

Pruning, Training and Grape Canopy Management

Contents:

- Pruning and Training:
 - Single-Curtain Training Systems
- Canopy Management:
 - Shoot positioning
 - Shoot topping

The Grapevine is a true vine

that requires some form of support to keep it off the ground. In the wild, tendrils along the canes attach to other vegetation and allow the vine to grow up off the ground. In our intensive cultural systems, there is no natural support for the vines. Therefore, we have to erect various trellis systems to train and support the vines, and facilitate other management practices.



Single Curtain Vineyard



Pruning and Training of Grapevines

- The culture of grapes dates back to early civilization:
 - Archaeological evidence that grapes were consumed by early humans dates back to the early Bronze Age (3,500 B.C.).
 - The oldest pictorial record of grape growing exists in Egyptian mosaics that date back to 2440 B.C.
- Though time, man learned to train grapevines for both production and aesthetic value.



circa 1500

Grapevine Fruiting Characteristic

Dormant buds on 1-yr-old canes (last year's canes) give rise to new (current season) canes on which the grape clusters are produced.

- Because of this character, pruning mature grapevines consists of replacing all the fruiting wood each year.
- This can amount to removing 80% or more of the 2-yr-old canes and replacing them with 1-yr-old canes.

Dormant bud on a 1-yr-old cane



Grape clusters on current season canes



An emerging current season cane

1-yr-old cane

Definitions

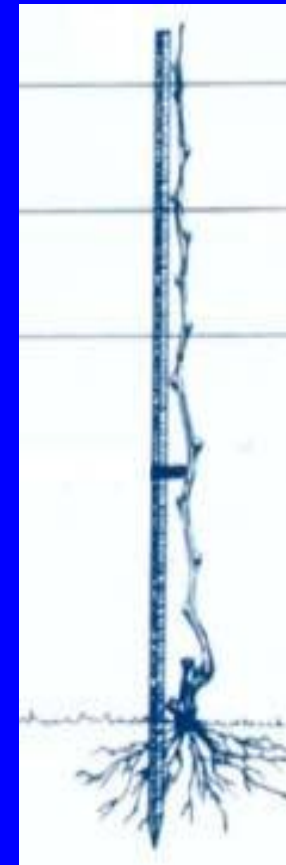
- **Pruning** can be defined as “the removal of plant parts to obtain horticultural objectives”. These objectives include:
 - Controlling the size & form of the grapevine.
 - Optimize the production potential of the grapevine.
 - Maintain a balance between vegetative growth and fruiting.
- **Training** can be defined as “the arrangement of plant parts spatially”. This is done to develop a structure that:
 - Optimizes the utilization of sunlight and promotes productivity.
 - Adapts to the characteristics of the grape cultivar.
 - Promotes efficient & sustainable vineyard management practices.
 - Is economical to establish and maintain.

Pruning and Training Young Grapevines

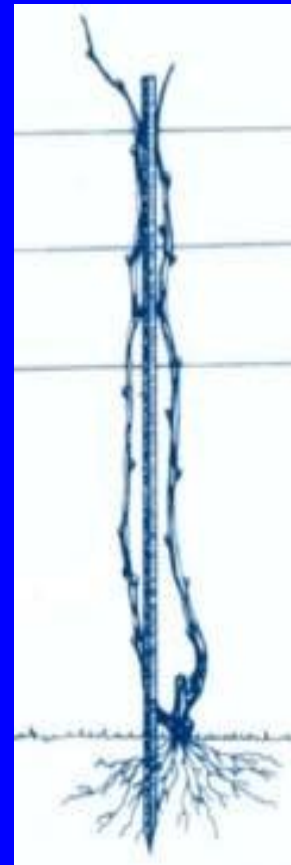
Grapevines can be trained with a single or double trunk.

- Training vines to a single trunk is the most common and simplest method.
- In cold climates or with marginally adapted cultivars, training vines to a double trunk is often preferred.
 - If one trunk is killed, the other trunk will provide some production until the dead trunk can be replaced.

Single
Trunk



Double
Trunk



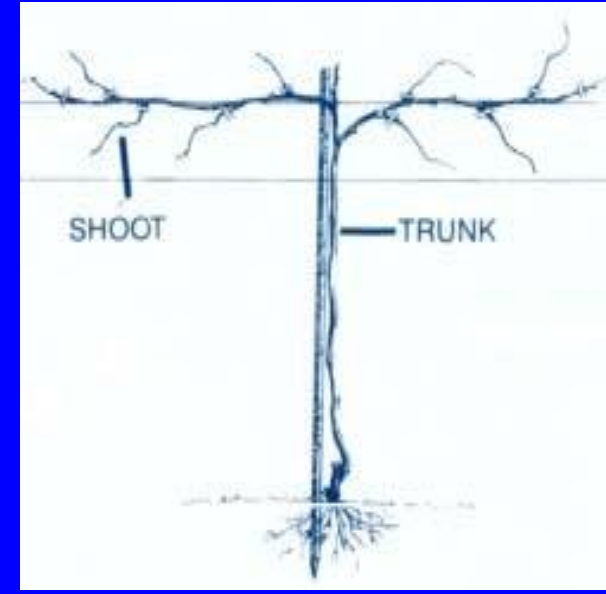
Pruning & Training Young Vines

From planting through the third growing season, pruning and training practices are essentially the same for the various training systems used for grapes.

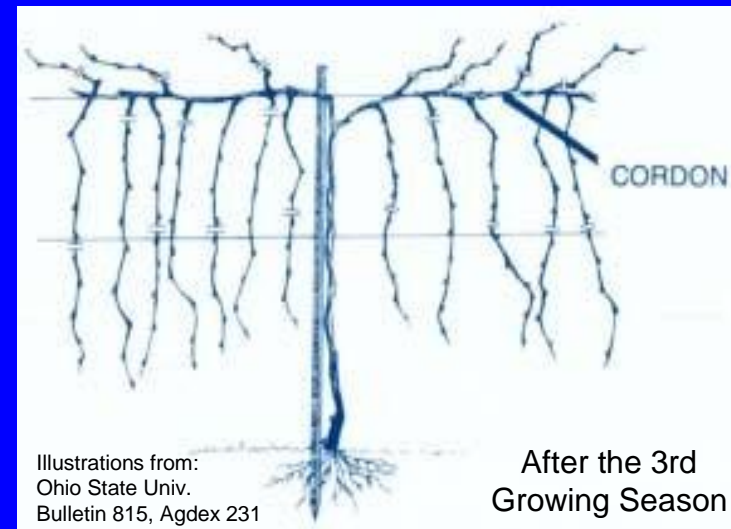
- Long cane (head) systems:
 - **Kniffen systems**
- Short cane systems (bi-lateral cordon):
 - **High cordon**, single or double curtain.
 - **Low cordon** w/ vertical shoot positioning.



After the 1st Growing Season



After the 2nd Growing Season



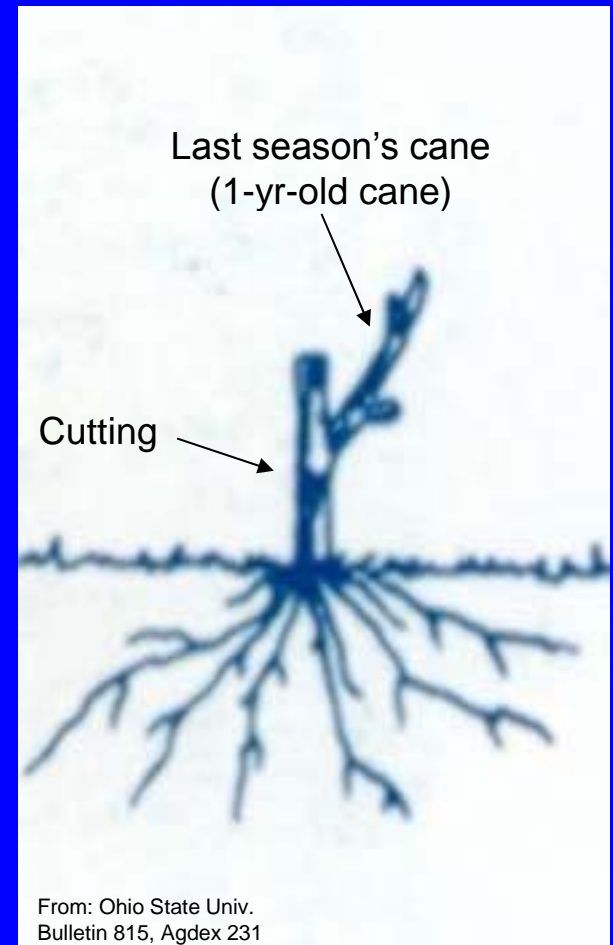
Illustrations from:
Ohio State Univ.
Bulletin 815, Agdex 231

After the 3rd Growing Season

Pruning Practices at Planting

After planting, cut last season's (1-yr-old) canes back to 2 to 3 buds.

- Training to a single trunk:
 - Retain one cane.
- Training to a double trunk:
 - Retain two canes.

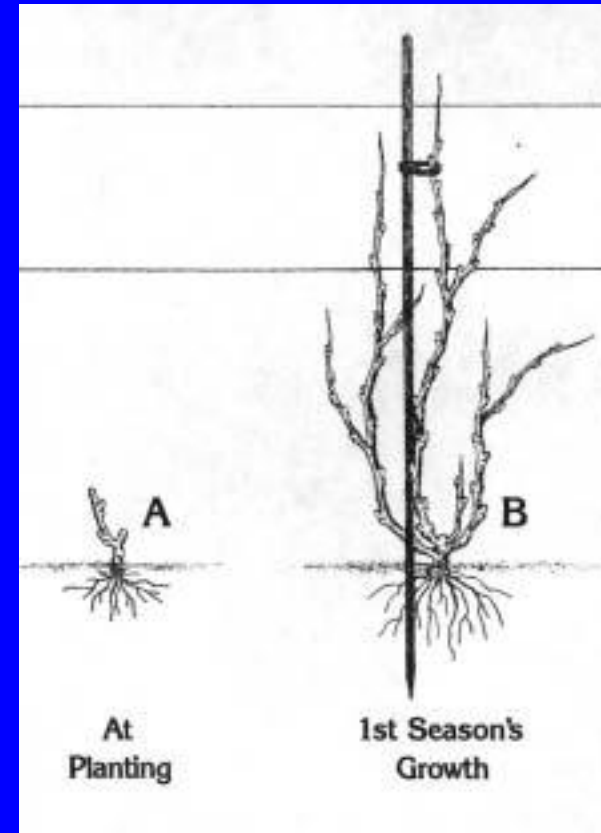


From: Ohio State Univ.
Bulletin 815, Agdex 231

During the First Growing Season

The objective is to train the vine up to the desired wire.

- Top wire for a high cordon.
- Mid-level wire for a low cordon.
- This requires going through the vineyard several times during the season and tying up the canes to keep them vertical.
- Whenever the canes are allowed to droop over, the axillary (lateral) buds at the highest point on the cane will begin to grow & the terminal cane growth becomes stunted.
- Remove any grape clusters that develop at bloom.

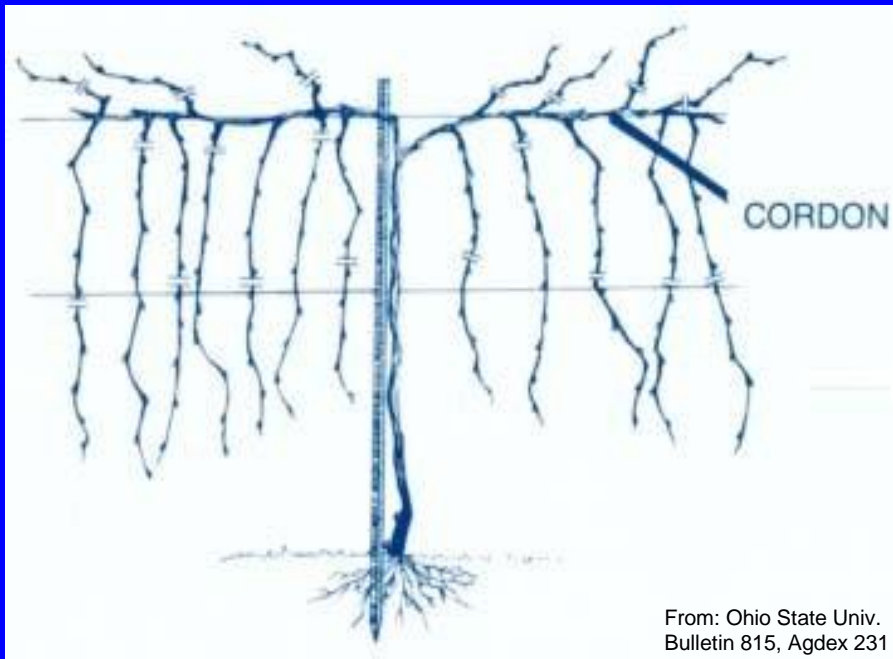


From: Ohio State Univ.
Bulletin 815, Agdex 231

Single Curtain Training Systems

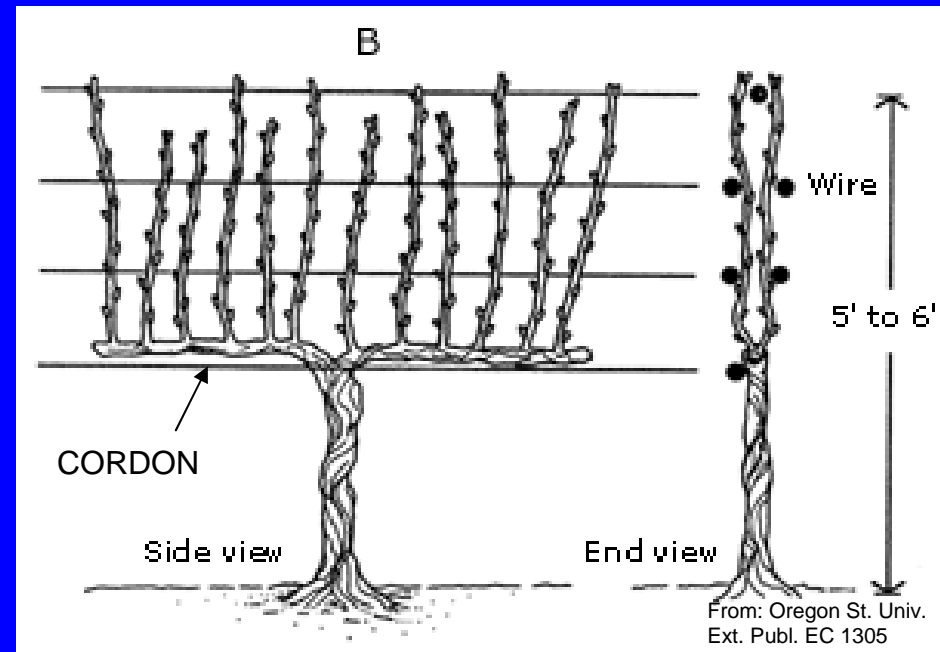
Bi-lateral Cordon

High Cordon



Suitable for cultivars with a trailing / drooping growth habit.

Low Cordon w/ catch wires



Suitable for cultivars with an upright to semi-upright growth habit.

Growth Habit

Trailing / Drooping



Characteristic of American species
and many French-Amer. hybrids.

Upright



Characteristic of *V. vinifera*
& some French-Amer. hybrids

French - American Hybrid Cultivars Suited for a Low Cordon & Vertical Shoot Positioning

Semi-upright:

Chambourcin
Chardonel
De Chaunac
La Crosse
Prairie Star
Seyval Blanc
Traminette

Upright:

Chelois
St. Vincent
Vignoles

First Year Training Options

- Include:
 - No pruning, and training all canes that develop up to the desired wire.
 - Install grow tubes and allow 1 or 2 canes to develop.
 - Prune back to 1 or 2 canes and train them up to the desired wire.
- Differences occur in the amount of root mass that develops.



Photos from: "Vineyard Establishment"
by Dr. Bruce Bordelon, Dept. of Horticulture
Purdue University. Presented at the Grape
Growing Workshop, Feb. 22, 2001

First Year Training Options

The use of grow tubes or pruning to 1 or 2 shoots promotes top growth as opposed to root growth.

- A greater root mass promotes better growth the following year.
- Whether one uses grow tubes should be based on other management practices.
 - They protect the canes when herbicides are applied.
 - They initially protect the vines from rabbits & deer.

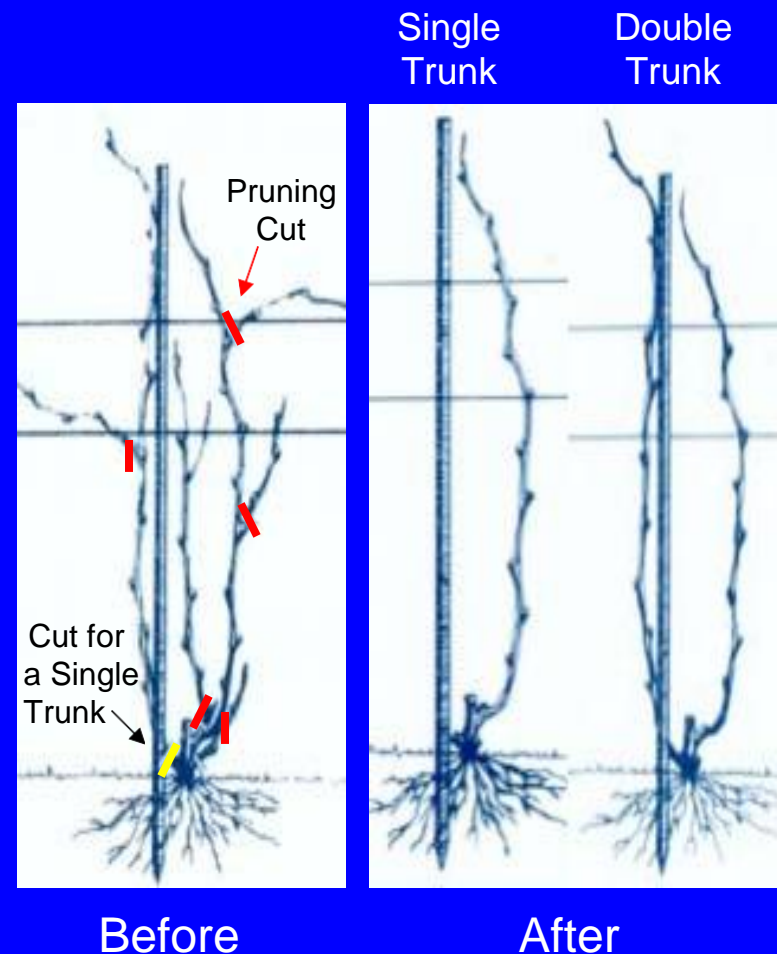
Photos from: "Vineyard Establishment" by Dr. Bruce Bordelon, Dept. of Horticulture Purdue University. Presented at the Grape Growing Workshop, Feb. 22, 2001



First Dormant Pruning (Spring of the 2nd Year)

Establishing the trunk:

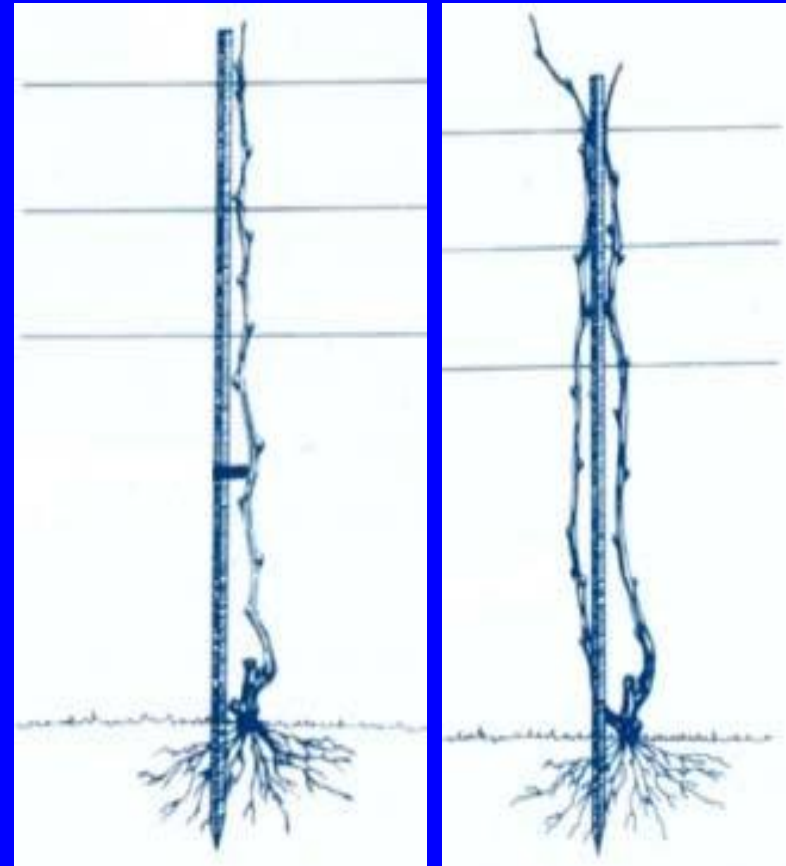
- Select 1 or 2 of the best canes and remove the others.
- Remove any lateral canes.
- If the canes have reached or extend above the desired wire they can be:
 - Tied onto the desired wire.
 - Pruned back to just below the desired wire to promote new canes that will be trained along the wire.



First Dormant Pruning (Spring of the 2nd Year)

Establishing the trunk:

- If the canes did not reach the desired wire, prune back to healthy wood that is at least 3/8" in diameter, or back to 2 - 3 buds and start the process over.
- The selected canes should be tied to a temporary stake or string, and to any lower wires to promote a straight trunk.



Illustrations from:
Ohio State Univ.
Bulletin 815, Agdex 231

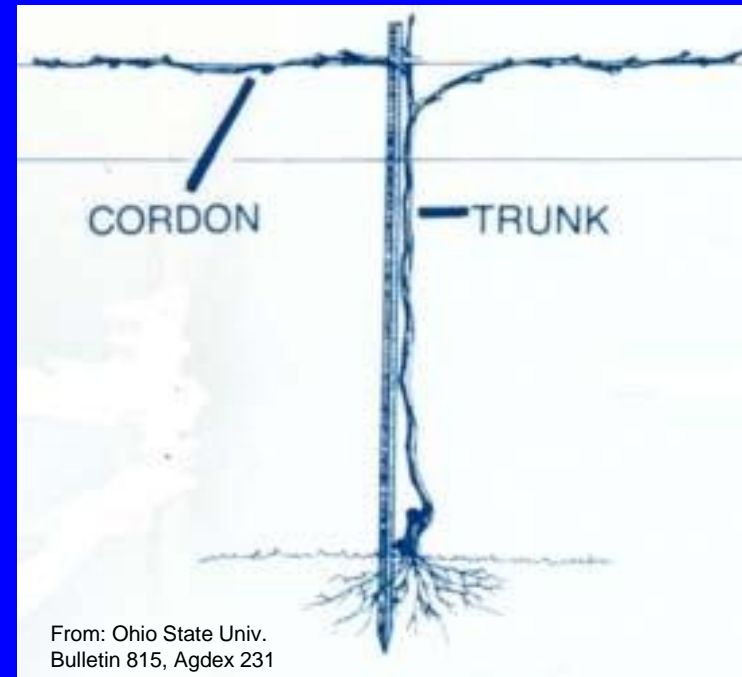
Single
Trunk

Double
Trunk

During the 2nd Growing Season

The objective is to train the new canes out onto the desire wire to develop the cordon.

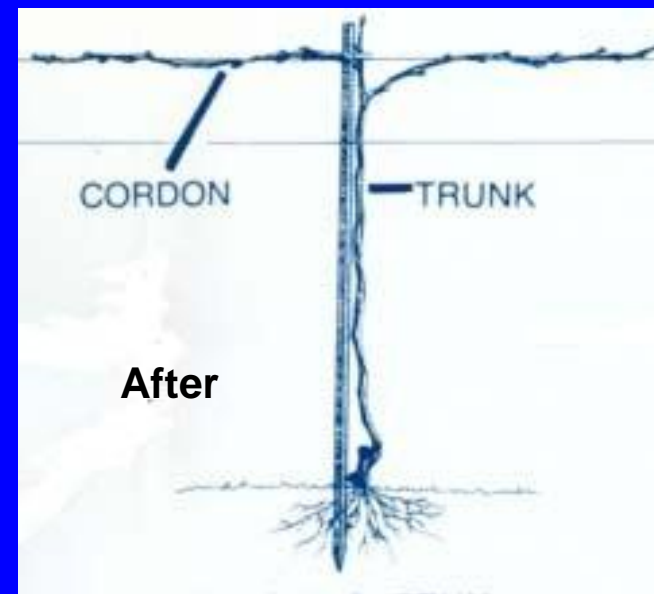
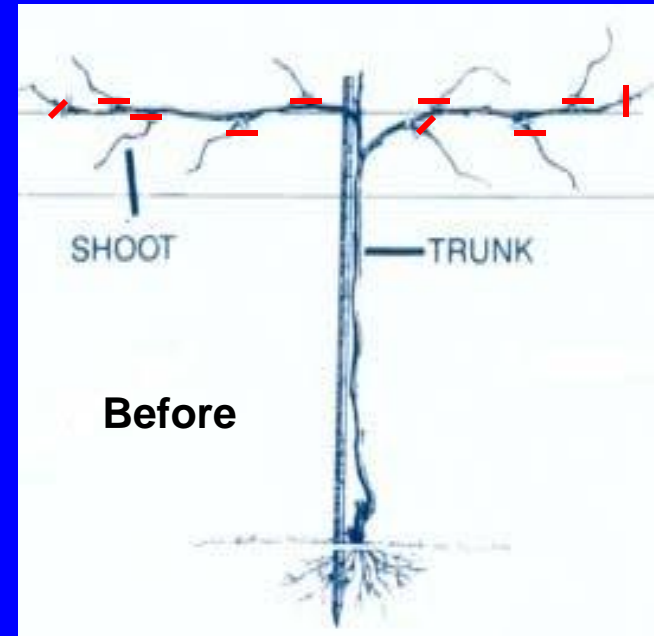
- Train any canes in close proximity on to the wire.
- Any canes developing low on the trunk should be rubbed off when they are young.
- Suckers arising from the ground should be removed.
- Any grape clusters developing on the canes should be removed at bloom.



2nd Dormant Pruning (Spring of the 3rd Year)

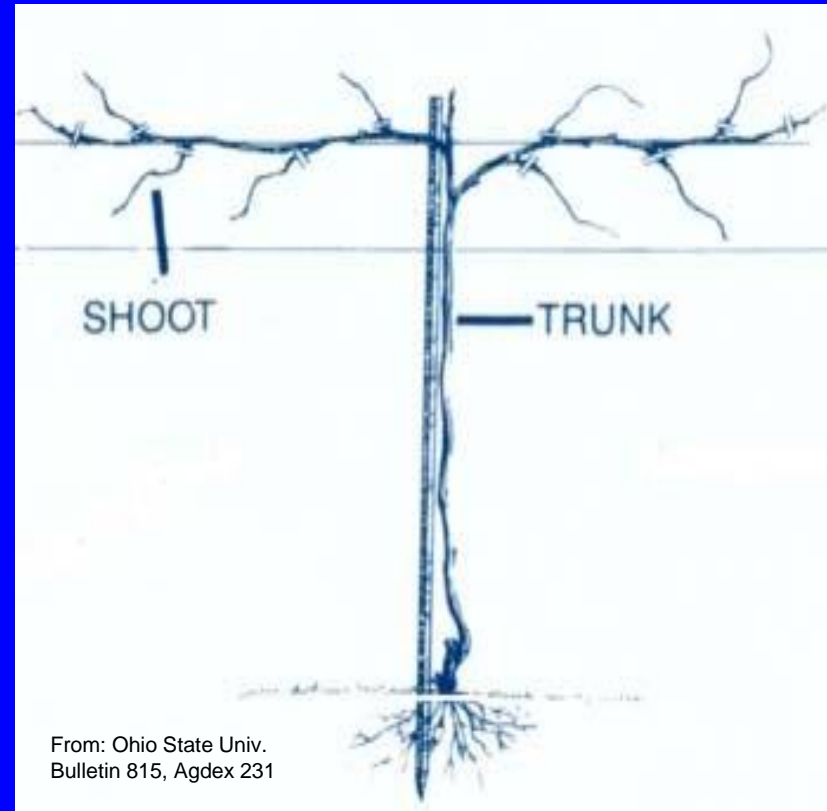
Establish the Cordon:

- Select the best canes based upon position, vigor, and health to form the cordon.
- If the vine has sufficient vigor, prune back the selected canes so that they fill in about 2/3's of the allotted space between vines.
- Prune back any lateral canes developing off the 1-yr-old canes to a single bud.



3rd Growing Season

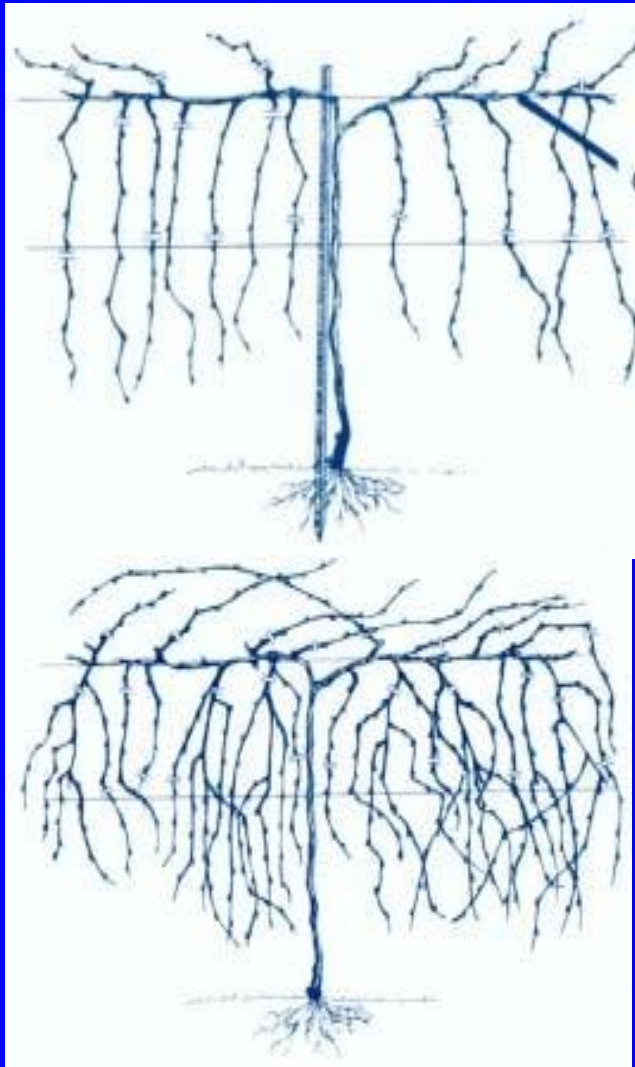
- If the vines are developing on schedule, and exhibit good vigor, they can be allowed to carry a partial crop.
- Some cluster thinning may be necessary, particularly with French-American hybrid cultivars.
- Rub off any canes developing low on the trunk early in the growing season.
- Remove suckers developing from the ground.



Pruning Mature Vines *

- Practicing Balanced Pruning -

Before

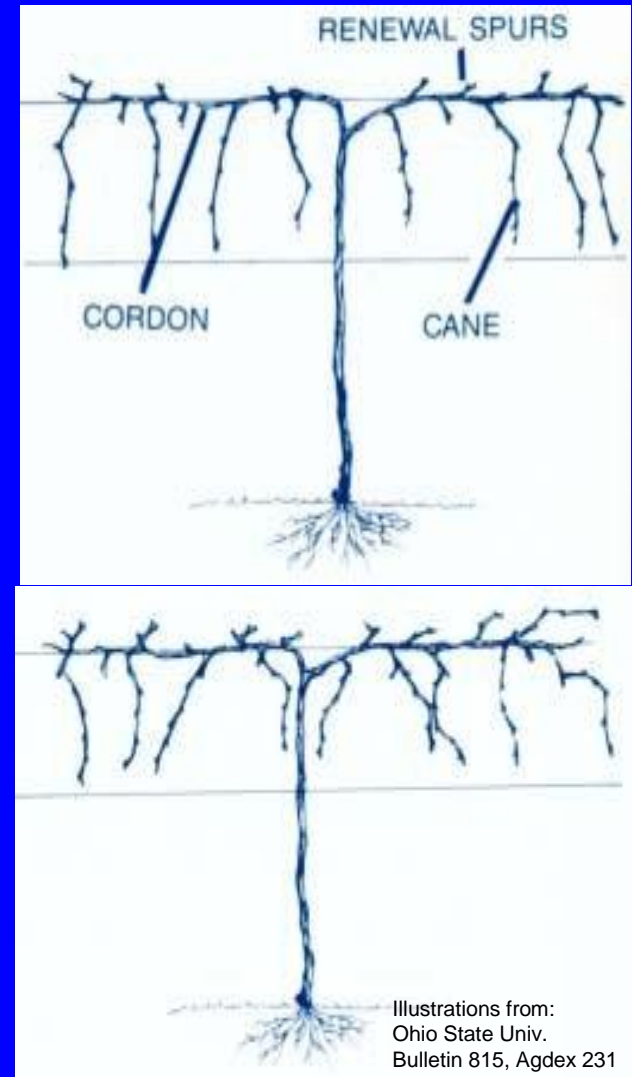


3-yr-old Vines
(3rd Dormant,
Spring 4th Year)

Mature Vines
(Spring 5th Year
& Beyond)

* For long cane pruning systems, canes trained to the wires are replaced each year.

After



Pruning Mature Vines

Balanced Pruning

Balanced pruning is practiced to maintain a balance between vegetative growth and fruiting.

- The amount (weight) of the previous year's cane growth (1-yr-old canes) determines how many buds to retain for the current production year.
- A base number of buds to retain for the first pound of trimmings has been established for various cultivars based on their inherent vine vigor and production characteristics.
- To compensate for vine vigor, additional buds are retained for each additional pound of trimmings removed up to a maximum of 4 pounds.

Balanced Pruning

What Does it Mean?

“30 + 10”

The number of buds to retain for the first pound of 1-yr-old trimmings removed.

- If the vines produce less than one pound of trimmings, reduce the number of buds retained in proportion to the weight.

The number of buds to retain for each additional pound of 1-yr-old trimmings removed.

- If the weight of trimmings exceeds 4 lbs, do not retain any more additional buds.

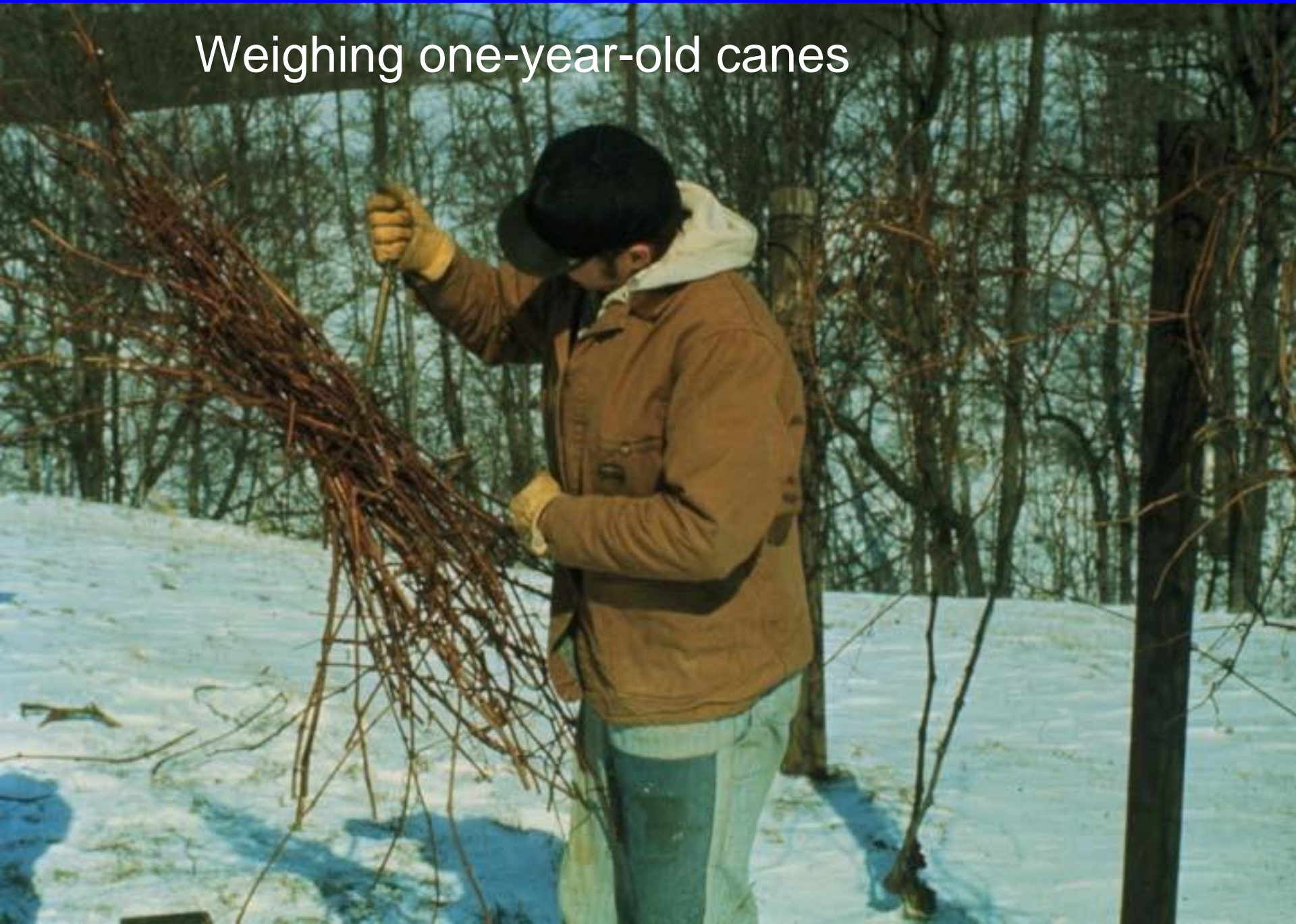


Pruning Mature Vines

Steps in Balanced Pruning

- Size-up the vines & estimate the weight of the 1-year-old canes.
- Remove all 1-year-old fruiting canes EXCEPT those positioned close to the trunk or cordon that may be retained for fruiting.
 - For long cane (Kniffen) systems, leave the entire cane.
 - For bi-lateral cordon systems, leave 5 to 6-bud spurs.
- Weigh the 1-year-old canes from a few vines.

Weighing one-year-old canes





Pruning Mature Vines

Steps in Balanced Pruning, cont.

- Based upon the weight of the 1-yr-old trimmings, determine the number of buds to retain per vine.
 - “30 + 10” balanced pruning system
 - “20 + 10” balanced pruning system
- Remove any extra buds to obtain the desired bud number for the vigor of the vine.

The ideal canes to retain are those that are moderately vigorous (about $\frac{1}{4}$ inch diameter at the 5th or 6th node/bud). Avoid weak & spindly canes with short internodes, and “bull” canes that are very thick with long internodes.

Balanced Pruning



for High-vigor Cultivars

“30 + 10 Rule”

<u>Lbs. of Canes</u>	<u># Buds kept</u>
1	30
2 (30 + 10)	40
3 (30 + 10 + 10)	50
4 (30 + 10 + 10 + 10)	60*

* Max number of buds



Balanced Pruning

for Low-vigor American Type Cultivars

“20 + 10 Rule”

<u>Lbs. of Canes</u>	<u># Buds kept</u>
1	20
2 (20 + 10)	30
3 (20 + 10 + 10)	40
4 (20 + 10 + 10)	50*

* Max number of buds

Balanced Pruning Formula

American Type Cultivars*

20 + 10	25 + 10	30 + 10
Delaware Elvira	Catawba Niagara	Concord Cynthiana / Norton Fredonia Steuben All other American-type cultivars including seedless table cultivars

* Add additional buds for up to 4 pounds of trimmings.

Balanced Pruning Formula for French-American Hybrid Cultivars “20 + 10 Rule” *

Small Clustered	Medium Clustered	Large Clustered**
Marechal Foch Leon Millot Baco Noir	Chelois Chardonel Vignoles **	Seyvel Chancellor Chambourcin De Chaunac

* Add additional buds for up to 4 pounds of trimmings. For unlisted cultivars, use the 20+10 rule for those that are moderately vigorous to vigorous, and the 30+10 rule for those that are very vigorous.

** Usually require cluster thinning, and are thinned to one cluster per shoot.

Balanced Pruning

Compensating for Winter Injury

Because the cane buds are the least hardy portion of a grapevine, it is always a good practice to inspect the buds before pruning.

- Randomly collect 100 buds for each cultivar.
- Slice through the buds with a razor and examine them for injury with a magnifying glass.
- Record the number of injured buds to assess the extent of injury & determine if compensation in pruning is necessary.



Healthy



1° Injured

Balanced Pruning

Compensating for Winter Injury

- 0 to 20 % bud injury:
 - No compensation is necessary.
- 20 to 80 % bud injury:
 - Adjust the number of buds retained in proportion to the extent of injury.
 - If the weight of trimmings indicates that 50 buds should be retained and the extent of winter injury is 40%, then $50 \times 1.4 = 70$ buds should be retained.
- 80 % or more bud injury:
 - Keep pruning to a minimum! Only remove canes that will touch the ground.



Balanced Pruning

- Position of canes and numbers of buds on each cane is dependent upon the training system.



Training Systems

- Many “named” systems
- All contain several basic principles
- Train canopy growth for
 - Optimal light interception (photosynthesis)
 - Optimal air movement (prevent diseases)
 - Optimal management (rows for equipment)



Training Systems

- *Labrusca* types = downward growth



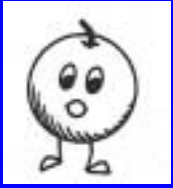
‘Concord’ - Umbrella Kniffin



Training Systems

- *V. vinifera* types = upward growth



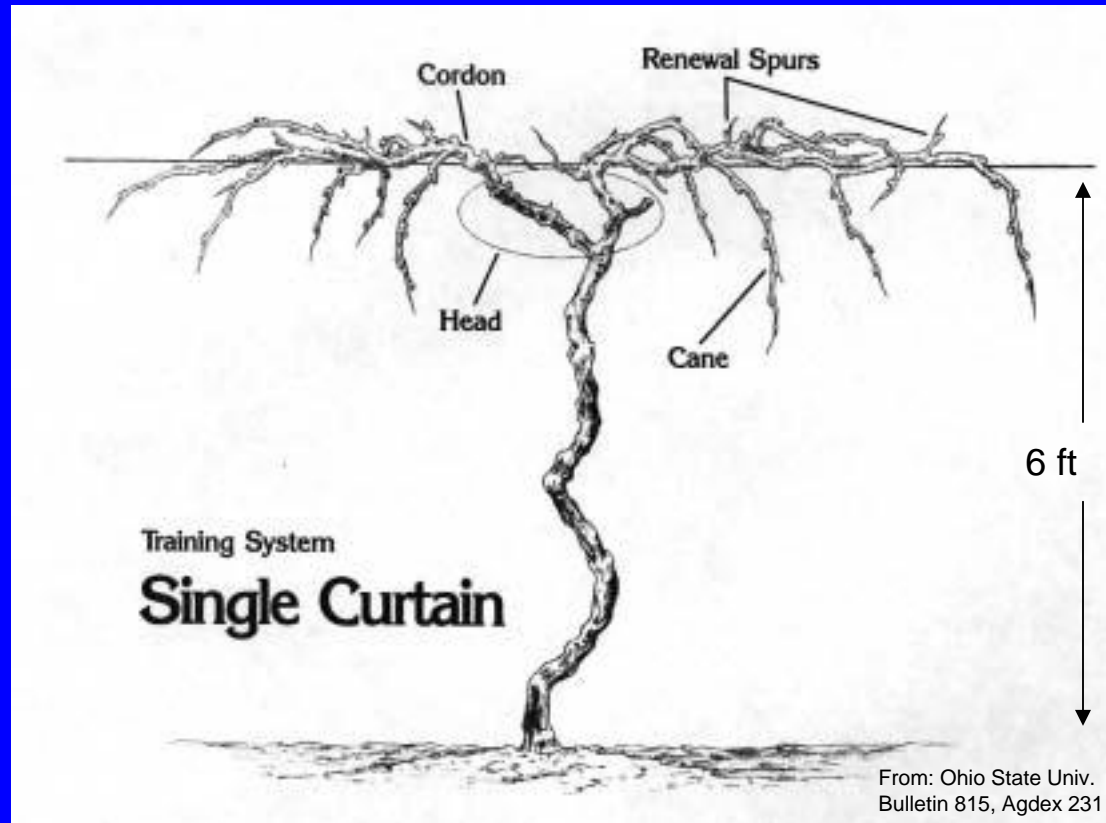


Single Curtain High Cordon

Also called “Bilateral
Cordon”

Uses 2 wires:

- Mid-level wire is set 3 to 4 ft above the ground.
- Top wire is set at 6 ft.
- At maturity, 1 wire is adequate.

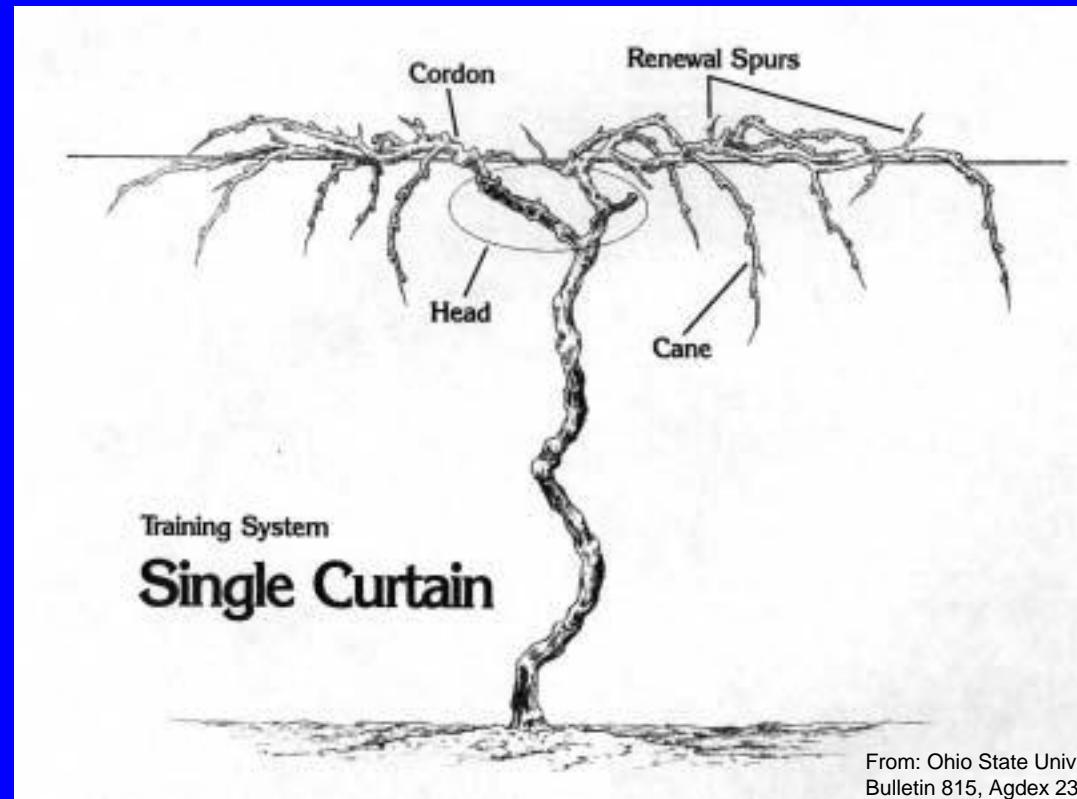




Single Curtain High Cordon

Suitable for moderate to vigorous cultivars with a trailing / drooping growth habit.

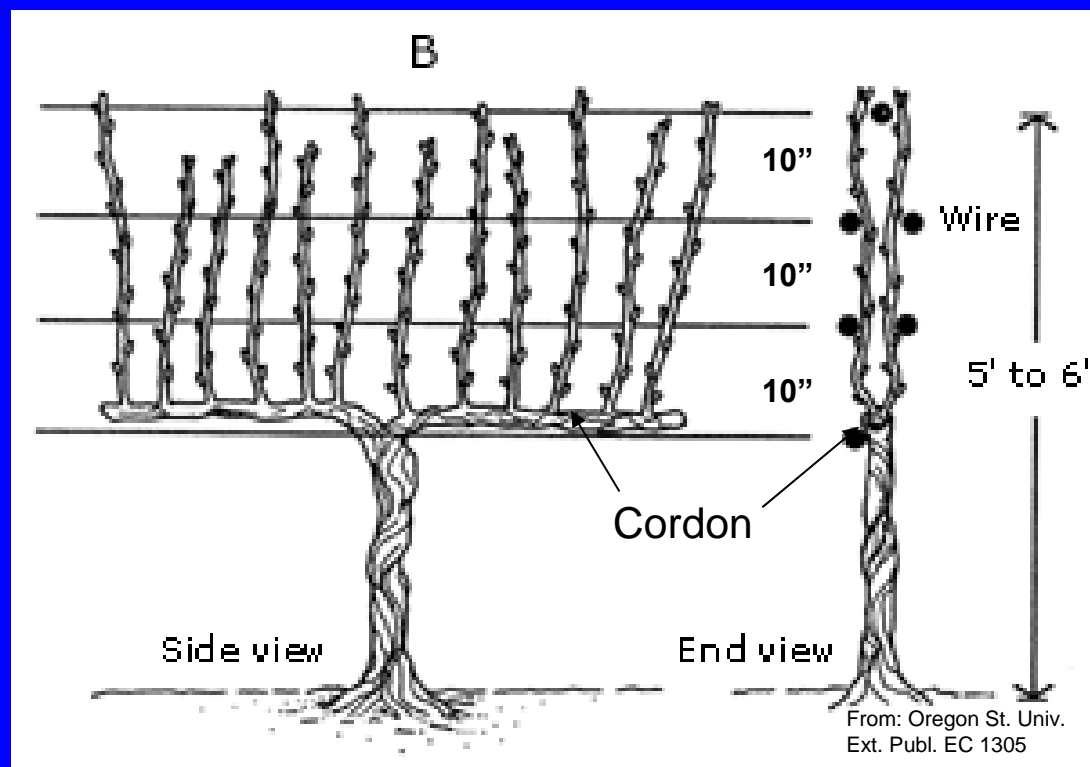
- Central trunk with cordon (horizontal trunk) is trained to the top wire.
- Cordon contains “spurs” (5-bud canes), and 1- to 2-bud renewal spurs.



Single Curtain Low Cordon

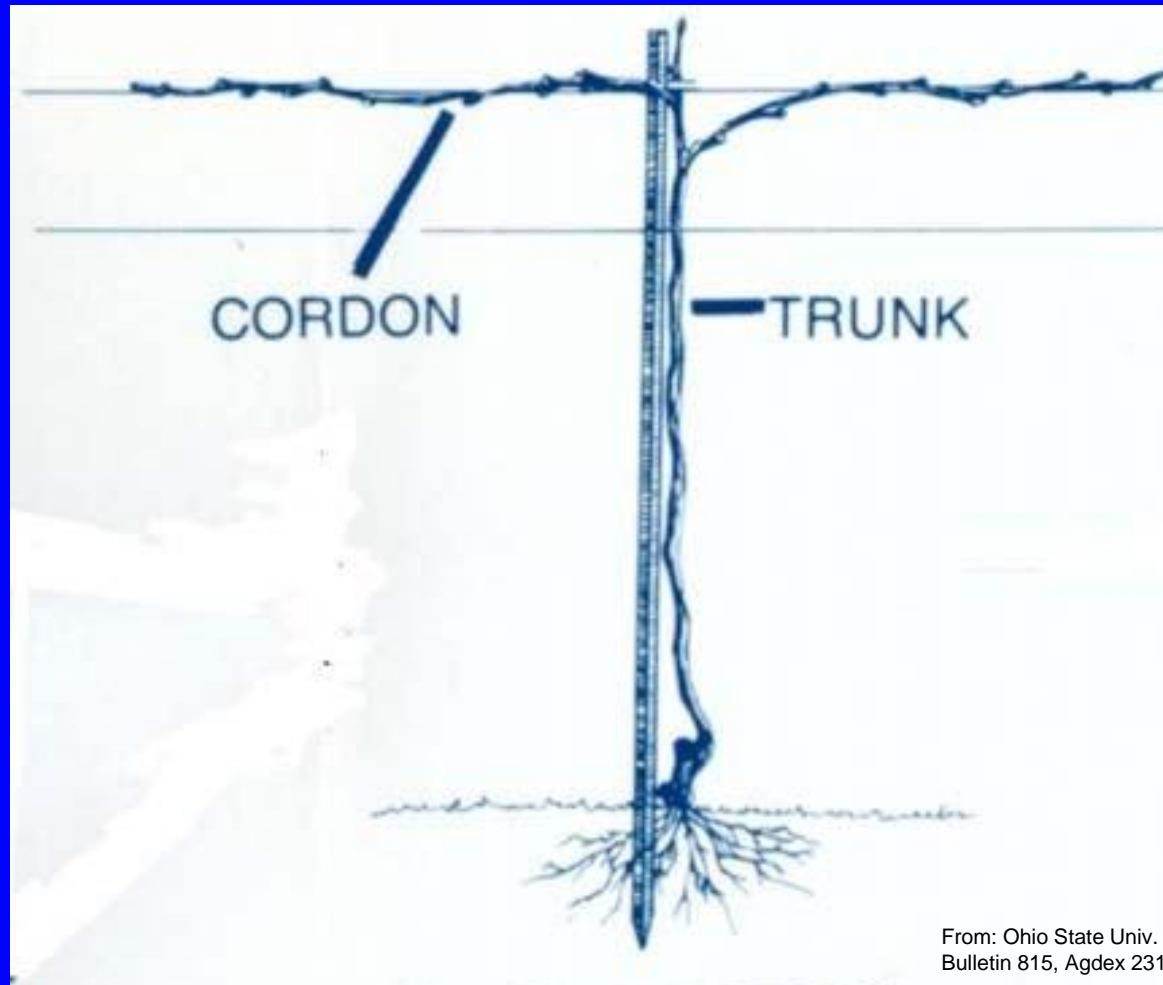
Suitable for cultivars with an upright to semi-upright growth habit.

- Cordon is trained on to a mid-level wire set at 3 to 3.5 ft above the ground.
- Additional sets of catch wires are required.
- Pruning is the same as with the high cordon, except upright growing canes are selected.



Single Curtain

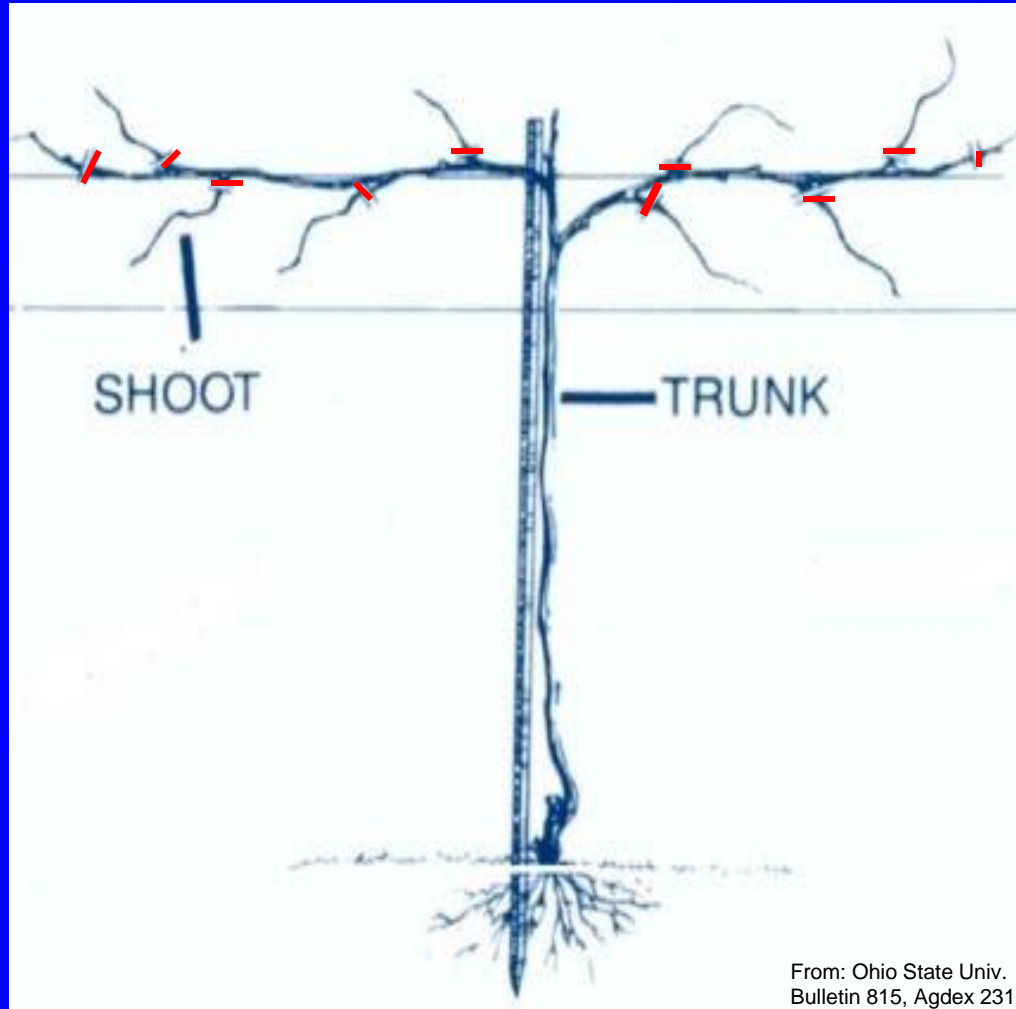
Beginning the "Cordon", 2nd Growing Season



From: Ohio State Univ.
Bulletin 815, Agdex 231

Single Curtain

- Pruning cuts – 3rd Spring



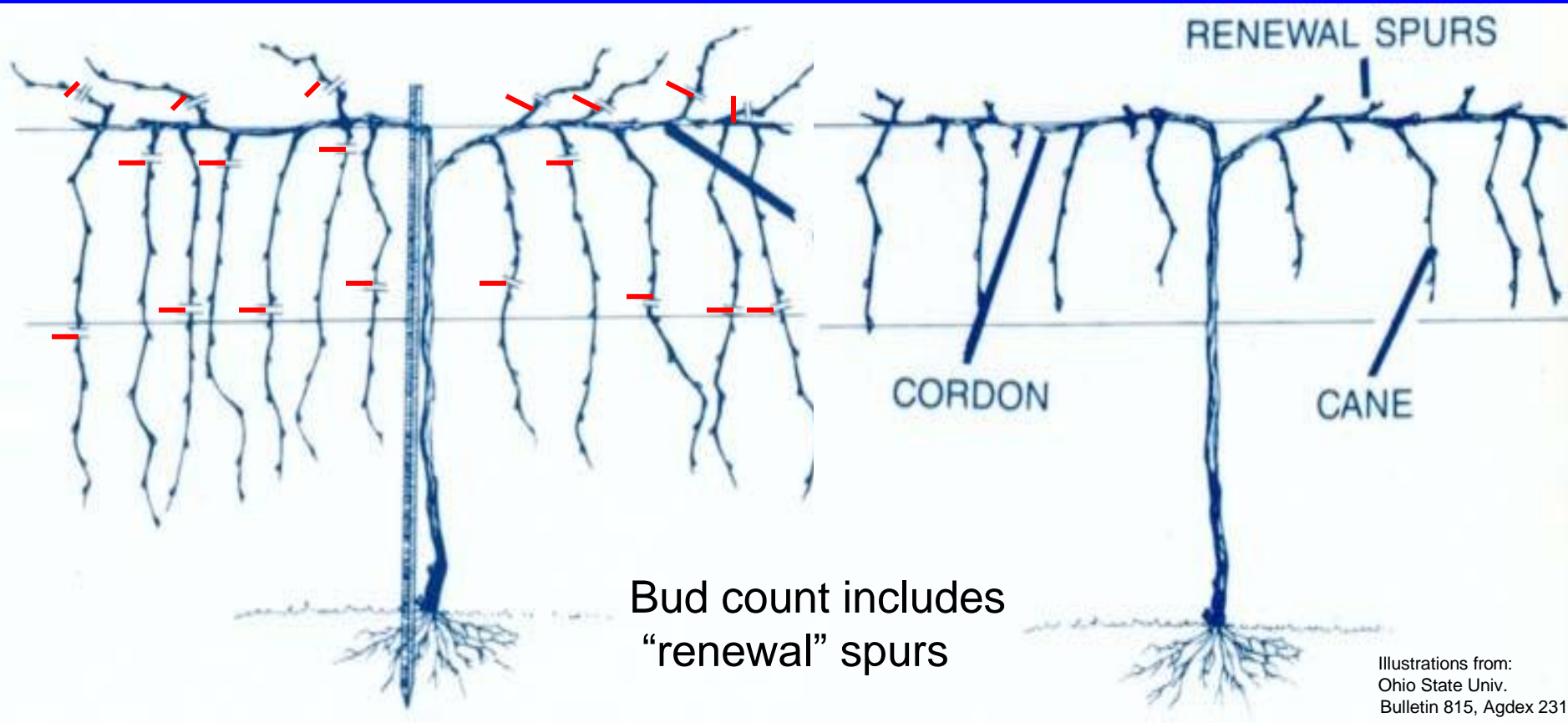
From: Ohio State Univ.
Bulletin 815, Agdex 231

Single Curtain

- Pruning cuts – 4th Spring

Before

After



Single Curtain

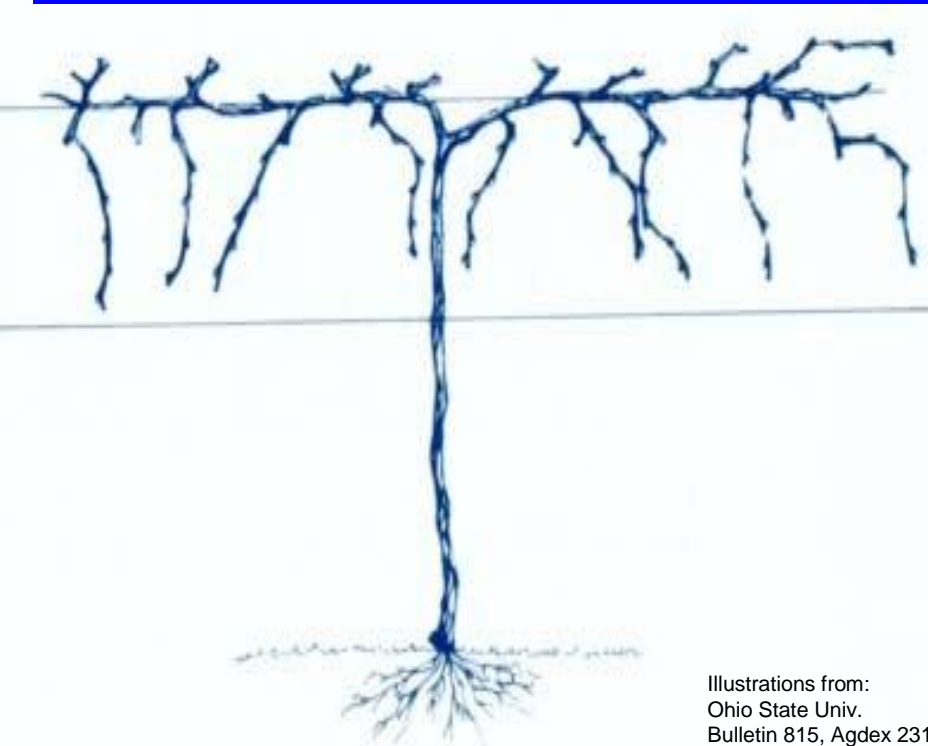
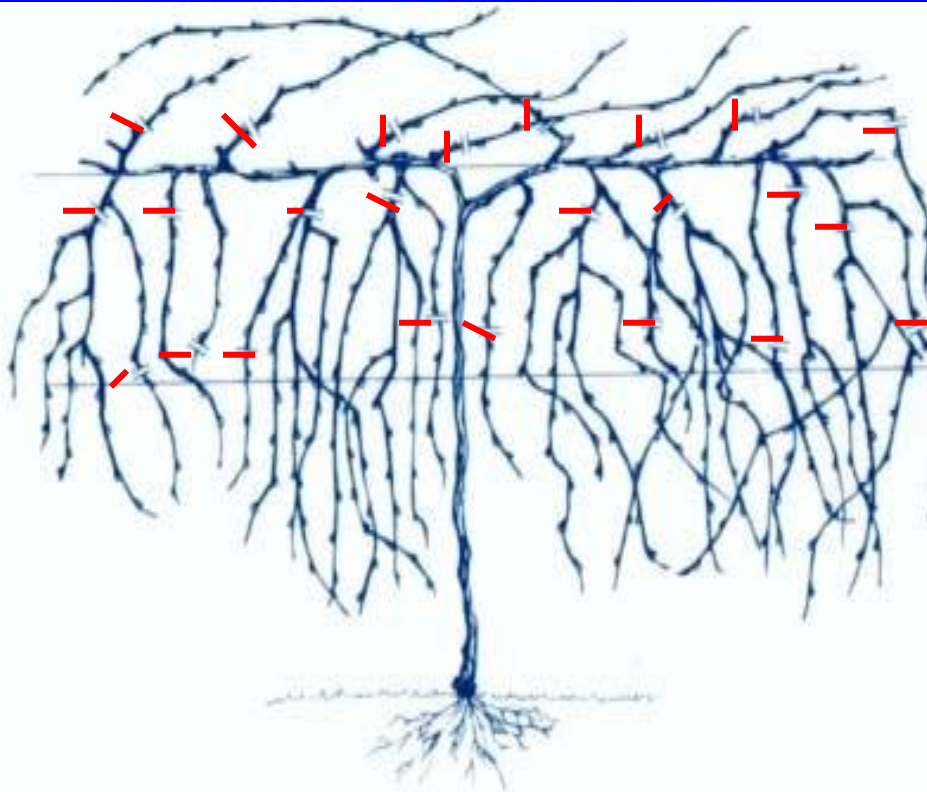
Distribution of Buds Retained

Lbs of Prunings	# of Buds to Retain	# of 5-bud Canes	# of 1-bud Renewal Spurs
1	30	4	10
2	40	6	10
3	50	8	10
4	60	10	10

Single Curtain Pruning Mature Vines

Before

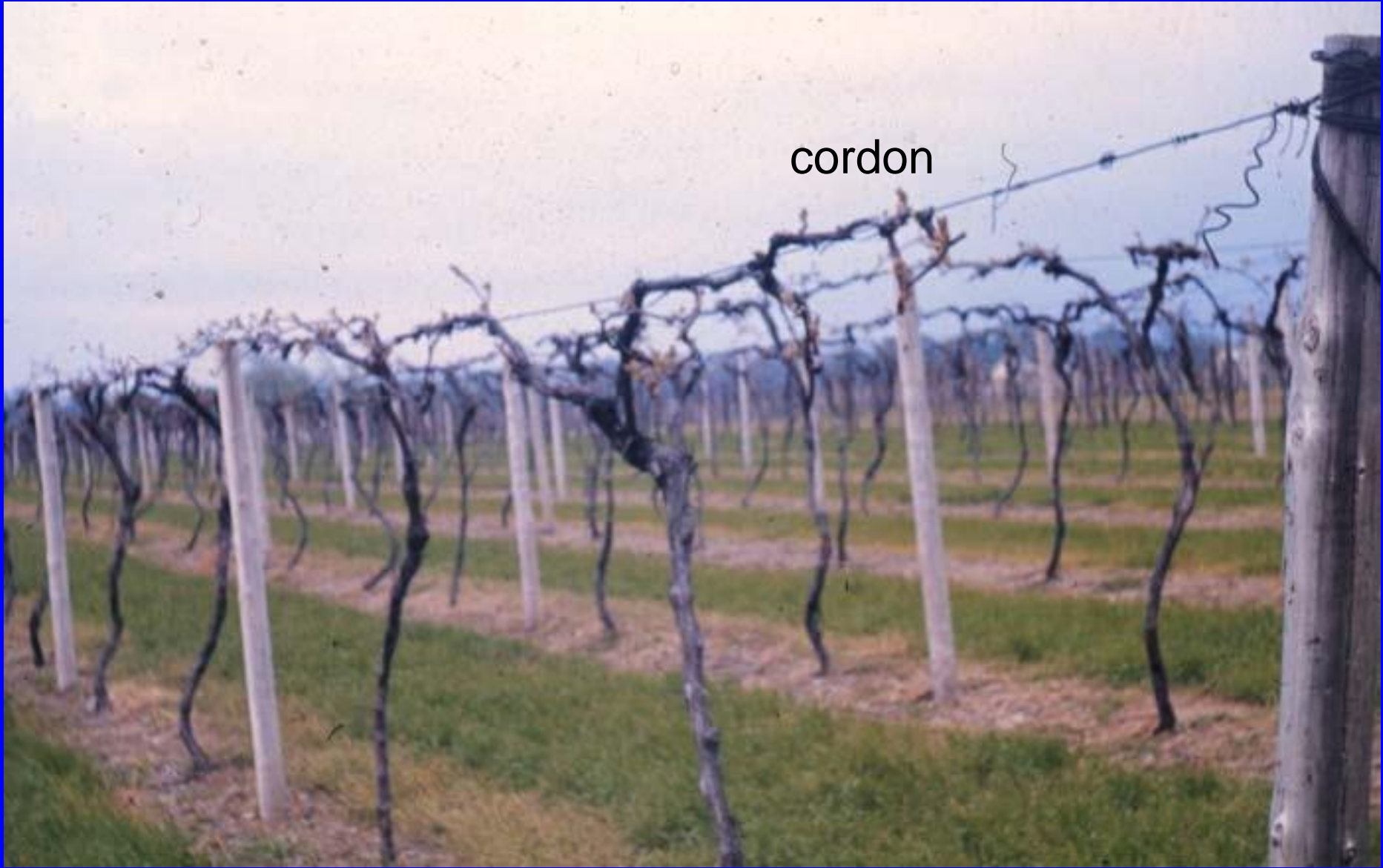
After



Illustrations from:
Ohio State Univ.
Bulletin 815, Agdex 231

The cordon should fill the space between vines.

cordon



Pruning and Training

Remember:

- Beginning the first year, remove any flower clusters on the shoots (for at least 2 years).
- Develop straight trunks to the desired wire.
- Next, develop the cordons.
- Allow cordons to fill in trellis length.

Grape Shoot Canopy Management



Canopy Management

Remember:

- Practices conducted during the growing season will affect next year's growth and productivity.
 - Fruit buds for the current year's crop were formed during the previous growing season.
- To maximize productivity and quality in the current year, and maximize the potential productivity for the following year, the leaves have to be positioned to optimize photosynthesis.

Canopy Management

Remember:

- An open canopy is need for:
 - Maximum sunlight interception & optimum photosynthesis.
 - Good air circulation to minimize disease problems.

Grape Canopy Management

American type grapes growing at the Bluffs Research Farm near Council Bluffs, Iowa (circa 1950).

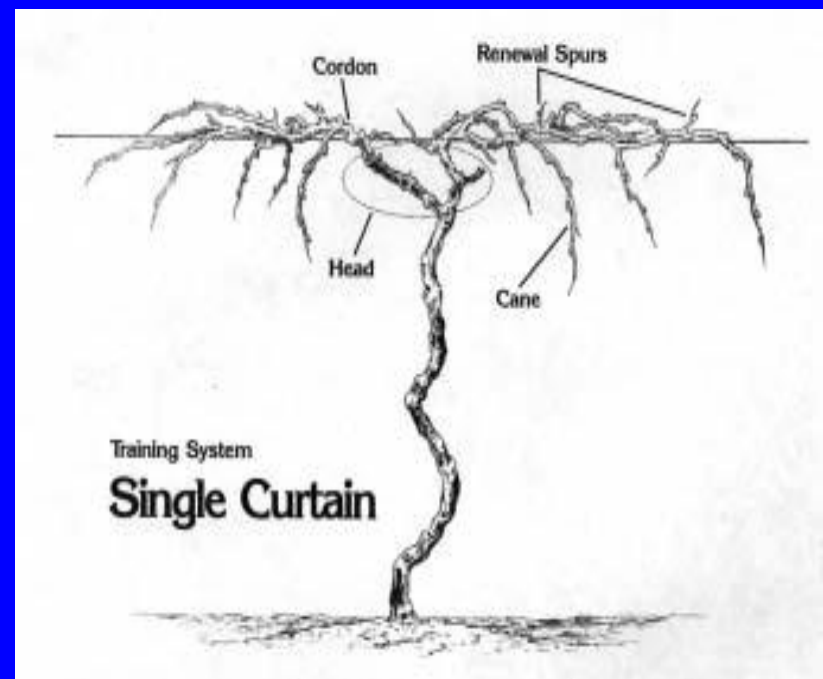
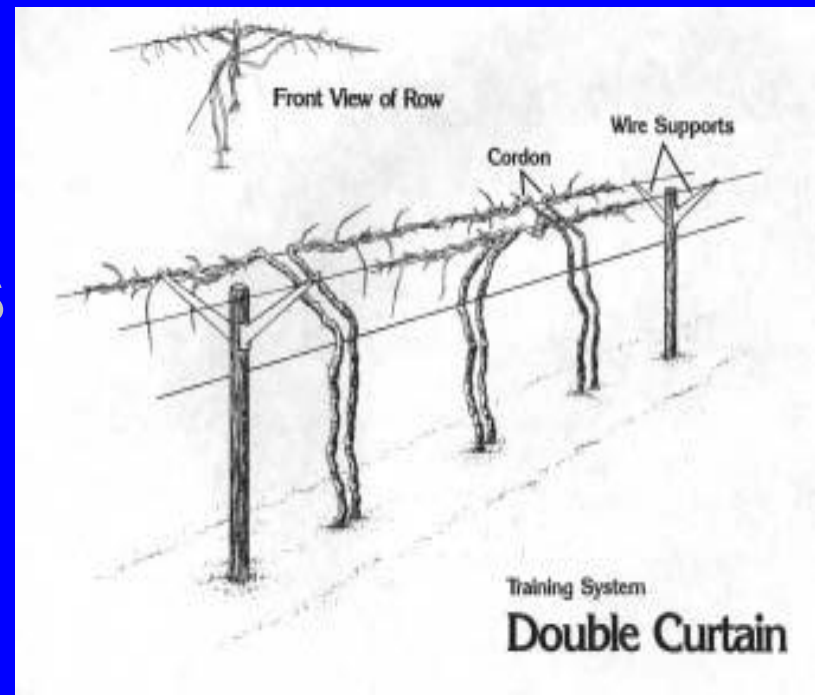


Shoot Positioning On High Trellis Systems

- Shoots are positioned so that they are not a “solid mat” on top of the cordon.
 - Canes growing along or cross the top of the cordon are repositioned so that they flow downward from the cordon.
- Positioning is done after shoots become strongly attached.
 - When lignin begins to form at the base of the canes (canes begin to change color from green to brown).
 - Generally done beginning in early to mid-July.
 - May have to be repeated 30 days later.

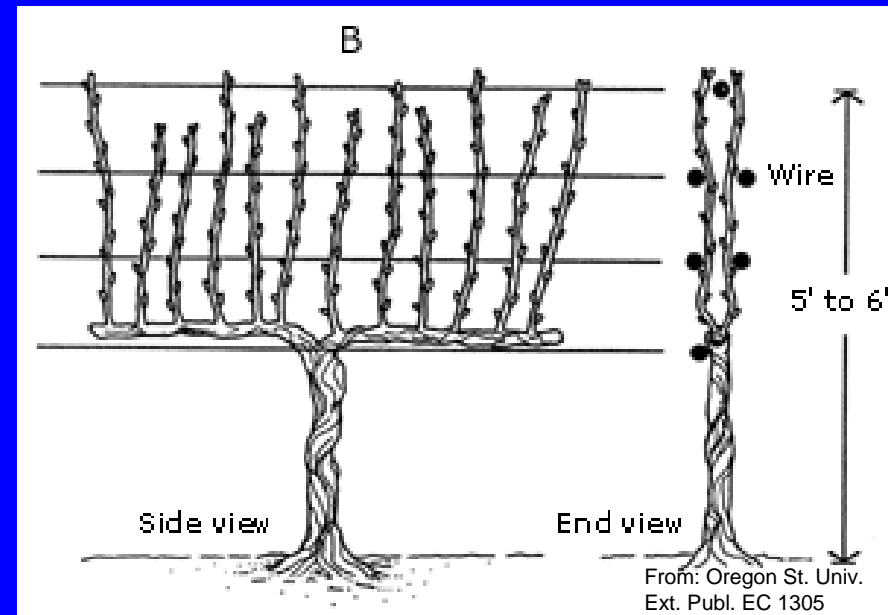
Shoot Positioning On High Trellis Systems

- Usually practiced on high-vigor vines, or Double-curtain training systems where shoots intertwine.
 - The practice is often referred to as “Combing”.
- May be done with Single-curtain vines to obtain better-positioned canes.



Shoot Positioning On Low Cordon Systems

- Cultivars with an upright to semi-upright growth habit adapt well to the low cordon system and vertical shoot positioning.
 - Shoot positioning consists of tucking the canes between the sets of catch wires as they develop.
 - This may require several trips through the vineyard during the growing season.



Shoot Topping

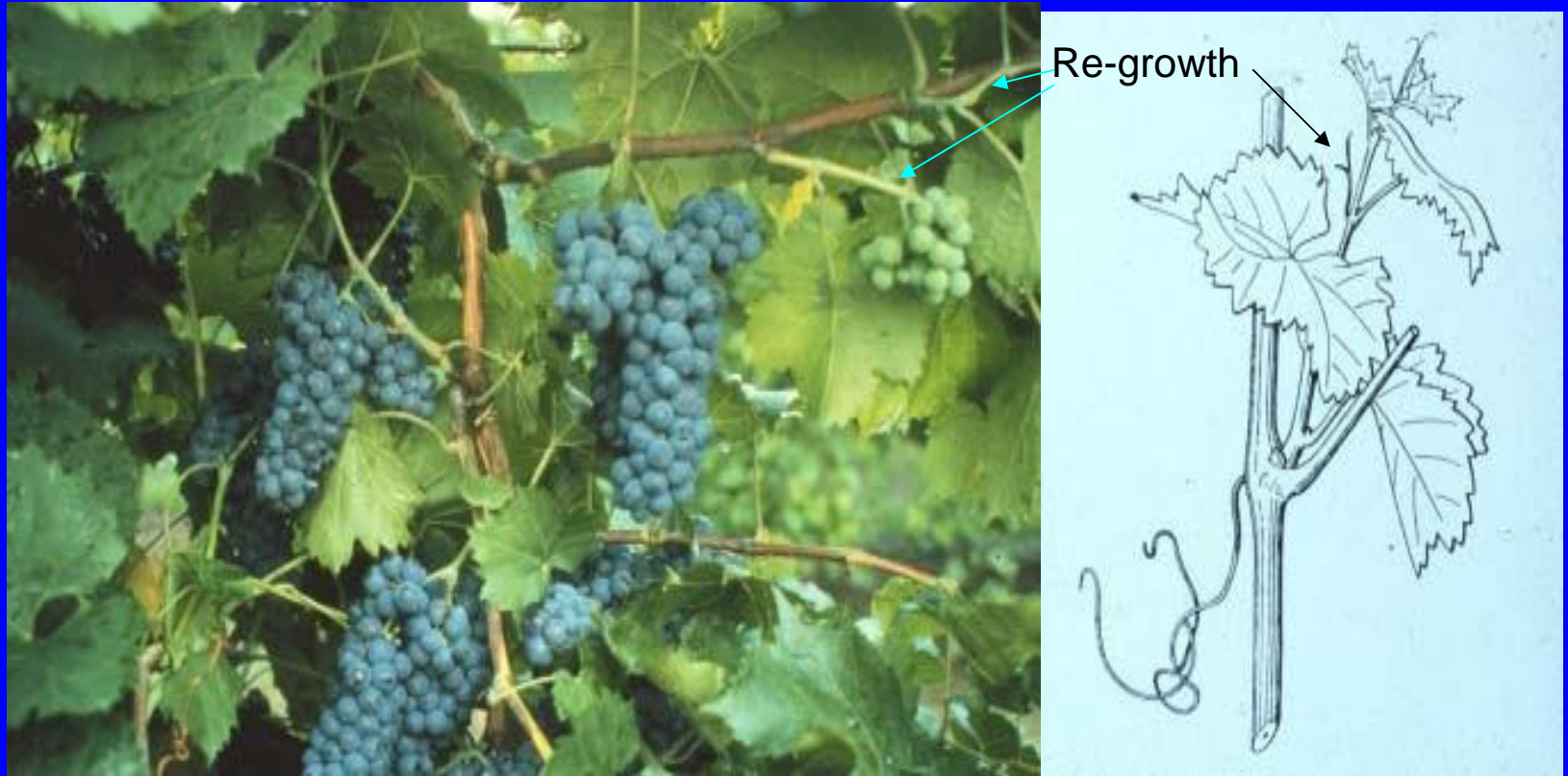
Shoot topping is the practice of removing a portion of the cane during the growing season.

- It is practiced to shorten the skirt of the vine when the canes get long enough to interfere with cultural practices.
- Otherwise, it is not a proven practice.
 - Timing and length need to be determined.
 - Remember that whenever leaves are removed, the photosynthetic potential of the vine is reduced, and this can affect next year's crop.

Shoot Topping

- If shoot topping is to be practiced, do it in late summer.
 - Avoid doing it during the period of fruit bud formation.
- Retain at least 11 to 13 leaves per cluster on the main cane plus any laterals that develop.
 - Studies in Germany on *V. vinifera* cultivars found that 11 to 13 leaves are required to adequately mature a grape cluster.
- Any time a cane is cut back, axillary buds near the cut will begin to grow.

Shoot Topping



- If the canes are cut too far back, re-growth will sacrifice clusters for next year.
- Re-growth uses reserve photosynthates during the current year, and may not properly mature.

Grape canopy management

Remember:

- Shoot positioning can be helpful to maximize sunlight interception, and enhance air movement.
- Shoot topping is unproven.
If used - keep major portion of shoot.

Pruning & Training Grapevines

References

- **Grapes: Production, Management and Marketing.** Ohio St. Univ. Bull. 815, Agdex 231.
- **Pruning Grapes.** Cornell Coop Ext. Video 155VPG
- **Pruning Grapes.** Michigan St. Univ. Ext. VT021 (video)