THE GENEVA DOUBLE CURTAIN FOR CONCORD GRAPES

VINE TRAINING AND TRELLIS CONSTRUCTION

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Cover Photo and Figure 1 - Overhead view of Geneva Double Curtain trained Concord vines at harvest time in 1965 with leaves removed. GDC training started in the Spring of 1963.

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THE GENEVA DOUBLE CURTAIN (GDC) is an improved system of training certain varieties of grapes used for processing. Research on this system, developed at the Geneva Agricultural Experiment Station, was initiated in 1960, and grower trials started in 1964.

In this system, vines are trained to a bilateral cordon and are short cane pruned. The elongated trunks are secured to a horizontal cordon wire located 5-1/2 - 6 feet above the vineyard floor. There are two of these cordon supporting trellis wires, located 4 feet apart, for each row of grapes. Vines in the row are alternated to the left or right cordon wires to give the double curtain effect. These cordon wires are held in position by wood or metal supports attached to sturdy posts, spaced 24 feet apart in the row.

Advantages of changing to the GDC system from the traditional Kniffin training include better fruit and vine maturation, increased yield (from a vigorous vine), and adaptability for mechanical harvesting of fruit. Increased maturation and increased yield result from the better exposure of the leaves to sunlight on the basal half of the shoot. Mechanical harvesting is possible because of the unique positioning of the cordons and canes as shown in Figures 1 and 2. They are positioned in a vertical curtain 2 feet from the trunks and posts of the vineyard row.

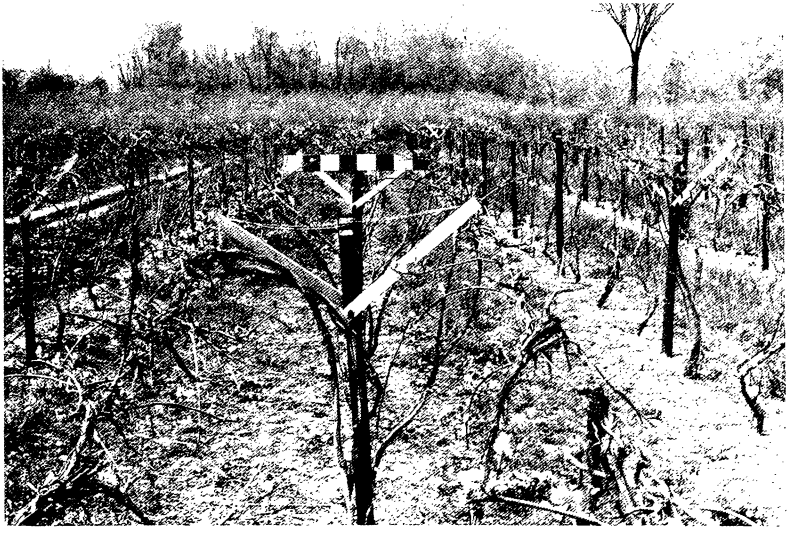


Figure 2 - Overhead view of Concord vines with GDC training in Spring 1965. GDC training started in Spring 1963.

APPLICABILITY OF GENEVA DOUBLE CURTAIN TRAINING

Vine vigor

The increase in maturation of fruit and/or yield, is obtained most frequently where the vine size is at least 2 to 3 lbs. of cane prunings per vine when spaced 6 to 8 feet apart, respectively, in the row. This is an expected response because shading is greatest in high vigor vines and Geneva Double Curtain is a correction for that shading.

Distance between rows

The mechanical harvester straddles each row as it harvests the fruit from both curtains. It is currently designed to operate on rows spaced at least 8 feet apart. Vines trained to the Geneva Double Curtain can be managed with available vineyard equipment on rows at least 9 feet apart. Shielding is recommended for wheeled equipment of all widths. For rows 8 to 8-1/2 feet apart, the spacing of the cordons may have to be reduced to 42 inches, even though this complicates the management.

Headland requirements

For mechanical harvesting, the minimum headland width at each end of the vineyard is 25 feet. This space must be free of anchor guy wires or other obstructions. Maximum row length is dependent on the capacity of the mechanical harvester, and this decision should be made in consultation with the processor fieldman.

Vine spacing

The Geneva Double Curtain may well be used on vines whose spacing is 6 or more feet. The proper vine spacing is dependent on the vigor of the vine and the basic objective is to obtain 0.2-0.3 pounds of prunings per foot of curtain. For example, a vine spaced at 8 feet with cane prunings of 3.2 pounds per vine provides 0.2 pounds per foot of curtain.

Double trunks

For Geneva Double Curtain training, vines spaced 8 or more feet apart should have double trunks. In fact, double trunks are desirable for all training systems used in New York State vineyards.

DEFINITIONS

The terms cordon wire supports, cordons, cordon wires,

curtains, trunk support wires, 5-bud fruiting canes, 1-bud renewal spurs, and cordon ties are explained in Figure 3.

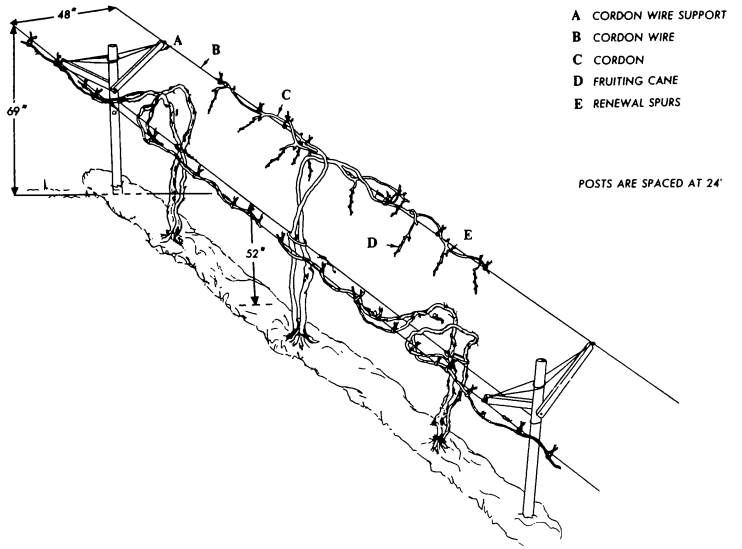


Figure 3 - Diagrammatic sketch of Concord vines trained to GDC system. Spurs and canes are shown only on the middle vine of the post length.

Cordon Development and Tying

Ultimately, the cordon system of a vine should consist of two cordons extending 6-8 feet in each direction along the cordon wire. This should be secured to the wire by semi-permanent ties.

Initially, one or more canes (whatever is needed to obtain the desired bud number) will be used in each direction. If more than one cane the number can be gradually reduced until only one remains in each direction by the third or fourth year. The cordon system for a row should be nearly continuous. It is suggested that in the first year the cordon components be wrapped around the cordon wire a sufficient number of times to provide support and that the canes be tied securely at the end with wire. In the second or third year the cordon should be unwrapped and the desired number of cordons be tied with semi-permanent ties (plastic or metal) along the cordon wire. Aluminum ties as designed and used in 1965 were not satisfactory for mechanical harvesting.

TRELLIS CONSTRUCTION

End Post Construction

Suggestions for the Geneva Double Curtain trellis end post construction are based on the premise that it provide: (1) stability -- so that the cordon wires will not sag unduly due to end post movement; (2) durability -- to the extent that the construction will not have to be repaired or replaced for a long period of time, perhaps 10 to 20 years; (3) economy -- in the long run and not necessarily the cheapest installation cost; and (4) convenience. The construction incorporates these characteristics.

Strong end post anchoring systems are needed as shown by failures of conventional systems. The GDC cordon wires are subject to greater crop loads and receive less support from the trellis than with conventional training systems. For mechanical harvesting it is much more important that the cordon wires be kept taut with a minimum of sag between supports. For these reasons the end post must be braced or anchored.

The construction shown in Figure 4 is dependent on the availability of used railroad ties. The minimum length for the end post is 8-1/2 feet. Both this post, and the brace post, should be set 4 feet in the ground with the earth tamped tightly around it. Fall setting is best. The end post should be set at a slight angle so that the earth will be compressed ahead of it as it is pulled toward the vertical position when wires are loaded. Wire tightening after frost is out of ground in spring is best. Longer posts permit higher attachment for the cordon wire. The 52 inch height shown for the attachment is the minimum desirable for mechanical harvesting. A railroad tie is also chosen for the brace post because of greater stability and lower cost. It should be set at least 5-1/2 feet from the end post to prevent disturbing the soil close to the end post. The horizontal brace piece is shown as a 4 inch post although it is intended that this be selected from the largest of the 3 inch pressure-treated line posts. Two strands of No. 9 galvanized tension wire doubled (to give 4 wire strands) and tightly twisted adds strength to the construction.

Advantages of this construction seem to be:

1. Stability and durability.
2. Used railroad ties, pressure-treated posts, and galvanized or aluminum coated wire are readily available.
3. Used ties are cheaper than most other posts.

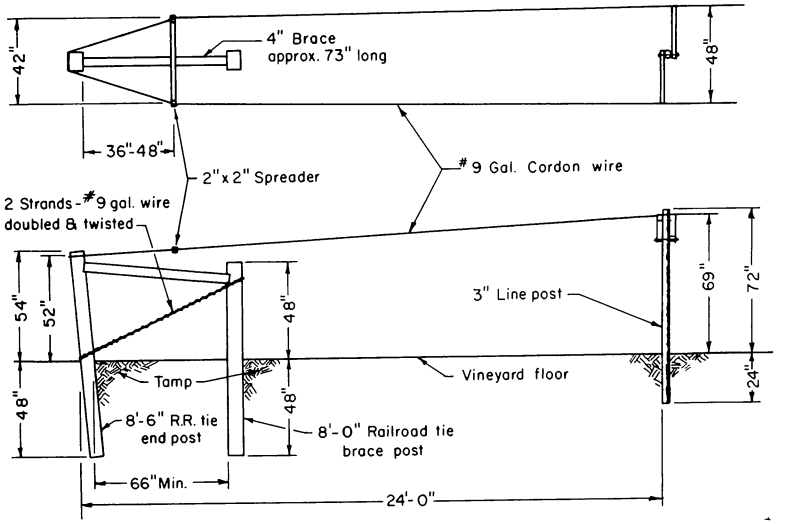


Figure 4 - Suggested end post and brace construction for GDC Trellis System. Cordon wire and brace should be kept high. Success of the design depends on the deep setting of the wide surface railroad ties.

Alternatives to the suggested end post structure:

1. The stability required is obtained by the large surface of the railroad tie pushing against the soil. Large surfaces can be provided by bigger ties or posts, or by adding cleats to the front edge of the posts. Setting the post in concrete will also help increase the cross section so long as the concrete does not crack along the side of the post.

2. Substituting round posts with diameters of less than the width of the railroad ties will provide less stability. Five and 6 inch pressure-treated poles will be much less desirable than the railroad ties for end and brace posts. Their use will contribute to earlier failure of the construction. At the same time costs are considerably higher.

A guy wire and anchor can be used for end post stability. The holding resistance of the soil is an unknown quantity and specific recommendations cannot be made.

Several types of anchors might be used - logs, posts, ties, concrete - as well as commercially available screw anchors used by telephone and power companies. The costs of the latter are

likely to be high (Figure 5).

The best guide to the use of an anchor system would be that a 5 inch Mathews Scrulix Type (or equivalent) screw-in anchor screwed 5 feet into the ground, guyed to a railroad tie (or 5 inch min. diam. post) at a 45 degree angle (approximately 4 feet from bottom of post) is sufficient. Other equivalent anchors, such as expanding types, could be substituted. Anchors should be installed before the ground freezes in the fall.

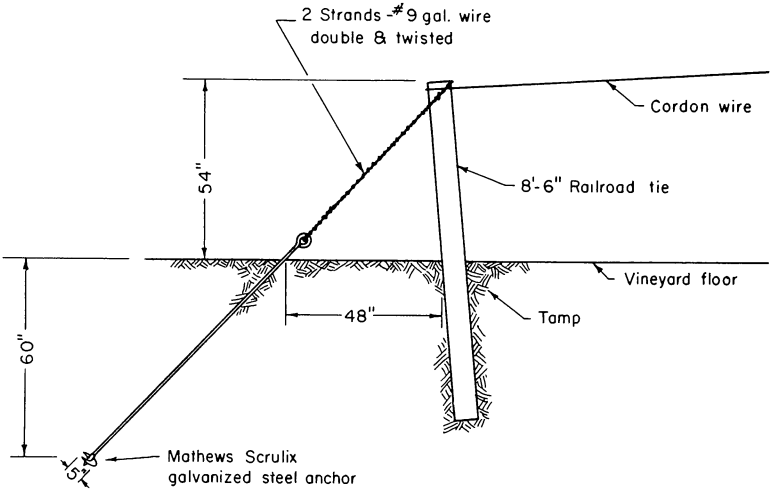


Figure 5 - One type of commercial anchor. Note depth, angle of guy, and size. Homemade anchors with equivalent holding power may be used.

Trellis

Experimental field installations of various designs of trellises have indicated that this trellis meets the needs the best of any developed to date. Some features include a pin joint and angle of attachment of the cordon wire support so that it moves freely up, in, and away from the spiked-wheel shaker of the harvester on contact. Placing the wire at the extreme end of the cordon wire support prevents protruding parts that would entangle with the spiked-wheel of the harvester. The arm must be free to drop back to home position after shaker operation. The trellis can be home-built and installed. The most serious disadvantage of this design is the labor requirement for installation.

Instructions and suggestions for the INSTALLATION and

USE of the GENEVA DOUBLE CURTAIN TRELLIS for 9 foot rows and 69 inch wire height (Figure 6):

Line Posts

(1) Only sound, straight pressure-treated posts with a minimum diameter of 3 inches should be used.

(2) Uniform height makes installation and all other work easier, including mechanical harvesting.

(3) Minimum height recommended is 5-1/2 feet.

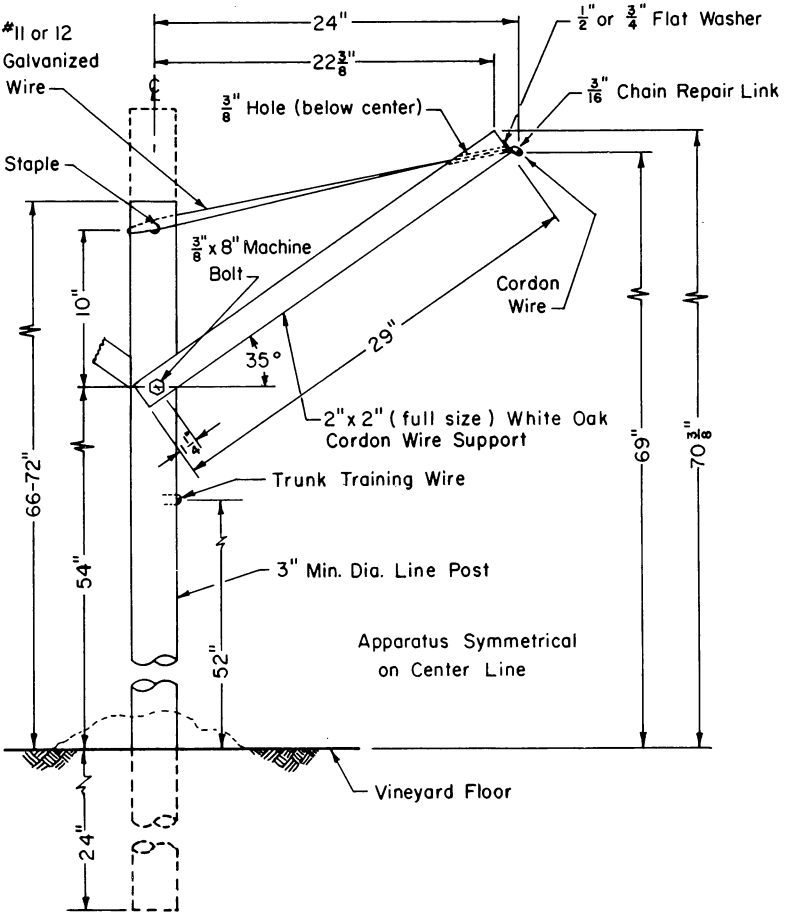


Figure 6 - Details of construction for the Geneva Double Curtain Trellis System. Note: 69" Cordon wire height, length, and angle of support, and minimum height of post for support wire position.

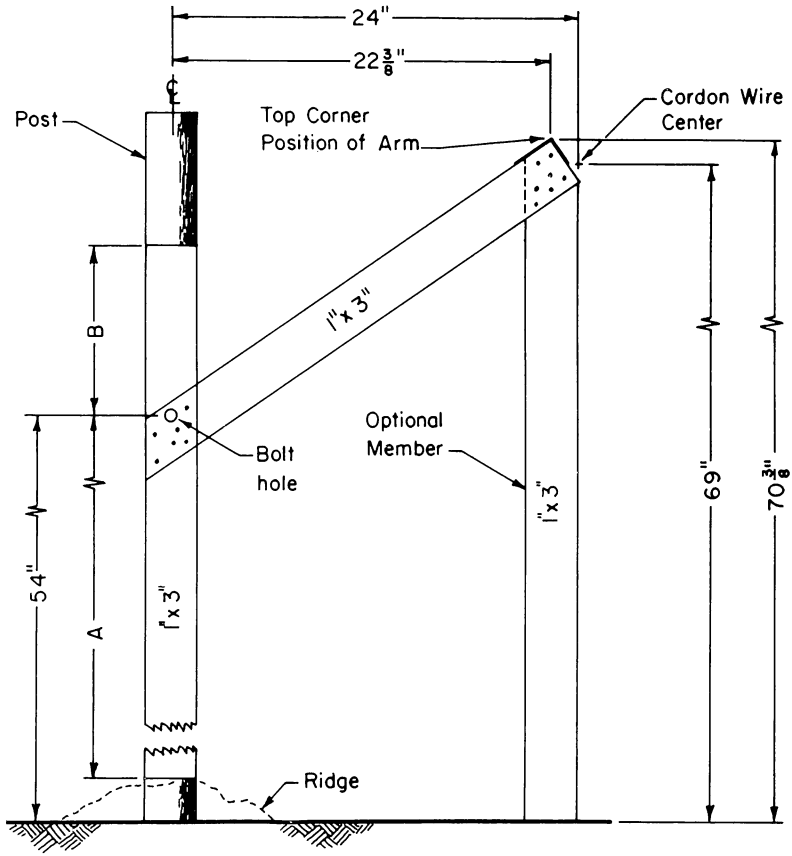
(4) Maximum height recommended is 6 feet.

(5) Posts should be firmly set in an upright position.

Cordon Wire Supports (Figure 7)

(1) Attachment recommended is 54 inches from vineyard floor.

(2) White oak is longer lasting than most other native



Note: A. Adjust length to fit on top of average height of ridge in vineyard.

B. Minimum of 10 inches. Should be as high as average height of posts will allow — up to a horizontal position. See # 3, support wire.

Figure 7 - An idea for a jig to speed installation of the GDC Trellis.

woods. Douglas fir and hickory are possibilities also. Pressure-treated yellow pine and red oak are satisfactory if treatment is done after supports are made.

Support Wire (post to support)

(1) Can be #11 or #12 galvanized.

(2) Strongest design is with wire running horizontally from support to post.

Note: sketch shows wire to post at lowest recommended angle and attachment.

(3) A jig can be made for installation to facilitate location of support piece, cordon wire height and wire length, and position on post. Wire position should be at highest average position allowable with post height in a particular vineyard.

(4) Wire should be loosely stapled to the side of the post.

Cordon Wire

(1) Height of trellis wire and distance between wires is affected by changes in dimensions of the trellis structure. It might be well to install the wire at 69-1/2 inches to 70 inches high with slightly less than a 24 inch offset (by pulling the wire a little tighter), because some stretch and sag will take place.

(a) Offset becomes 24-3/4 inches to 25 inches when wire drops to 69 inches high.

(b) Offset becomes 25-1/2 inches when wire drops to 68 inches high.

(c) If pulled up to 71 inches high (by tightening support wire), the offset will be narrowed to 23-1/4 inches.

It is more economical in the long run (Figure 8).

Note that a 2 inch x 2 inch full dimension rough sawed spreader for the cordon wires is used near the end post. This keeps the wires spread for the GDC system as near to the end of the row as possible.

Cordon wire spacing described here is 48 inches for rows spaced 9 feet apart. It can be reduced to 42 inches for rows 8 feet apart. Cordon wire spacing and row widths should remain uniform in any one row and preferably throughout the vineyard.

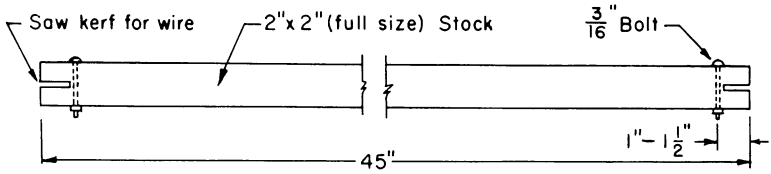


Figure 8 - Details of a suitable spreader. See Figure 1.

Variations in wire and row spacing can lead to difficulties in machine operations.

(2) Use #9 galvanized smooth wire.

Trunk Training Wire

(1) Needed to train trunks to post line when mechanical harvesting is contemplated.

(2) Recommended height is 52 inches.

(3) Old cordon or salvaged wire can be used (Figure 7).

Wires

By convention, No. 9 (Steel wire gauge) black annealed wire has been used for trellis construction in vineyards. Galvanized or aluminum coated steel wire will last longer. It is recommended that the zinc coating of galvanized wire meet ASTM standards for Class II wire which is 0.6 oz. per square foot. The galvanized or aluminum coating will prevent the rapid corrosion and pitting which weakens black wire. The heavier loads imposed on the wires from increased production, the offset support in the GDC trellis system, and the necessity for tighter wires, particularly for mechanical harvesting, dictate the use of the more durable galvanized or aluminum coated wire.

TRAINING OF VINES

Conversion of mature vineyards

Any vigorous vine with one or two trunks of 5-1/2 feet height can be converted to Geneva Double Curtain training at one pruning. The first year of conversion can afford gains in fruit maturation and mechanization. An increase in yield can be expected from the second year on. The mature vineyard with vines spaced at 8 feet would, with Geneva Double Curtain training, have the odd-numbered vines trained to one cordon wire and the even-numbered vines trained to the other. This would afford 16 feet

of cordon wire per vine when they are 8 feet apart. The two trunks developed to the top wire by Kniffin training should be spread about 2 feet apart when converting to the GDC. In the first year, a vine needs to have sufficient canes tied parallel to the cordon wire to afford the appropriate shoot number for a normal crop. Buds on the basal portion of the canes which are more than 6 inches from the cordon wire should not be counted. In the second year, for each of the two trunks, a 2 foot arm and the best 6 foot arm are to be retained to form the cordons. The bud number in the second and subsequent years should be determined by the standard pruning severity scale of 30 + 10; in no instance should the bud number per 16 feet of trellis space exceed 70. These buds retained for fruiting would be borne on a system of 5-bud canes and 1-bud renewal spurs from the cordon. These 5-bud canes should be spaced evenly. It is essential that for each 5-bud fruiting cane at least one 1-bud renewal spur be retained. These renewal spurs should originate as near the cordon as possible and be spaced evenly along the cordon. Because these 1-bud spurs are highly fruitful, they should be included in the bud number counting. See Table 1.

The need for trunk renewal, and consequent cordon renewal, would be the same as for umbrella trained vines.

The use of Geneva Double Curtain training in new vineyards

It is suggested that new plantings in which it is planned to use Geneva Double Curtain training be handled in the customary way for umbrella or Hudson River umbrella training for at least the first crop. When the trunks have adequate size, proceed to install the cordon wires and convert the vines to Geneva Double Curtain training. It is important to realize that the mechanical harvester moves the cordon wire vertically about 5 inches. To afford flexibility for this, the trunk should extend vertically 5-1/2 feet and then extend horizontally to the cordon wire.

CONTROL OF CROP SIZE

Balance pruned vines with Geneva Double Curtain training are more fruitful than with other training systems. This fruitfulness is due to a greater number of fruiting shoots for buds retained and to the increase in cluster size. This increased fruitfulness which occurs in the second and subsequent years will lead to serious over-cropping if excessive buds are retained. The controls are: (1) Maintain balanced pruning at 30 + 10 including the buds on renewal spurs in the count, (2) space the fruiting canes

over the full length of the cordon wire (for that vine), and (3) keep the bud number at or below 70 as in the following table.

Table 1. Number of buds to retain on each Geneva Double Curtain trained Concord vine.

Pounds of cane prunings	Buds (including renewal spurs) per vine	No. of 5-bud canes	No. of 1-bud renewal spurs
	Bud Number per vine in second and succeeding year		
1	30	4	10
2	40	6	10
3	50	8	10
4	60	10	10
5 and more	70	12	10

Under a combination of very high fruitfulness, of very high vine capacity (as over 5 pounds per vine), and of cool and cloudy weather (as in 1965) it will be necessary to flower cluster thin the crop down to about 8 tons per acre. This flower cluster thinning is necessary to prevent over-cropping which reduces vine and fruit maturity.

CURTAIN FORMATION

A trellis which is well anchored, has the best cordon wire support, has the highest quality cordon wires, the best development of cordons, the ideal selection of 5-bud canes and 1-bud renewal spurs and balanced pruning does not have Geneva Double Curtain training until there is shoot positioning to form the two curtains. For Geneva Double Curtain training, shoot positioning must be done each year. The heart of the whole Geneva Double Curtain development is the shoot and leaf position for adequate exposure, and without this the structure is meaningless because it will not increase yield and it will delay maturity. It is difficult to harvest even by hand.

The curtain formation is necessary to expose the leaves on the basal portions of the shoot to higher light intensities, and thus to higher temperatures which lead to better development of clusters for the following year, as well as to more rapid maturation of the fruit in the current year. To get this critically important exposure the long horizontally growing shoots, must be put in a vertically downward position so that the basal leaves of nearly all of the shoots will be well exposed. This positioning can only be done

by hand. It can require 40 hours of work per acre per year and unless one is willing to do this, Geneva Double Curtain training should not be attempted. This shoot positioning can be done during the 4-week period starting immediately after bloom.

Two procedures for shoot positioning are:

1. Make the first shoot positioning early in the 4-week period, and repeat it in 2 to 3 weeks as the shoots again become horizontal. This is recommended!
2. Make the only shoot positioning near the end of the 4-week period. Then, the tendrils will have to be cut because they will have attached shoots to each other and to the trellis structure. This need not be repeated, but is more time consuming than procedure #1, which is recommended.

The only tool necessary for shoot positioning is a pair of grape picking shears for cutting tendrils.

SOIL MANAGEMENT OF GDC VINEYARDS

Much of the emphasis during the past decade on having vines of 2-3 pounds of cane prunings per 8 foot space with umbrella or with any Kniffin training should be changed to having 3-4 pounds of vine vigor per 8 foot vine space where the Geneva Double Curtain training is used.

To achieve and maintain this additional vigor on Geneva Double Curtain the following steps need to be considered:

1. Potassium applications will have to be increased for those vineyards where the potassium status of the vine is near the deficient stage.

2. Weed control may have to be more complete, especially where vines have less than 3 pounds of cane prunings.

3. Nitrogen applications may have to be substantially increased.

In some desirable vineyard sites vine vigor is very difficult to increase by soil management procedures. Therefore, the use of vines grafted to resistant rootstocks is an effective way to attain the desired vigor.

COSTS

Because it is so new, exact cost figures on Geneva Double Curtain are not known. Research data indicate that the fruit

maturity increases, particularly in critical years like 1965, are nearly 1 per cent soluble solids, and this is a splendid response. The mechanization of harvest is of sufficient economic gain to justify the entire Geneva Double Curtain training effort. But with only a maintained maturity and with hand picking, the yield increase of 50 per cent in vigorous vineyards obtained in 1962-1964 experiments can repay the costs of installation and operation.

Geneva Double Curtain training of vigorous vines is a system requiring a high input of labor and materials but which has a much higher output of ripe grapes. It is a system which can be abused by careless installation or by careless management. It is the only system of grape training for which the mechanical harvester is adapted. It is new. It is certain that there will be improvements in the future but we believe the principle and the basic outline here presented afford adequate guide to New York growers to utilize this development to make the vineyard enterprise even more competitive.