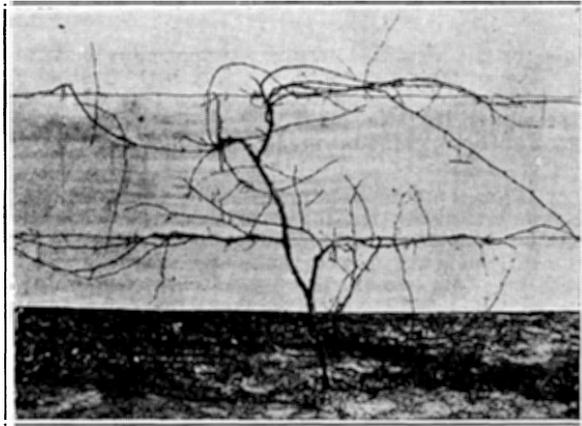


Fig. 12.—A mature vine on the Kniffin trellis before pruning

Pruning After the Third Year

The same general plan of pruning for each of the systems as outlined for the end of the third year should be followed year after year. The vigor of the plant must always be taken into consideration in determining how many buds should be left for fruiting. Plants which have made the least growth should be more severely pruned than those which have made the largest amount of growth. Experience and observation are necessary in

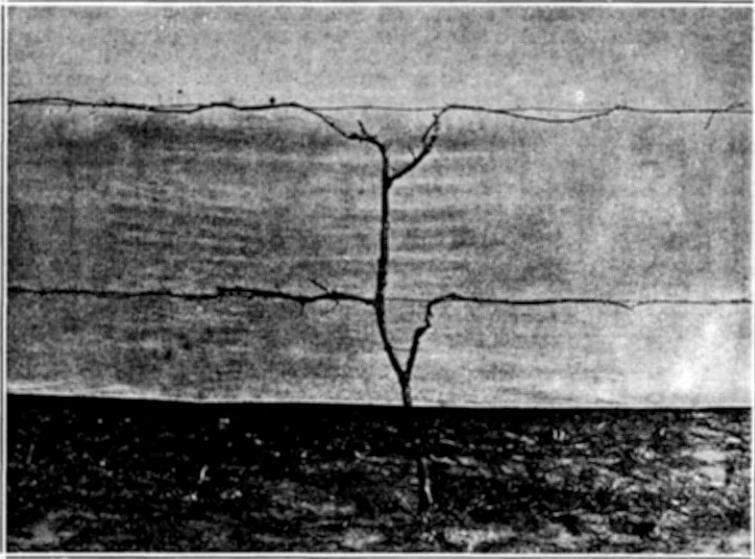


Fig. 13—Same vine as shown in Fig. 12, after pruning

order to prune for the very best results. If too many buds are left on a plant a heavy crop of fruit will follow but very little fruiting wood will be produced. It is necessary to establish a balance between amount of fruit and annual growth so that the plant bears heavy crops and at the same time produces a sufficient amount of new growth for a crop the following year.

After 10 or 12 years plants sometimes become weakened or less vigorous, making it desirable to renew the tops. This may be accomplished at any time by selecting a cane or shoot developing from the base of the plant and training it up on the wires in the same way as the original plant was trained. After this shoot has developed a sufficient amount of growth and fruiting canes to make a full crop, the old trunk may be removed at the surface of the ground or near the point from which the new trunk developed. An additional reason for occasional renewal is the tendency observed in all varieties of producing fruiting wood further and further from the head of the plant with the growth of each successive year.

Unless it is desired to start a new trunk, shoots should always be removed from around the base of the plant as soon as they appear. They are too often allowed to remain and sap the vitality of the vine.

SPRAYING BEARING VINES

At the United States Southern Great Plains Field Station, it has not been found necessary to spray grapes for the control of black rot. Leaf hoppers and root worms have been about the only pests for which it has been necessary to spray. If it is necessary to spray only for the control of these insects the sprays mentioned under numbers V and VI, in the spray schedule, may be used with the Bordeaux mixture left out. In other

words, use 50 gallons of water to which are added 1½ pounds of arsenate of lead and ½ pint of nicotine sulphate. These sprays should be applied about two weeks after the blossoms fall. Spraying at the right time is very important, as after the grape leaf hoppers are fully developed this spray will not destroy them.

At Stillwater it has been found necessary, during some years, to follow the spray schedule as outlined in order to control black rot and other diseases and insects fully. At other times three sprays as designated in the note have been found adequate. The number of sprays for the control of black rot will depend to a considerable extent on climatic conditions, frequent rainfall increasing the trouble and making it necessary to apply more sprays than would be required during a year of light rainfall. The best practice which we can recommend is for growers in the western part of the state to be guided by the experience of the United States Southern Great Plains Field Station and growers in the central and eastern part of the state to be guided by the experience of the Experiment Station at Stillwater.

The early sprays are very important in the control of black rot. In the eastern part of the state where this disease is most prevalent it is best to be safe and follow the full schedule.

Spray Calendar

The following spray schedule for grapes is copied from Orchard Spray Calendar, Oklahoma A. and M. College Extension Division Circular No. 168:

No. and Name of Spray and When to Apply	What to Spray For	Amount and What to Use
I. Dormant Spray. When buds begin to swell.	Scale insects; anthracnose; and black rot.	Lime sulphur 1 to 7 for both scale and anthracnose. If scale is absent, use Bordeaux 8-8-50.
II. First Summer Spray. When shoots have two leaves.	Black rot; anthracnose; and flea beetle.	Bordeaux mixture 3-4-50 and 1½ lbs. arsenate of lead.
III. Second Summer Spray. Before blossoms open.	Black rot; anthracnose; and flea beetle.	Bordeaux mixture 3-4-50 and 1½ lbs. arsenate of lead.
IV. Third Summer Spray. After blossoms fall.	Black rot; anthracnose; curculio.	Bordeaux mixture 4-4-50 and 1½ lbs. arsenate of lead; also add ½ pint of nicotine sulphate if leaf hoppers or lice are present.
V. Fourth Summer Spray. Two weeks after third summer spray.	Black rot; anthracnose; curculio; leaf hopper; root worm.	Bordeaux mixture 4-4-50 and 1½ lbs. arsenate of lead; also add ½ pint of nicotine sulphate if leaf hoppers or lice are present.
VI. Fifth Summer Spray. Two weeks after fourth summer spray.	Black rot; anthracnose; curculio; leaf hopper; root worm.	Bordeaux mixture 4-4-50 and 1½ lbs. arsenate of lead; also add ½ pint of nicotine sulphate if leaf hoppers or lice are present.

NOTE: The most serious losses in grape growing come from black rot. Other diseases and insects frequently need attention. The complete schedule is necessary for best results in the control of all insects and diseases. However, good results may sometimes be secured from the application of three of the above sprays, viz: III, IV, and V.

HARVESTING AND PACKING

The stage of maturity at which grapes should be harvested will depend to a considerable extent on the use to be made of the fruit. If shipping to a distant market it will be necessary to harvest earlier than if selling locally. It is desirable to leave the fruit on the vines as long as possible in order to develop the highest quality and sugar content. Many varieties of grapes are fully colored long before they are ripe. Color is only an indication of approaching ripeness. The real test for ripeness is quality and sweetness. The fruit should in every case be picked at a stage of maturity which will place it on the market in the best condition. The clusters are usually removed from the vines by cutting the stems with sharp spring scissors or grape shears, or by means of a sharp knife. The clusters should be handled carefully in order to disturb the bloom as little as possible. As they are harvested they should be placed in the shade of the vines until removed to the packing shed.

It is customary to permit the clusters to wilt slightly before packing. Grapes are usually packed and marketed in Climax baskets varying in capacity from four quarts or six pounds up to 12 quarts. The clusters should be packed evenly in layers in the basket alternating shoulder ends with tip ends. The top layer should consist of well formed clusters, the stems of which are covered in packing. The top should be level and the baskets packed level full or about one-half inch above the edge of the basket. Nothing except good clusters should go into the basket. Rot and mould will spread quickly throughout the basket from a few rotten or mouldy grapes.

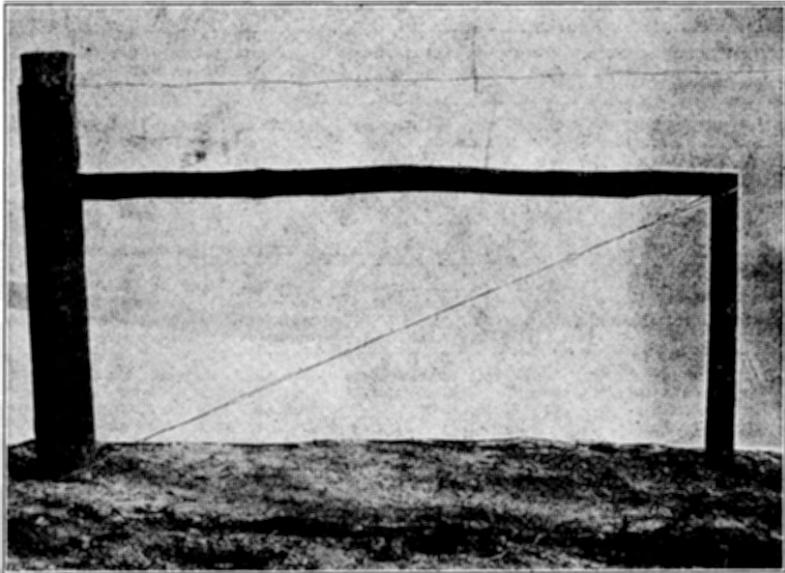


Fig. 14.—Brace used on end posts of trellis, wire extends around bottom of post to "Dead Man" about two feet from post

TREATMENT OF OLD VINEYARDS

There are many old vineyards in the state which are no longer productive because they have not been properly pruned, sprayed and cultivated in recent years. With proper treatment many of these vineyards may be brought back into normal annual production and thus give good profits to the owners. If a high percentage of the original vines are still living and are thrifty and vigorous it will usually pay to rejuvenate the vineyard.

A consideration of the growing and fruiting habits of the grape vine will make it easier to understand how to rejuvenate old vineyards. As growth develops from year to year in an unpruned or improperly pruned vineyard, the fruiting wood consisting of one year old canes becomes farther and farther removed from the trunk of the plant. More annual growth develops at or near the ends of the old vines than on the trunk or other parts of the vine. As growth progresses from year to year an increasing number of canes develop and the length of each cane decreases. This soon develops a thick matted vine consisting of weak spindly shoots or canes

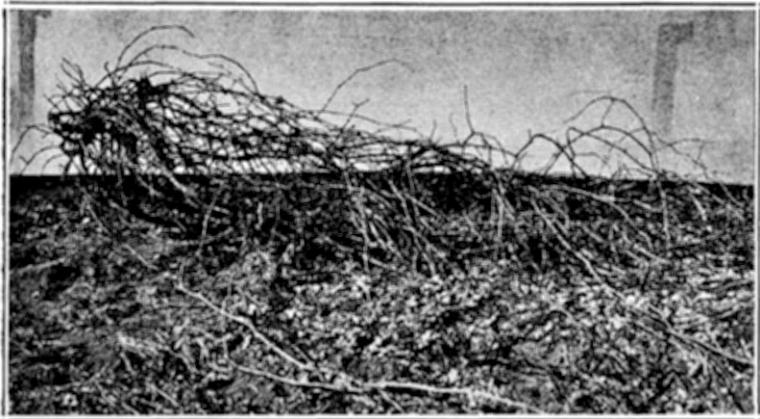


Fig. 15.—An old vine in a neglected vineyard, before pruning

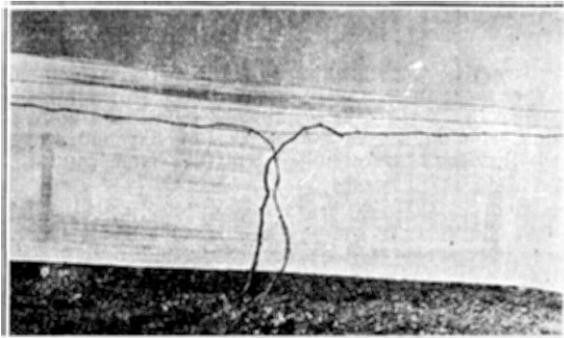


Fig. 16.—The same vine after pruning to the Munson system. It was necessary in this case to leave two trunks temporarily

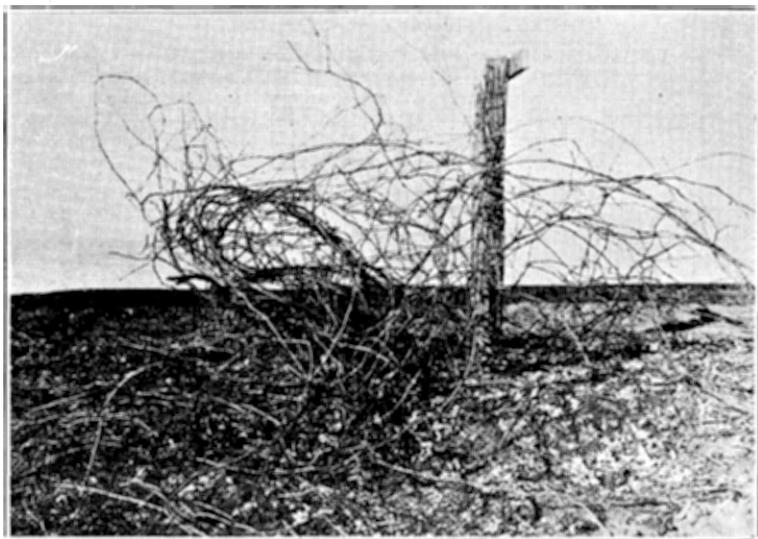


Fig. 17.—A vine in the same vineyard as Fig. 15, before pruning

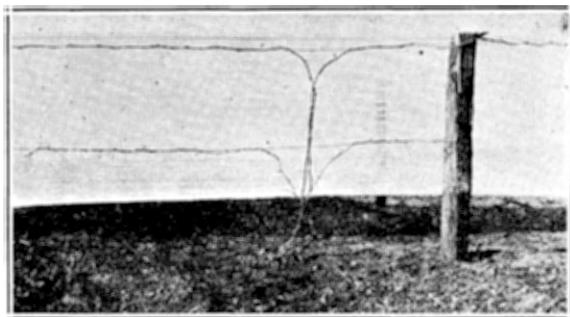


Fig. 18.—The same vine after pruning to the Kniffin system. If it is necessary to have more than one trunk the first year, the growth should be trained so that eventually all but one trunk may be removed, giving a vine similar to that in Fig. 13, depending upon whether the Munson or the Kniffin system is used

far removed from the head of the vine and bearing small bunches of fruit, with berries of inferior size and quality. This undesirable distribution of the wood on the trellis is one of the reasons for the necessity of rejuvenation.

The length of time required for rejuvenation of an old vineyard will depend upon the pruning methods employed. If the vineyard is producing crops of fruit of any size, it will be best to take two or three years for complete rejuvenation. However, if very little fruit is being produced rejuvenation

nation may be accomplished in one year by sacrificing all of the fruit, in which case the old vines should be cut off at the top of the ground. When so treated shoots will develop, most of which should be removed, and those remaining trained as outlined for young vines. These shoots may be expected to develop into fruiting canes for a crop the following summer. A different type of pruning should be followed in vineyards which are producing any considerable amount of fruit. In pruning a vineyard of this type it should always be kept in mind that the fruiting wood consists of one year old canes. Fruiting canes for bearing a crop should be selected as near to the head of the vine as it is possible to secure the proper amount of one year old wood. All other growth should be removed. In most instances this will mean that long vines must be untangled and pulled away from the trellis. If the old plant consists of a number of vines or stems this number should be reduced so that only one or two are left. After the vines are pruned and the prunings removed from the vineyard all posts should be examined, replacing those which are missing or decayed. The end posts should be braced and the wires tightened. As soon as growth begins in the spring, cultivation and other methods of vineyard management as outlined in this bulletin should be started.

Under either of the methods of pruning outlined above it will be necessary to remove a large number of suckers and useless shoots which develop from the base of the vine. It is desirable to renew all of the top as quickly as possible. In pruning for fruit production, shoots will usually develop from the base of the vine and be trained in such way as to form the trunk of the new vine. This selection of a cane for a new trunk is usually made when pruning the second year. In many instances, however, it will be possible to secure a cane when pruning the plant the first year. If such a cane is found growing up through an old matted vine it should always be given preference to any other type of growth found on such a vine. As soon as possible the vines should be brought into the proper shape and trained on either type of trellis (Munson and Kniffin) which may be selected.

Some of the varieties in these old vineyards may be unsuited to Oklahoma conditions. If such is the case and if the vines and roots are strong and vigorous it may be possible to change to profitable varieties by grafting. In grafting, the tools required are a good sharp knife, a saw and a chisel. A grafting chisel is to be preferred if much grafting is to be done as this has a blade for making a split in the stock to be grafted and also a wedge for opening the split to receive the scion. In grafting such varieties the old trunk should be cut off at or below the surface of the ground. This should be done so that the scion will eventually become established on its own roots. It will be necessary, however, to make this cut high enough above the roots to leave a straight grained portion of the trunk so that it will split fairly straight for about two inches.

The same type of wood as that selected for fruiting canes should be chosen from the variety with which it is desired to graft the old vineyard. The soil should be dug away from around the plant to be grafted so as to select the proper place to cut off the trunk. After the trunk is cut off it should be split with a chisel and a wedge inserted to hold the two halves apart. A scion or piece of wood having two or three buds should be cut from the wood selected to be grafted. This should be cut far enough below the lower bud so as to give room to cut a wedge at the lower end of the scion. This wedge should be made with two long sloping cuts, one on each side of the scion, and should be made so that the wedge is slightly thinner on the side away from the bud, thus permitting all of the pressure of the stock to be placed on the outer edges of the scion. The scion must be placed in the split portion of the stock so that the cambium layer or inner

bark of the stock comes in contact with the cambium of the scion or there will be no possibility of the graft growing. In grafting old vines the stock is usually stiff enough to hold the scion in place and no tying is necessary. If the stock is large enough two scions may be inserted, thus doubling the chances for success. The cut surface should not be covered with grafting wax, but the soil should be carefully mounded up over the entire graft covering to slightly above the top of the scion. This should be done very carefully so as not to disturb the scion.

When vines are grafted a large number of shoots will usually start from the roots below the graft. These should all be removed as soon as they show through the surface so as to throw the strength of the plant into the graft. The graft will not usually start to grow as early as ungrafted vines and it is good practice to keep all of the shoots off of the stock for at least a month or six weeks to give the graft a chance to start. If it does grow they should be kept off during the entire season and succeeding seasons. If the graft does not start growth after a reasonable length of time the shoots should be allowed to develop and all but the strongest one removed and this one may be allowed to grow for grafting the next season.

The wood to be used for grafting should be selected as early in the dormant season as convenient and stored in a cool place in damp sand or sawdust until it is used. Probably the best time for grafting is just as the buds commence to swell. It may be done later but is not likely to be as successful. If the work is not done at this time it should be done considerably earlier and before the heavy sap flow commences.

VARIETY TESTING

There are several species of native grapes which do particularly well in Oklahoma. This led people to believe that cultivated varieties of grapes should also prosper and many were planted, especially Concord. Concord did not ripen evenly and had other faults in some parts of the state. Experiments were therefore undertaken to determine if there were varieties of grapes which would be more successful than Concord in Oklahoma.

About 70 varieties of grapes were planted on the Experiment Station farm at Stillwater during 1915 and 1916. Three vines of each variety were planted. The grapes were trained to Munson system. Unfortunately the soil is heavy clay loam with a hardpan and thus not well adapted to

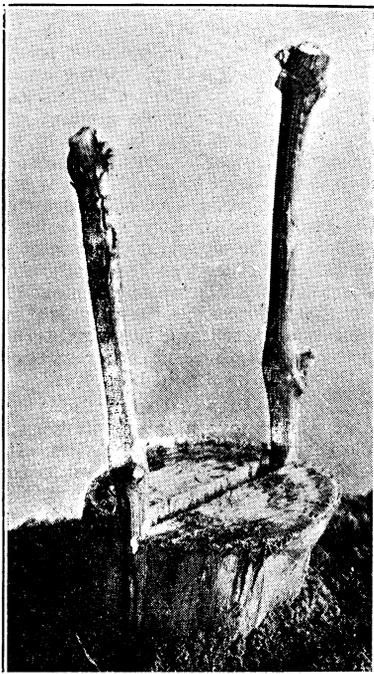


Fig. 19.—A cleft graft before covering with soil

grapes. The vines were planted 10 by 10 feet apart which is too close for many of the more vigorous varieties. Production records and blooming records were kept of the different varieties and the vines have been pruned, sprayed and cultivated in accordance with the best practice for this section.

In 1933 and 1934 a vineyard was planted on the Extension Station Farm near Perkins, Oklahoma. The soil is a sandy loam, favorable for grape production. Some of the more promising varieties were planted and new varieties have been added as available. Many new varieties have been acquired and added each year. It will be noted in the following table that there is considerable variation from results at Stillwater. The differences are probably chiefly due to differences in soil.

In the spring of 1915 ten vines each of about 75 varieties of grapes were planted on the United States Southern Great Plains Field Station at Woodward, Oklahoma. Smaller numbers of vines of numerous other varieties have been added almost annually since that time. The vineyard was planted on about the highest location on the Station farm in a very sandy soil which is overlaid with a sandy subsoil. It was thought that if grapes would succeed in this location they should succeed on sandy soil in almost any location in that section. The vines were trained to Munson system and pruned according to the recommendations for that system. These vines were planted 10 by 10 feet. This has been found to be much too close for many of the more vigorous varieties, as it does not give sufficient room on the trellis. Clean cultivation of the soil has been practiced, and a cover crop is planted each fall to keep the soil from blowing. Records have been kept of time of blooming, time of ripening, evenness of ripening, weight of fruit produced on each vine, in addition to several items of less importance.

Although the two original tests, at Stillwater and Woodward were started independently, there were 61 varieties which were included in both. The variation in yield of the same varieties in the two localities may, in part at least, be accounted for by the difference in soil type on which the vineyards were planted. This is confirmed by the difference in results in the Stillwater and Perkins vineyards. Some of the differences in the Stillwater and Woodward results are, no doubt, due to differences in altitude and climate.

A table of yields, arranged in alphabetical order, giving the results for all varieties at the Perkins, Stillwater and Woodward Experiment Stations, appears below. The second column gives the average yields in pounds per vine at the Woodward station. The next column gives the average yield in pounds per vine at Stillwater station, and the last column gives the same information for the new vineyard at Perkins. These last yields are average production records for the years 1936 and 1937 only, as this is a new planting.

A Discussion of the Results of the Variety Tests

These tests have shown that there are a large number of varieties of grapes which will produce heavy annual crops in Oklahoma. No attempt has been made to estimate the marketability of any of these varieties except that in no instance is a variety recommended for planting or further trial unless it has shown sufficient quality for a market grape combined with good color and heavy yields.

Considerable variability in the average production of the varieties is noticeable at Stillwater, Woodward and at Perkins. Practically two-thirds of the varieties at each station have made higher average yields than the Concord. Since these tests are planted in different types of soil and since the varieties included in the tests are growing under different climatic conditions, the conclusion may be drawn that there are a number of varieties which under average conditions any place in the state may outyield

Grape Yields

Variety	Woodward Okla. Lbs. per Vine	Stillwater Okla. Lbs. per Vine	Perkins Okla. Lbs. per Vine
Agawam	5.6	1.4	---
Albania	7.1	17.3	---
Amerbonte	12.2	---	---
America	17.8	6.0	13.0
Amythest	---	1.0	---
Armalaga	9.9	8.7	8.6
Augustina	4.3	1.6	---
Bachman	.5	---	3.8
Bailey	8.3	13.5	11.8
Banner	2.8	8.5	---
Beacon	24.1	4.9	20.1
Bell	5.1	---	---
Ben Hur	16.9	7.0	---
Beta	8.3	---	---
Blondin	12.1	6.8	---
Bride	2.2	---	---
Brighton	2.8	2.8	---
Brilliant	3.7	3.2	---
Brocton	1.9	---	10.6
Caco	1.8	---	8.7
Campbell Early	1.2	1.0	8.6
Canada	20.2	---	---
Captain	13.7	---	---
Captivator	4.2	6.0	8.5
Carman	10.5	5.5	5.5
Catawba	17.5	8.9	11.5
Champanel	11.4	6.0	---
Champion	5.5	---	4.6
Christina	3.8	---	---
Clinton	13.4	8.8	---
Cloeta	10.9	4.6	9.5
Columbia	---	1.5	---
Concord	3.9	4.8	8.9
Cottage	3.6	---	---
Croton	6.3	---	---
Cunningham	4.2	---	---
Cyncona	3.3	---	---
Cynthiana	3.9	10.9	---
Daisy	---	---	15.4
Delakins	2.6	---	---
Delaware	10.3	4.3	7.6
Delicious	1.7	8.3	---
Diamond	6.9	4.1	11.9
Dr. Collier	7.7	---	---
Dutchess	11.3	---	---
Early Daisy	3.9	---	---
Early Victor	3.0	---	---
Eclipse	.6	4.7	---
Edna	19.2	8.4	12.4
Ellen Scott	19.6	11.7	14.9
Elvira	13.7	9.0	---
Empire State	6.2	---	---
Ericson	---	8.0	---

Grape Yields—(Continued.)

Variety	Woodward Okla. Lbs. per Vine	Stillwater Okla. Lbs. per Vine	Perkins Okla. Lbs. per Vine
Extra	14.5	13.1	10.9
Fern Munson	9.7	5.7	---
Fredonia	1.5	---	11.8
Gaertner	2.1	---	3.7
Garland	.8	---	---
Geyer	---	2.6	---
Goethe	8.6	---	7.4
Gold Coin	.5	6.0	---
Golden Muscat	1.9	---	10.2
Green	1.7	---	9.5
Hanover	---	---	3.1
Hartford	9.2	---	---
Hayes	1.4	---	---
Headlight	3.3	1.3	---
Herbemont	16.2	3.0	---
Herbert	6.1	9.0	---
Hernito	2.1	---	3.2
Hicks	1.4	7.1	---
Hidalgo	2.0	---	---
Hubbard	.4	---	3.2
Husmann	11.1	---	---
Iona	6.6	---	---
Isabella	19.4	9.0	---
Ives	1.1	3.7	---
Janesville	13.8	---	---
Jefferson	.7	---	7.5
Jessica	6.0	---	12.8
Junior	1.1	---	---
King	.2	3.2	5.7
King Philip	1.7	---	---
Ladano	2.6	---	---
Last Rose	16.6	7.0	---
Lenoir	17.0	12.3	---
Lindley	8.2	9.3	---
Lomanto	3.6	7.4	---
Lucile	3.0	11.8	17.7
Lukfata	2.9	4.4	---
Lutie	3.4	5.0	---
Manito	19.0	7.6	---
Manson	5.5	---	---
Marguerite	13.4	---	---
Mathilda	1.7	---	---
Mericadel	10.3	6.0	8.8
Minnie	8.4	---	8.1
Moore Early	1.9	4.4	5.7
Moyer	3.0	---	---
Muench	12.8	12.0	9.5
Muscat Rose	---	6.2	---
Neva	12.0	---	---
Niagara	3.7	4.3	---
Norton	12.4	13.0	---
Ontario	2.0	---	9.3

Grape Yields—(Continued.)

Variety	Woodward Okla. Lbs. per Vine	Stillwater Okla. Lbs. per Vine	Perkins Okla. Lbs. per Vine
Perkins	12.9		
Pocklington	1.2	5.5	4.1
Pontiac	1.3		5.2
Portland	3.2		12.5
President	1.6		11.1
Regal	7.2		16.3
Ripley	1.1		6.7
Rommel	9.1		10.3
Ronaldo	13.1	7.0	7.1
R. W. Munson	7.4	5.6	3.9
Salamander	4.0	9.8	
Salem	5.5		6.0
Sheridan	4.6		
Star		14.1	
Sunrise	2.7		
Triumph	5.4		
Urbana	1.4		6.2
Valhalla	6.9	14.7	
Vergennes	6.2	5.4	9.9
Volney	7.1		
Wapanuka	1.7		10.0
Watkins			2.5
Wayne			9.8
Wetumka	4.0		
White Cross	1.2		
Wilder	3.4	6.3	
Winchell	4.4	6.1	11.0
Wine King	13.9	8.5	10.7
Woodruff		3.5	
Worden	2.7	7.9	8.5
Xenia	3.2		
Xinta	6.9		

NOTE: Where a dash (—) occurs it indicates that the variety was not grown at that station.

To estimate roughly the yield per acre multiply the above vine yields by 435.

NOTE: Many varieties in the above table have made higher yields than the Concord at one or both stations, but are not considered worthy of further trial because of one or more of the following reasons: unevenness of ripening, poor quality, loose clusters, small size of cluster or berry, susceptibility to disease or insect injury, moderate yields, cracking of the skin, shattering, lack of hardiness and drought resistance. The list is as follows: Albania, Agawam, Amberbonte, Banner, Ben Hur, Blondin, Canada, Captivator, Champanel, Champion, Clinton, Croton, Cynthiana, Diamond, Dutchess, Eclipse, Elvira, Empire State, Ericson, Fern Munson, Gold Coin, Hartford, Heribmont, Herbert, Hicks, Husmann, Isabella, Janesville, Lindley, Lomanto, Lukfata, Lutie, Manson, Marguerite, Mericadel, Muscat Rose, Neva, Perkins, Pocklington, Rommel, Ronaldo, Star, Valhalla, Vergennes, Wilder, Winchell, Wine King, Worden.



Fig. 20.—Vine and Fruit of Beacon

the Concord. Many of these varieties are equal to or better in quality than the Concord and possess other qualifications which should make them acceptable in the market.

Grapes which have done well at two places as different in soil and climate as Woodward and Stillwater should be worthy of trial at any place in the state. A list including eight varieties which have done well at both stations follows: Armalaga, Catawba, Edna, Ellen Scott, Extra, Last Rose, Lenoir and Manito.

However, for a trial vineyard, which it would be well for every prospective grower to start on his own place, there are other varieties of grapes which have succeeded well at only one or the other of the stations, or that have been observed to do well at places other than Woodward or Stillwater, or which have qualities other than high yield that recommend them for some purposes, at some places in the state. All grapes, so far as is known, that have proved worthy of trial at any place in the state are included in the table on page 28. These varieties should not be chosen for planting in any particular place, or for any particular purpose, without first reading the discussions of the individual varieties which follow.

SHORT DISCUSSION OF VARIETIES

Since many of the varieties in the table on page 28 are not well known, a few of the more important points in connection with each are given. This is done for the purpose of helping those who wish to select one or more varieties from a group ripening in a certain season. In the description of varieties given below, the distance at which plants should stand in the row is indicated in feet.

***America:** Very vigorous; cluster, medium in size and loose; berry, small to medium; color, black; skin, thin, but medium tough; pulp, tender;

CHARACTERISTICS OF PROMISING VARIETIES

Variety	Date Ripe*	Vigor of vine	CLUSTER		Size of Berry	Color of Berry	Color of Juice	Shipping Quality	Storage Quality	Quality as Table Grape	Self Fertile	YIELD	
			Size	Compactness								Stillwater	Woodward
Moore Early Campbell	7-31	Weak	Medium	Medium	Medium	Black	Red	Good	Good	Good	Yes	Low	Low
Early Beacon	8- 2	Weak	Medium	Medium	Large	Black	Red	Good	Good	Good	No	Low	Low
America	8-11	Vigorous	Large	Medium	Large	Black	Red	Fair	Good	Good	Yes	Low	High
	8-12	Very Vigorous	Medium	Loose	Medium	Black	Dark red	Fair	Fair	Fair	No	Low	High
Delaware	8-13	Medium	Small	Compact	Small	Red	Straw	Good	Excellent	Excellent	Yes	Medium	Medium
Lucile	8-14	Medium	Medium	Compact	Medium	Dark red	Light red	Good	Good	Fair	Yes	High	Low
Balley	8-14	Medium	Large	Medium	Large	Black	Red	Excellent	Good	Good	Yes	High	Medium
Niagara	8-14	Medium	Large	Medium	Medium	Green	Straw	Good	Poor	Good	Yes	Low	Low
R. W. Munson	8-15	Very Vigorous	Medium	Medium	Medium	Black	Dark red			Good	No	Low	Low
Concord	8-17	Medium	Medium	Medium	Medium	Black	Red	Good	Good	Good	Yes	Low	Low
Captain	8-18	Vigorous	Large	Loose	Medium	Black	Red	Poor	Fair	Fair	No	High	High
Extra	8-20	Vigorous	Medium	Compact	Medium	Black	Red	Excellent	Good	Good	Yes	High	High
Carman	8-21	Medium	Medium	Medium	Medium	Black	Red	Good	Good	Good	Yes	Low	Medium
Ellen Scott	8-23	Vigorous	Large	Compact	Medium	Violet	Light red	Poor	Fair	Good	Yes	High	High
Armalagø	8-24	Medium	Medium	Medium	Medium	Green	Straw	Good	Good	Good	Yes	Medium	Medium
Edna	8-24	Very Vigorous	Large	Medium	Medium	Green	Straw	Poor	Poor	Good	No	Medium	High
Norton	8-26	Vigorous	Small	Compact	Small	Black	Dark red	Excellent	Good	Fair	Yes	High	Medium
Lenoir	8-27	Vigorous	Large	Medium	Small	Black	Dark red	Excellent	Excellent	Fair	Yes	High	High
Muench	8-29	Medium	Medium	Compact	Medium	Black	Red	Good	Good	Fair	Yes	High	High
Catawba	9- 5	Medium	Medium	Medium	Medium	Red	Light red	Fair	Excellent	Excellent	Yes	Medium	High
Goethe	9- 8	Medium	Medium	Loose	Very Large	Red	Straw	Poor	Good	Excellent	Yes	Medium	Medium
Last Rose	9-24	Medium	Large	Compact	Medium	Dark red	Light red	Fair	Good	Good	No	Low	High

*NOTE: Date Ripe—this is a 10-year average at Woodward.

color of juice, dark red; shipping quality, fair; storage quality, fair; season of ripening, early midseason; yields low at Stillwater, high at Woodward and Perkins; self fertile; use, juice and market.

This variety has a peculiar flavor for which some people acquire a taste and which they like very well. It makes a very dark red juice, which also has a peculiar flavor. The juice may be mixed with that of other grapes to give color.

This variety is worthy of trial at least on a small scale in northwestern Oklahoma where it makes high yields. There are reports of its doing well in other parts of the state.

Planting distance, 14-16 feet.

Armalaga: Moderately vigorous; cluster, medium size and moderately compact; berry, medium size; color, green; skin, thin and tough; pulp, tender but moderately firm; color of juice, straw; shipping quality, good; storage quality, good; season of ripening, late midseason; yield, fair at all three stations; self fertile; use, table and market.

This variety has made only fair yields at all stations, but it is of very high quality and deserves a trial where a grape of this color and season is desired.

It is inclined to be somewhat tender in the northwestern part of the state.

Planting distance, 12-14 feet.

Bailey: Moderately vigorous; cluster, medium to large, moderately compact; berry, medium to large; color, black; skin, medium thick and tough; pulp, moderately firm; color of juice, red; shipping quality, excellent; storage quality, good; season of ripening, early midseason; yield high at Stillwater and Perkins; medium at Woodward; self fertile; use, table, market, and juice.

The Bailey is of good quality and has larger clusters than the Concord, and therefore may compete successfully with it on the market. In the northwestern part of the state, yields have been medium, but yields have been high at Stillwater. There are reports of this variety doing well in other parts of Oklahoma.

Planting distance, 12-14 feet.

Beacon: Vigorous; cluster, medium to large; moderately compact and shatters easily; berry, medium to large; color, black with heavy blue bloom; skin, medium thick and tough; pulp, medium tough and firm; color of juice, red; shipping quality, poor; storage quality, fair; season of ripening, early midseason; yield, high at Woodward and Perkins; self fertile; use, table, market and juice.

This variety will probably never become a commercial grape except for local market because of berries shattering from the cluster. For home use it should not be neglected in the western part of the state, where it succeeds so well. It has a sprightlier flavor than Concord, which it much resembles, but which it far outyields.

Planting distance, 12-14 feet.

Campbell Early: Vine, weak; cluster, medium, moderately compact; berry, large; color, black; skin, medium to thin, tough; pulp, medium tough; color of juice, red; shipping quality, good; storage quality, good; season of ripening, early; yield, low at all stations; self sterile; use, table, market and juice.

*See page 32.

Campbell Early has made very poor yields at Woodward and Stillwater, and at Woodward the vines have been dead for several years. There are, however, persistent reports of its doing well in the southern and eastern parts of Oklahoma. It succeeds well only when planted on a fertile soil and given good care.

Planting distance, 10 feet.

***Captain:** Vine, vigorous; cluster, large, very loose unless well pollinated by other varieties; berry, medium size; color, black; skin, medium thick and fairly tough; pulp, tough and moderately firm; color of juice, red; shipping quality, poor; storage quality, fair; season of ripening, late midseason; yield, high at Woodward, not included in tests at Stillwater and Perkins; self sterile; use, table, market and juice.

This variety has made heavy yields at Woodward, but the clusters are usually very loose and stringy; at other places, where it has been planted with varieties that properly pollinate it, it is reported to make extremely large and handsome clusters. It does not ship well, so can only be recommended for home use or local market.

Planting distance, 12-14 feet.

Carman: Vine, moderately vigorous; cluster, medium size, moderately compact; berry, medium size; color, black; skin, thick and tough; pulp, tough and firm; color of juice, red; shipping quality, good; storage quality, good; season of ripening, late midseason; yield, low at Stillwater and Perkins; medium at Woodward; self fertile; use, table, market and juice.

Carman is included, not because of high yields at any station, but because of persistent reports, backed by observations, that it makes good yields and clusters in the central and southern parts of the state. The fruit buds have not always proved hardy at Woodward. The type of growth that it makes at the Stillwater station indicates that this variety is probably poorly adapted to heavy soils. It ships well and is a good variety to plant where it is known to do well.

Planting distance, 12-14 feet.

Catawba: Vine, moderately vigorous; cluster, medium size, moderately compact; berry, medium to large; color, red; skin, medium thick and tough; pulp, medium tough and firm; color of juice, light red; shipping quality, fair; storage quality, excellent; season of ripening, late; yield, high at Woodward, medium at Stillwater and Perkins; self fertile; use, table, market and juice.

Catawba may be regarded as one of the leading red grapes for Oklahoma, especially for home use and local market. It is an excellent table grape, but does not stand shipping well. However, it keeps well in storage, and ripening late, can be kept until long after the grape season is past, and will still be in excellent condition. It apparently is adaptable to a wide range of climatic conditions. It may be inclined to color somewhat unevenly.

Planting distance, 10-12 feet.

Concord. Vine, moderately vigorous; cluster, medium to large, moderately compact; berry, medium size; color, black; skin, medium thick and fairly tough; pulp, tough; color of juice, red; shipping quality, good; storage quality, good; season of ripening, late midseason; yields, low at all stations; self fertile; use, table, market and juice.

Concord is used as a standard of comparison, because practically everyone is familiar with it. Many people, however, are familiar with it as it grows in other states farther north and east, and where it is better adapted

*See page 32.

to conditions than it is in most parts of Oklahoma. In addition to making low average yields at both stations, it usually ripens unevenly, as it also does over much of the rest of the state. It grows and ripens satisfactorily only in the extreme northeastern part of Oklahoma.

Planting distance, 10 feet.

Delaware: Vine, moderately vigorous; clusters, small, very compact; berry, small; color, red; skin, thin, but medium tough; pulp, tender; color of juice, straw; shipping quality, good; storage quality, excellent; season or ripening, early midseason; yield, moderate at all stations; self fertile; use, table and market.

This variety is well worth growing in a home vineyard as a choice table grape, but yields are probably too low to make it of value commercially, unless it can be sold at fancy prices. The quality is excellent.

Planting distance, 10 feet.

***Edna:** Vine, very vigorous; cluster, medium to large, moderately compact to loose; berry, medium size; color, green; skin, medium thick and fairly tough; pulp, tender; color of juice, straw; shipping quality, poor; storage quality, poor; season of ripening, late midseason; yield, medium at Stillwater and Perkins; high at Woodward; self sterile, use, table and market.

Edna is a rather high quality green grape. It does not ship well and keeps very poorly in storage, soon beginning to rot around the attachment to the stem. The Edna is quite susceptible to black rot. Its use will likely be restricted to growing where there is a local demand for a high quality, rather late green grape.

Planting distance, 14-16 feet.

Ellen Scott: Vine, vigorous; cluster, large, very compact; berry, variable in size from below to above medium; often irregular in shape because of compactness of cluster; color, violet; skin, thin and tender; pulp, tender and very juicy; color of juice, light red; shipping quality, poor; storage quality, fair; season of ripening, late midseason; yield, high at all stations; self fertile; use, table, market and juice.

Compared with other varieties of grapes, the Ellen Scott seems to thrive especially well in the drier portions of the state, and under dry conditions its quality seems to be more uniformly good than when grown in more humid sections. It makes a high yield and the cluster is exceptionally attractive in appearance. By many people it is considered an excellent table grape, and it will, therefore, continue to be grown for home use and local market even though it is too tender to ship well. The Ellen Scott is susceptible to anthracnose and black rot in the more humid parts of Oklahoma. It is not entirely hardy, the buds sometimes being killed during cold winters.

Planting distance, 12-14 feet.

Extra: Vine, vigorous; cluster, medium size, compact to moderately compact; berry, medium size; color, black; skin, thin and tough; pulp, medium tough and firm; color of juice, red; shipping quality, excellent; storage quality, good; season of ripening, late midseason; yield, high at Woodward and Stillwater; self fertile; use, table, market and juice.

Extra is one of the best all-round grapes, somewhat resembling Concord in appearance and general characteristics, though yields are much higher and the vine is more vigorous. This variety is probably adaptable to a wide range of soil and climatic conditions, and may prove a good commercial grape. It is suggested for trial in all parts of Oklahoma.

Planting distance, 14-16 feet.

*See page 32.

Goethe: Vine, moderately vigorous; cluster, medium size, loose; berry, very large; color, red; skin, thin and medium tough; pulp, tender; color of juice, straw; shipping quality, poor; storage quality, good; season of ripening, late; yield, medium at Woodward; self fertile; use, table and market.

Its large size, fine appearance and excellent flavor may make it valuable where there is a nearby market for fancy table grapes. It is inclined to ripen somewhat unevenly. This is a good red grape for its season.

It probably will do better than many others on heavy soils, but may be short-lived.

Planting distance, 10 feet.

***Last Rose:** Vine, moderately vigorous; cluster, large, very compact; berry, medium size; color, dark red; skin, thin and tough; pulp, medium tough and firm; color of juice, light red; shipping quality, fair; storage quality, good; season of ripening, very late; yield, low at Stillwater, high at Woodward; self sterile; use, table, market and juice.

This variety ships fairly well, but the clusters are so solid that they are inclined to crush if handled roughly. This is the last variety to ripen, so should be planted in the home vineyard; it may become of value commercially.

Planting distance, 10-12 feet.

Lenoir: Vine, vigorous; cluster, large, compact; berry, small; color, black; skin, thin and medium tough; pulp, tender; color of juice, dark red; shipping quality, excellent; storage quality, excellent; season of ripening, late; yield, high at Woodward and Stillwater; self fertile; use, market and juice.

Lenoir grows well under more different conditions of soil and climate than the majority of grapes. It has a large attractive cluster, and excellent shipping and storage qualities, and makes a high yield. For these reasons, it will continue to be of commercial importance, even though the berries are too small and acid to make it a popular table grape. It is very susceptible to black rot in the more humid parts of Oklahoma. It is somewhat tender in the northwestern part of the state.

Planting distance, 12-14 feet.

Lucile: Vine, moderately vigorous; cluster, medium size, compact; berry, medium to large; color, dark red; skin, medium thick; pulp, tough and firm; color of juice, light red; season of ripening, early midseason; yield, high at Stillwater and Perkins; low at Woodward; self fertile; use, table and market.

This variety attracts attention because of early ripening and compactness of clusters. The quality is objectionable, except to those who like a very foxy grape. It lacks drought resistance and the grapes wilt on the vine in hot dry seasons.

Planting distance, 10 feet.

Moore Early: Vine, weak; cluster, medium size and medium compact; berry, medium size; color, black; skin, medium thick and fairly tough; pulp, tough; color of juice, red; shipping quality, good; storage quality, good; season of ripening, very early; yield low at all stations; self fertile; use, table, market and juice.

This variety is desirable from a commercial standpoint, but succeeds only when planted in a fertile soil and given good culture; it is better adapted to the eastern than to the western part of Oklahoma.

Planting distance, 10 feet.

*See page 32.

Muench: Vine, vigorous; cluster, medium, compact; berry, medium size; color, black; skin, thick and tough; pulp, tough and firm; color of juice, red; shipping quality, good; storage quality, good; season of ripening, late; yield, good at Stillwater and Woodward; self fertile; use, market and juice.

This variety deserves consideration because of its season of ripening combined with good production. It ripens considerably later than most of the varieties usually planted, so can be used for extending the grape season, where there is a good local demand for a late black grape.

Planting distance, 12-14 feet.

Niagara: Vine, moderately vigorous; cluster, medium to large, moderately compact to compact; berry, medium to large; color, green; skin, thin and moderately tender; color of juice, straw; shipping quality, good; storage quality, poor; season of ripening, early midseason; yield, low at Woodward and Stillwater; self fertile; use, table and market.

Niagara, which is an old-time standard green grape, deserves a higher place than the records indicate, and for that reason it is included in the list of varieties. This appears to be the best green variety that has been tried in the eastern part of Oklahoma.

Planting distance, 10 feet.

Norton: Vine, vigorous; cluster, small to medium, compact; berry, small; color, black; skin, thin and tough; pulp, medium tough and firm; color of juice, dark red; shipping quality, excellent; storage quality, good; season of ripening, late; yield, good at all stations; self fertile; use, market and juice.

This variety is too low in quality to be used as a table grape, but heavy production and freedom from disease, make it worthy of consideration, especially for the grower who is not prepared to give the proper attention to spraying.

Planting distance, 12-14 feet.

R. W. Munson: Vine, very vigorous; cluster, medium size, moderately compact; berry, medium size; color, black; skin, thin and medium tough; pulp, medium tough; color of juice, dark red; season of ripening, early midseason; yield, low at all three stations; self sterile; use, table, market and juice.

This variety has made low yields at all stations, but is recommended for limited trial as a substitute for Concord in the southern part of the state, where it is reported that it does well. As compared to the Concord, it may be expected to ripen more evenly, but it probably will not develop clusters as satisfactory from the standpoint of compactness and size.

Planting distance, 14-16 feet.

Caco: Vigorous and productive red grape where it does well. It does fairly well in eastern New Mexico and northwest Texas. It might, therefore be worth trying on a small scale in the Panhandle of Oklahoma.

If the records at Stillwater and Woodward, together with reports and observations in various parts of the state are any indication, many varieties in the list should produce heavier yields than Concord, and are undoubtedly adapted to commercial production in the state. The limited experience with them makes it difficult or impossible to designate any one particular variety as the best for any section of the state. Anyone going into commercial production should carefully study this list in connection with the description of each of the varieties and choose the variety or varieties which are adapted to his needs and to his section. If the grapes are to be grown for a distant market it is best to confine the planting to a very

few varieties so the crop may all be handled and marketed at approximately the same time. However, there are many local or home markets in the state in which grapes are in demand over a considerable period of time. If one were planning a vineyard for the purpose of supplying such a demand it would be advisable to select a longer list of varieties including some of those which ripen at different seasons. As noted above, varieties selected from this list may be depended upon to furnish a continuous supply of grapes from July until the middle of September, or later. For specific time of ripening of each variety, see Table on page 32, under column marked "Date Ripe." In using this table it should be remembered that the varieties as listed should ripen in approximately the same order, but the date of ripening of any particular variety will vary in different localities. The ripening dates given are a 10-year average at Woodward, which is located in northwestern Oklahoma. Ripening dates may be as much as two or three weeks earlier in the southern and eastern parts of the state. A variation in date of ripening of any particular variety will also be noticeable from year to year.

There is a general prejudice against any but a black grape, because most people are well acquainted only with the Concord, and they use it as a standard by which to judge others. However, where a grower has a local market, it seems possible to educate buyers to the use of red and green grapes because of their quality and attractiveness. Many prefer them because of the clear colored jellies they make. If green or red grapes do particularly well in a given locality it would be well to increase gradually their number in a vineyard as people become educated to them.

Self Sterile Varieties

Five varieties in the above list are self sterile or partially so and will not produce full crops or will produce loose clusters unless other varieties blooming at the same time are planted with them. A list of these varieties together with a list of varieties which bloom at approximately the same time, any one of which should prove satisfactory as a pollinator, is given below.

VARIETY RECOMMENDATIONS

As mentioned previously in this publication, when one is planting a commercial vineyard it is highly desirable to limit the number of varieties. This is for the purpose of economy in packing and marketing the fruit. However, no one variety in this list is good enough to be recommended to the exclusion of others for all parts of the state.

Suggestions of varieties for the different sections of the state, as shown on the map on the opposite page, are given below.

In Section 1. The extreme northeastern part of the state, the Concord probably answers the requirements for a commercial grape better than any other variety. Outside of this area the Concord is not satisfactory, because of uneven ripening. Such varieties as Moore Early, Campbell Early, Extra, and Muench may be grown on a small scale for trial as grapes that may develop into commercial varieties. Delaware, Niagara, and Catawba should be grown to give a variety for home use and local market.

In Section 2. The leading commercial variety should be found among the following: Carman, Extra, or Bailey. On the more fertile soils, Moore Early or Campbell Early may prove profitable. Such varieties as Muench, Delaware, Catawba, Goethe, Niagara, Last Rose, and Beacon may be planted to give a variety for home use and local market.

In Section 3. Extra should be the leading commercial variety, with Moore Early, Campbell Early, and Muench grown on a small scale for trial

**Varieties Needing Pollination and Fertile Varieties
Blooming at Same Time**

Based on nine years' average blooming records, U. S. Southern Great Plains Field Station.

Variety to be pollinized	Date of bloom	Pollinizers	Date of bloom
America	May 24	Beacon	May 24
		Bailey	May 26
		Extra	May 26
		Muench	May 26
Campbell Early	May 20	Catawba	May 19
		Delaware	May 21
		Niagara	May 18
Captain	May 24	Beacon	May 24
		Bailey	May 26
		Extra	May 26
		Muench	May 24
Edna	May 31	Carman	May 28
		Norton	May 28
		Armalaga	May 27
		Ellen Scott	May 27
		Lenoir	May 27
Last Rose	May 28	Carman	May 28
		Norton	May 28
		Armalaga	May 27
		Ellen Scott	May 27
		Lenoir	May 27
		Bailey	May 26
Extra	May 26		

as grapes that may develop into commercial varieties. Delaware, Niagara, Catawba and Beacon may be grown to give a variety for home use and local market.

In Section 4. Extra should be the leading variety, with such varieties as Beacon, America, Delaware, Armalaga, Ellen Scott, Lenoir, Goethe, Catawba and Last Rose planted for home use and local market.

In Section 5. Extra should be the leading commercial variety, with Carman and Bailey grown on a small scale for trial as grapes that may develop into commercial varieties. Beacon, America, Niagara, Ellen Scott, Armalaga, Catawba and Last Rose may be grown to give a wide variety for home use and local market.

In Section 6. Extra, Delaware, Catawba, Goethe, and perhaps Captain are most likely to succeed. Caco, Alpha and Beta should be worth trying on a limited scale. Many of the varieties that are suggested for Section 4 should be tested. Very little is known about grapes for this section and there is some doubt about hardiness and drouth resistance of many of the varieties.

