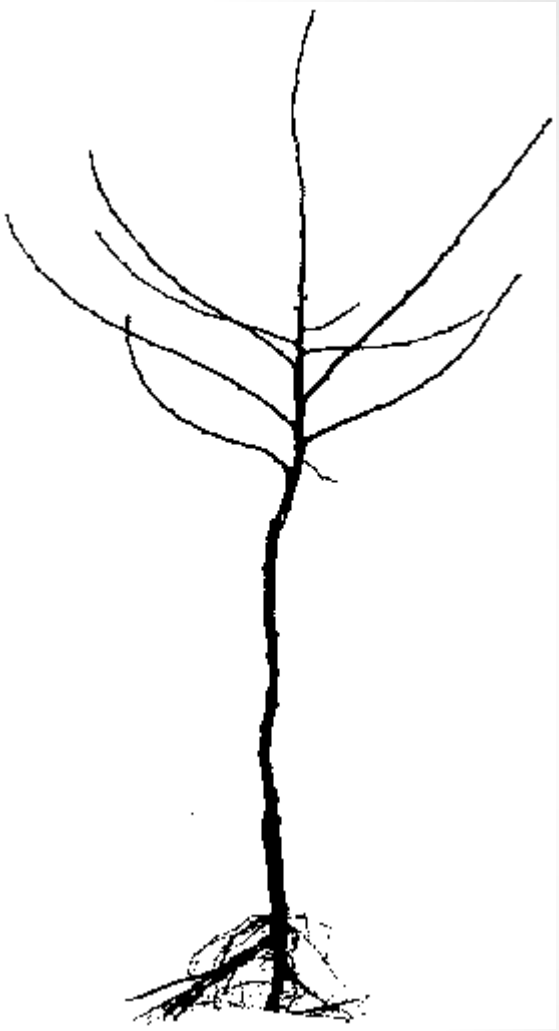
Common Mistakes to Avoid in Training Tall Spindle Trees



Mario Miranda Sazo
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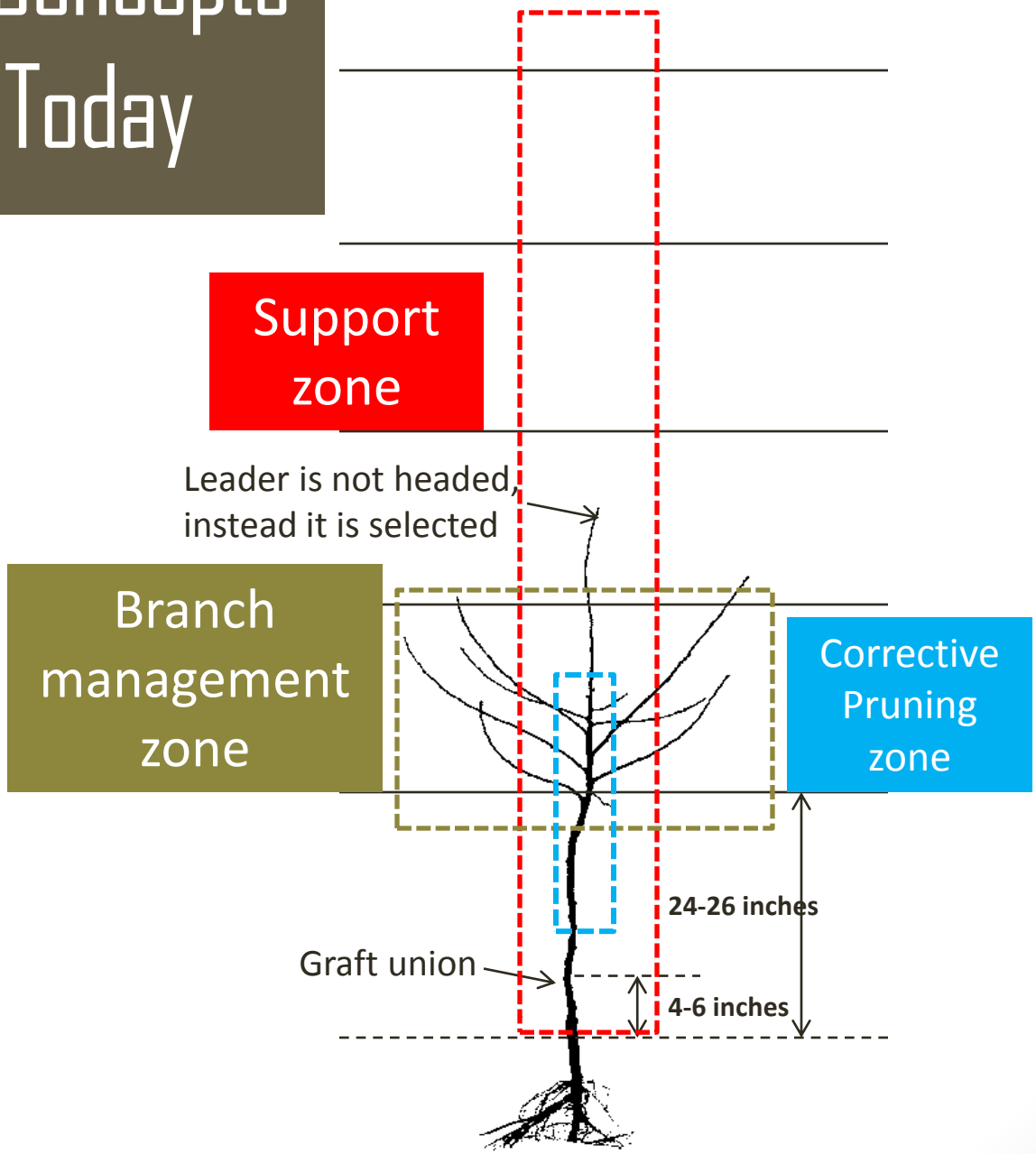
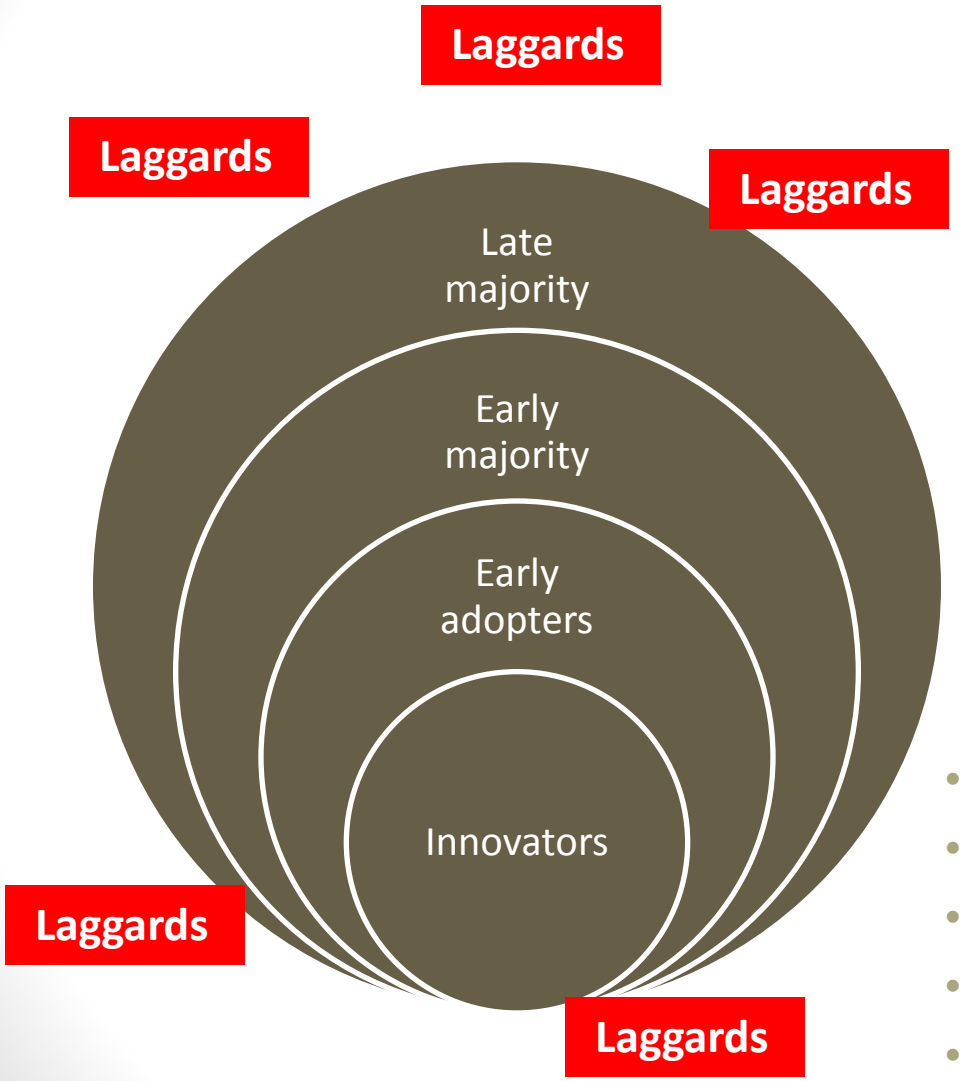
Main Concepts For Today

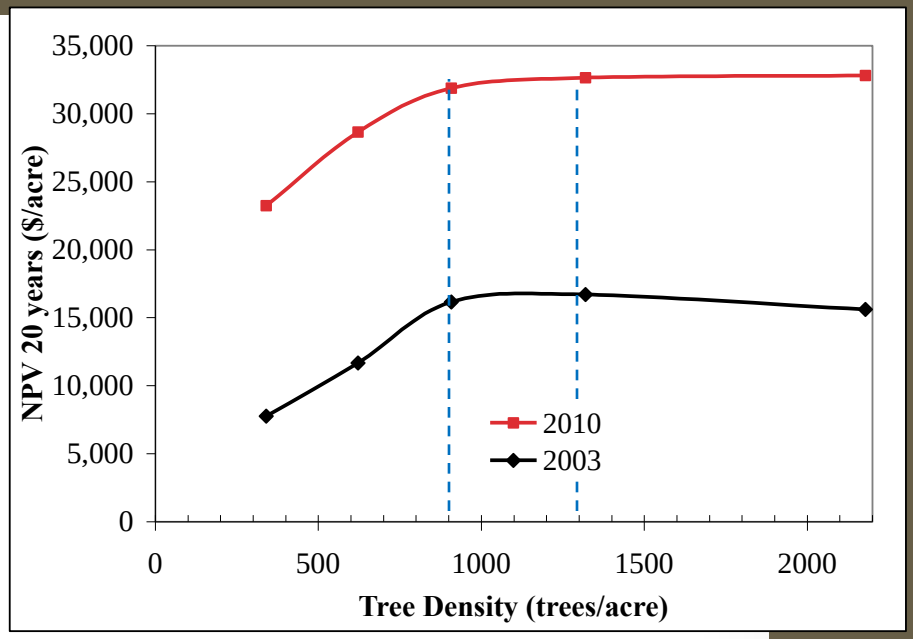


High Density Adoption Stages and Economic Value



Source: Adapted from "Crossing the Chasm" by Geofrey Moore

Profitability of Apple Orchards in NY over 20 years



Source: T.L. Robinson, Cornell U.

Definitions

- Innovator **"Try it!"**
- Early adopter **"Get Ahead"**
- Early majority **"Stick with the Herd"**
- Late majority **"Hold on!"**
- Laggards **"Skeptics: No way!"**

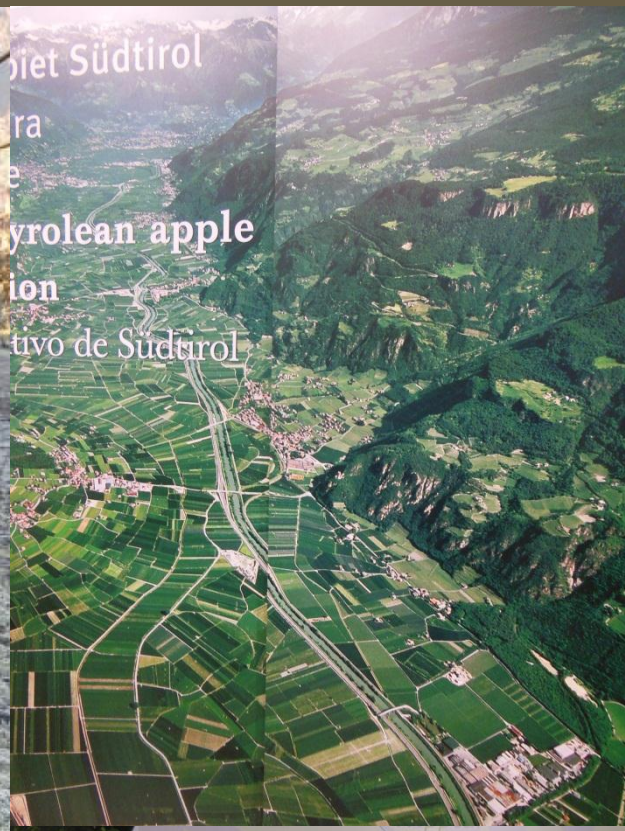
Typical South American fruit operation

- **Bigger** fruit acreage
- **Fewer** family controlled businesses
- Owner(s) **less involved** in the day to day operations
- **More** technical support
- **More** consultants involved
- Hand labor is more available and **cheaper**
- **Less** picking efficiency (3 bins per person per day)
- **Less** ready to be efficient (owner and employees)

Typical Northeastern fruit operation

- **Smaller** fruit acreage
- **More** family-controlled businesses
- Owner(s) **more or fully involved** in the day to day operations
- **Less** technical support
- **Less or none** consultants involved
- Hand labor is less available and **more expensive**
- **More** picking efficiency (5-6 bins per person per day)
- **More** ready to be efficient (owner and employees)

What about a typical South Tyrolean fruit grower?



The Challenge

- Mid-Atlantic fruit growers must **balance two conflicting** but equally important demands for **success**:
- **Efficiency** (which comes from exploiting standard opportunities)
- **Flexibility** (which allows a Mid-Atlantic fruit grower to seize unexpected opportunities)

Mid-Atlantic fruit growing….

- It is something you **live** and **breathe** every day
- It is something you do (i.e. fruit growing) **intensively** with family
- It is something you do outdoors expecting to make a profit

in one of the few US industries **“without a roof”!**

"Mindset" Mistakes?

- It is too costly the Tall Spindle "orchard thing"
- I am not planning to try it. Forget it!
- Mario, that idea is too crazy
- I am too old for this
- Not for me, but possibly for the Next Generation - YGA!
- All that wire and post thing is too much work
- I don't have extra help
- I think it is too intense
- I will never be able to contain tree growth with a 3x12 ft. planting density. It is impossible!
- I don't have the needed tractors and equipment for the narrow alleys

"Horticultural and Management" Mistakes

- Little or none advanced planning before planting the TS orchard
- Inadequate soil and poor drainage preparations, late planting
- Growing your own nursery trees without much care. Producing a whip
- Planting whips and heading them
- Planting trees with a few and long feathers
- Planting trees with many but long feathers
- Planting a TS orchard with short posts
- Installing the tree support system too late and getting minimum leader growth
- Planting a high density orchard without irrigation
- Little amount of time invested and none effort to manage feathers of a young and vigorous apple tree

Are You Ready to Plan, Prepare, and Establish a Successful High-Density Apple Orchard?

- The decisions made now and methods used this 2013 year for establishing that future TS orchard will have consequences for the next 20 years

I will stress the importance of…..

- Advanced planning for a minimum of two years to get the proper tree with the right price and to prepare the soil
- The use of nursery trees of excellent quality whether they are bought or produced on the farm
- Early spring or fall planting to allow early root establishment and maximum tree growth in the first year
- Quick installation of a trellis support and irrigation lines soon after planting
- Optimal leader growth for the first 2-3 years as a result of a balanced nutritional program, irrigation, excellent weed control and overall good orchard management.

Starting the New TS Orchard

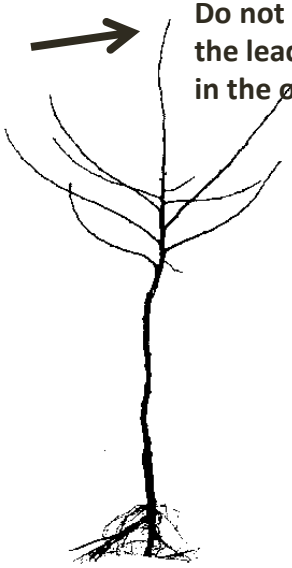
- Planning starts **3-5 years in advance**
- Site selected is rented to a field crop farmer for Roundup Ready soybean to increase soil nitrogen content and reduce weed pressure with glyphosate
- Drainage and nutrient evaluation two years before planting
- Chisel the soil the year before planting
- Soil is disked just before planting

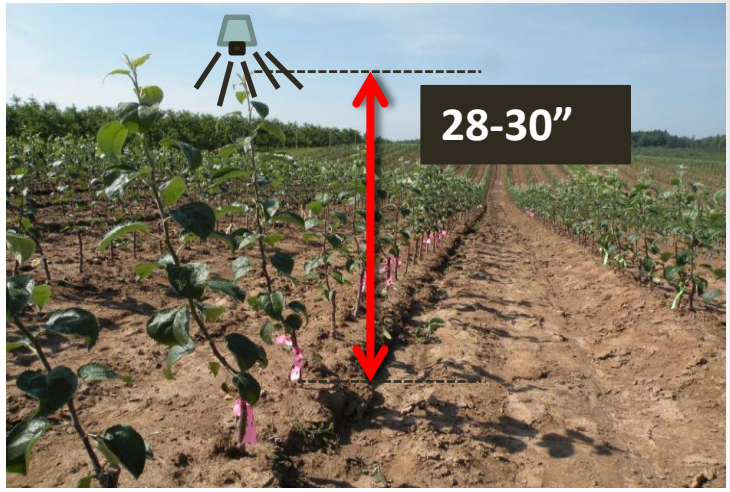
- Planning starts **2 years in advance** when ordering trees to get a good tree price
- Take soil samples 2 years before planting
- Drainage and nutrient adjustment two years before planting
- The previous summer plant a cover crop (i.e. Sudangrass) to add organic matter and prevent weed growth

- Planning start **2-3 years in advance when ordering the rootstocks for the on-farm nursery**
- Plants field corn two years before planting
- Atrazine soil residues must be low, zero before planting an orchard
- Deep plowing, ripping the year before planting
- Soil is disked before planting

Apical Dominance

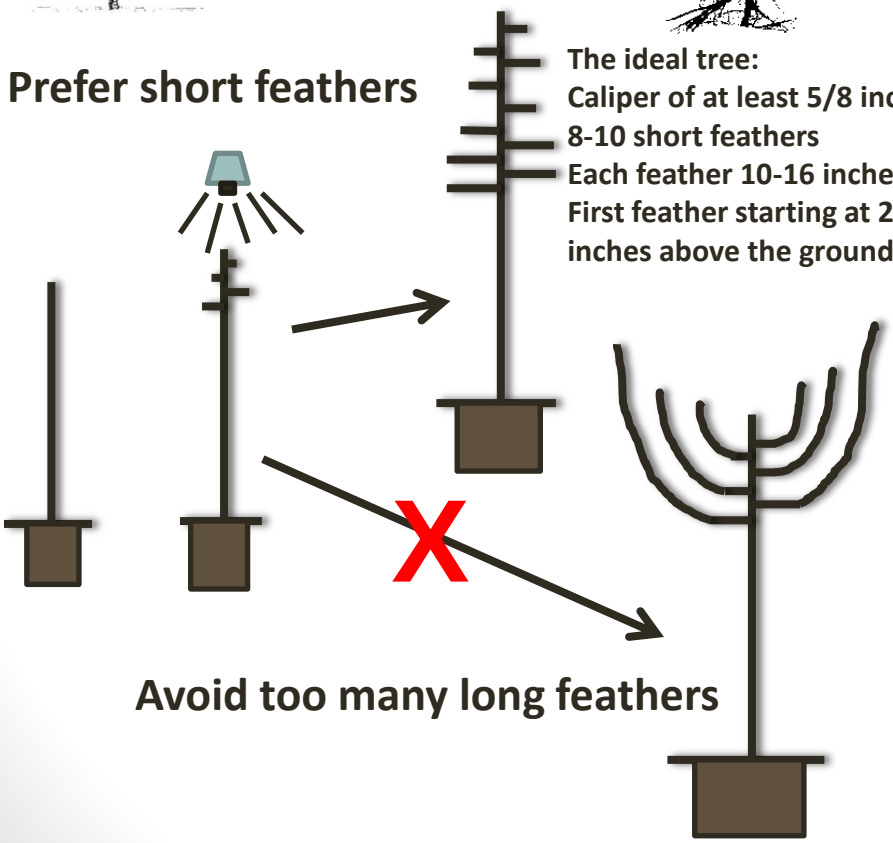
needs to be interrupted just in the nursery
Options are: Promalin, Tiberon, Maxcel, pinching/leaf removal





Prefer short feathers

The ideal tree:
Caliper of at least 5/8 inches
8-10 short feathers
Each feather 10-16 inches long
First feather starting at 24-26 inches above the ground



Avoid too many long feathers

- Consider the use of Maxcel 500ppm (320 oz of formulated product/100 gallons of water) for chemical branching of nursery apple trees
- First spray should be applied when tree height is about 28-30 inches above ground level
- Use a backpack sprayer with a single nozzle directed to the shoot tip of each tree
- We recommend 3 or 4 sprays per season
- The timing of the 2nd-4th sprays should be when the leader adds 5 inches of new growth after the last spray (about 7-10 days)
- Use regulaid (1pt /100gal=0.16oz/1gal) for better feathering results
- If possible apply in the morning when temperatures are 65-70 degrees
- Avoid spraying the nursery in the afternoon if temperatures are 90 degrees or more
- Do not tank mix with streptomycin or apply strep on the same day.

Tree Source and Quality

- Buys feathered nursery trees (6 or ideally more feathers)
- Buys feathered nursery trees (6-8 feathers)
- Grows on-farm nursery trees. 3-5 feathers are induced with the use of Maxcel

<u>The ideal tree!</u>

Caliper of at least 5/8 inches
8-10 short feathers
Each feather 10-16 inches long
First feather starting at 24-26 inches above the ground
Feathers well distributed along the trunk
Feathers with wide crotch angles
Feathers that are too low are not usable
Feathers below 24 inches must be removed after planting for all cultivars

Spring versus Fall Planting

- Prefers **only early Spring planting**
- Starts asking for the nursery trees the year before around October and gets the trees early by April 1
- Is always ready to plant the new orchard at the **earliest possible** date

- Has planted in the Fall without major problems in the past. But currently **prefers early Spring** planting

- Has **successfully planted in the Fall** for several consecutive years
- The nursery trees are dug in the fall and planted immediately (the same day)
- Trees are hand defoliated on site after planting (to prevent desiccation)

Main Tasks Completed "Quickly" After Planting a TS Orchard

- Trellis goes up **very quickly (5-7 days after planting)** to support feathered trees under frequent on-site windy conditions of 30-40miles/ hour
- Fertigation lines are installed 10-12 days after planting
- The goal is to have the trellis and irrigation lines installed **10-14 days after planting**

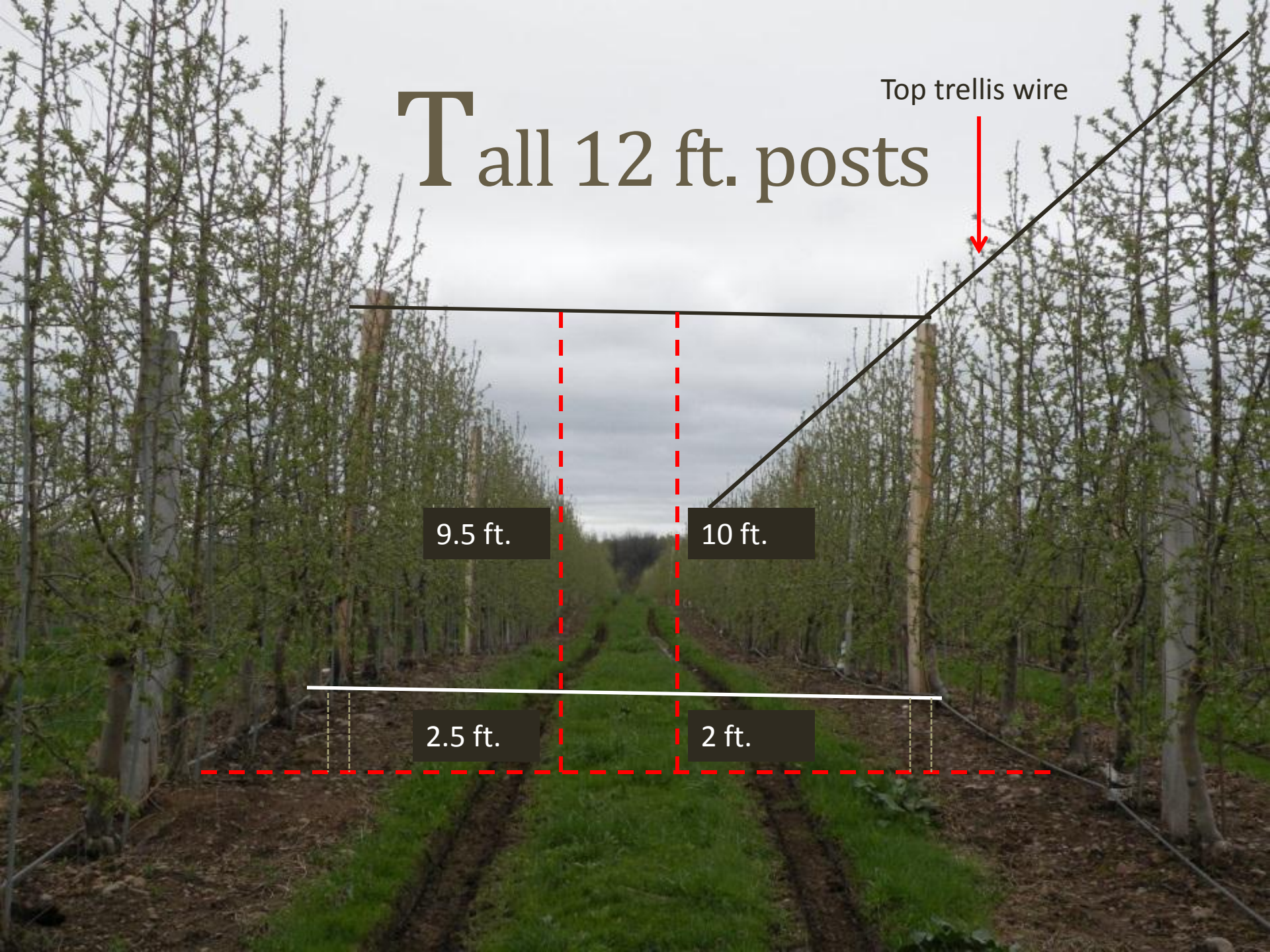
- **Posts and two wires** to support the trees are installed in the **fall after planting**
- Irrigation lines are installed **2-3 weeks after bud break**
- **2 more wires** are installed the following spring

Planting System/N° of Wires/Leader Support System

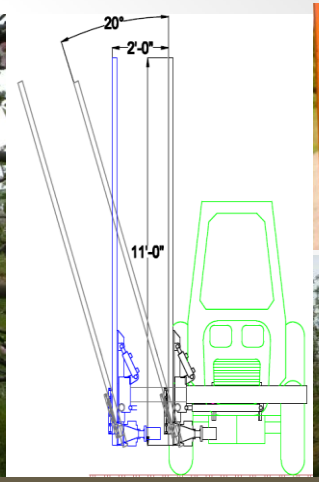
- Tall Spindle apple system (**3'x12'** spacing)
- **4 wires, 12' posts** (chemically treated wooden posts) spaced **30-35 feet apart**
- Uses a **bamboo tree stake attached to the wires** with a commercial tree clip

- Tall Spindle apple system **(3'x12'** spacing)
- **4 wires, 12'posts** (chemically treated wooden posts) spaced **30-35 feet apart**
- Uses a **wire-stabilizer for each tree**

- Tall Spindle apple system (**2.5'-3'x12' spacing)**
- **4 wires, 10' posts spaced 35-40 feet** apart. Has used chemically treated wooden posts and untreated black locust posts.
- Trees are held to the wire with a **rubber band (first lower wire) and with a looped metal tie to the second wire**


Tall 12 ft. posts
Top trellis wire
9.5 ft.
10 ft.
2.5 ft.
2 ft.

- Today a modern high density planting must be supported with 12 ft. posts so trees are properly supported to quickly reach the top trellis wire (10 feet) by the end of the second or third year
- A good, strong, and tall support system for a high density orchard must be viewed as an investment, rather than just an orchard establishment cost!
- A tall trellis support allows fruit production in the early years while preserving a vertical tree trunk and a vertical canopy (without ever bending the top if unsupported!)



- We expect to produce future large, mature yields from the bottom to the top of the tree
- By the years 2017/18, the orchard planted this year (as we envision it) will have a tall, vertical, and straight fruit wall easily managed by using platforms, hedgers, sprayers, and harvest machines for higher labor efficiency
- With a Tall Spindle tree and a row spacing of 12 ft. the hedging is done 2-3 feet from the trunk. A Tall Spindle canopy should be an angled wall of 4 ft. wide at the base and 2 ft. wide at the top.
- With a Super Spindle tree and 10-11 ft. row spacing the hedging is done one ft. from the trunk (the fruit wall is very narrow).

Leader Growth Expected for the 1st and 2nd years

- Expects **2 or more feet** of leader growth the first and second year

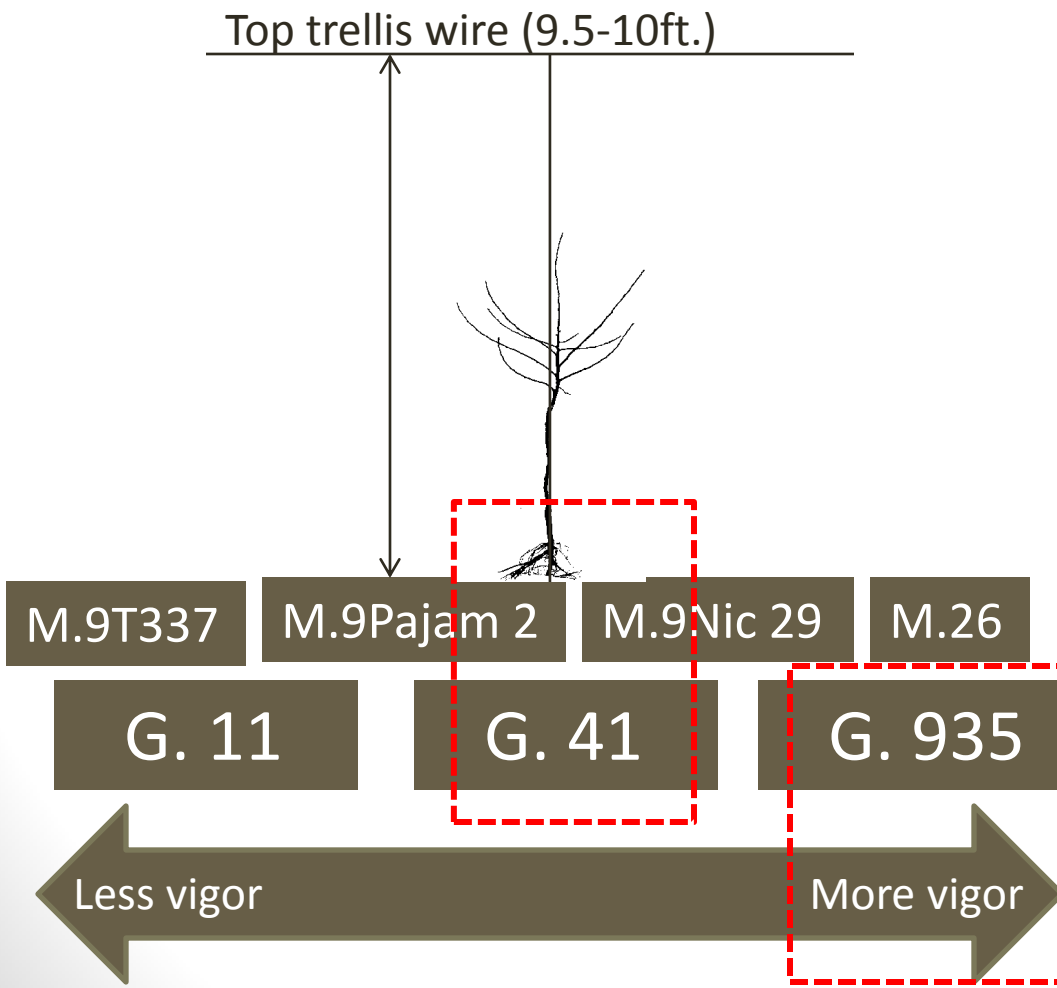
- Some of the new plantings are surrounded by orchards with fire blight pressure
- Grower expects **16-18 inches of shoot growth** for the first and second years after planting

- Expects **2 feet of leader growth** the first and second year

Why maximum leader growth is so critical in a TS apple system?

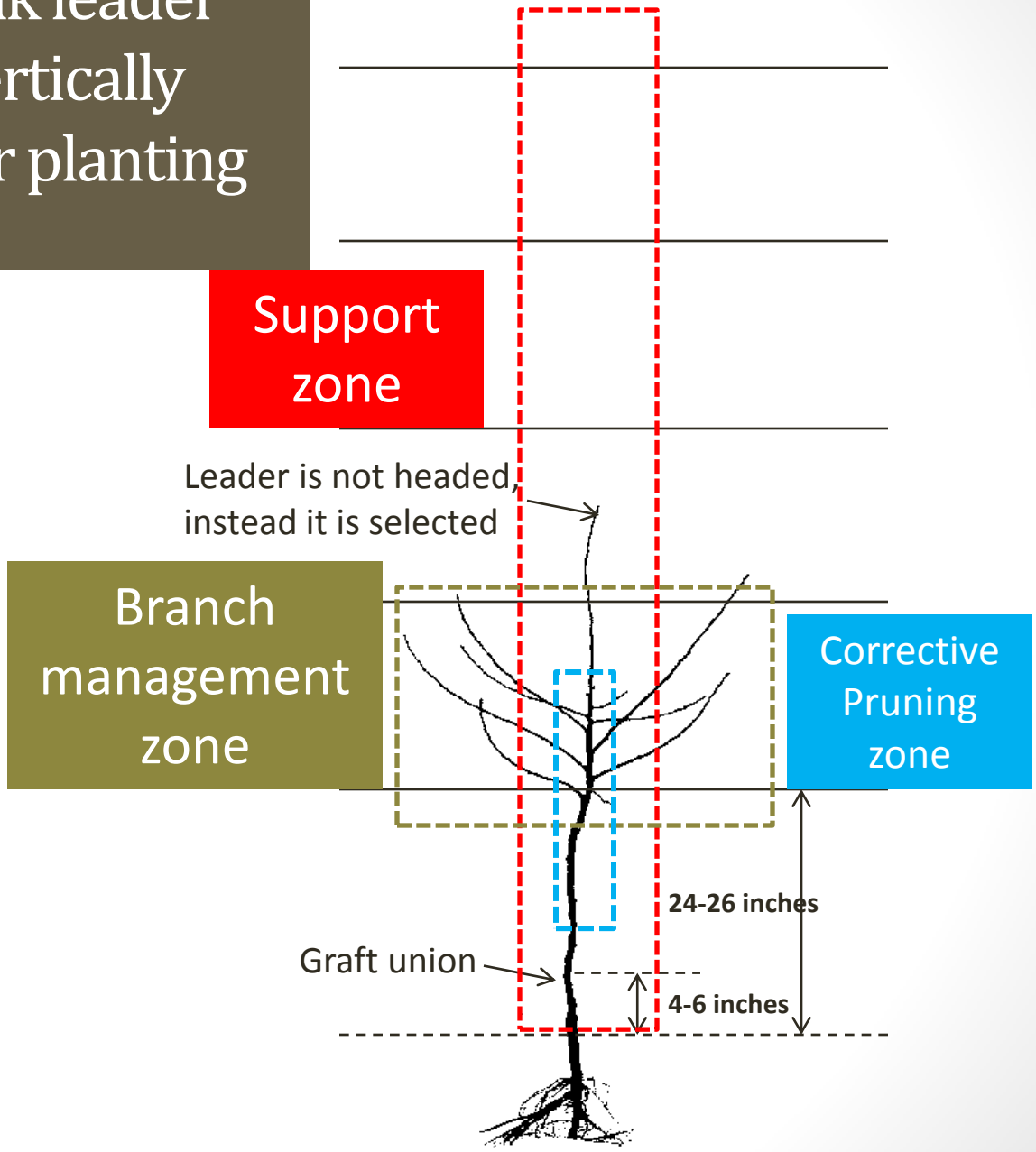
- With a **weak growing cultivar** such as Honeycrisp the **lack** of sufficient leader growth to reach the top of the trellis (10ft) by the end of the 3rd year is a serious problem that **limits** yield in future years
- With more vigorous cultivars such as Gala, Fuji or McIntosh reaching the top of the trellis by the end of the 3rd season is **usually not a problem**
- However with weak growing cultivars growers need to **intensively manage the trees** in the first 3 years to achieve the **desired growth**

By planning ahead you can push a weak leader to grow fast and vertically



- A weak cultivar must be planted at a close spacing (3ft or less) using the more **vigorous M.9 clones** (Pajam 2, Nic 29), or **G.41** (comparable to the large M.9 clones, fire blight resistant)
- **G.41** will be especially useful when orchards are **replanted on old orchard sites** since it has some tolerance to replant disease
- A good option is **G.935** for establishing high-density plantings for a weak growing cultivar like Honeycrisp

How to push a weak leader to grow fast and vertically in the orchard after planting (first 2-3 years)



You don't Head the leader, instead you Select the leader

- You **quickly install** the new trellis and irrigation lines after planting
- The goal is to **keep the leader growing** until the end of July through intensive water and nitrogen management and achieve 18-24" of shoot growth
- You **select** the leader when 2" long and remove buds #2-4 when 1" long, (if this is not done you should **cut competing shoots** back with clippers to 2" long) to prevent competition with the leader
- The new trees should grow healthy, without weed competition, mildew, and fire blight





You help the tree and the leader to growth fast without water stress

- Water (when needed) should be supplied by trickle or overhead irrigation with **low doses per tree** but **frequently**
- Water should be applied **2-3 times per week** (unless we get more than 1” or rainfall that week) but with relatively **small volumes each time (2-3 gallons per tree)**
- The best tree growth response can be achieved by injecting liquid nitrogen fertilizer (**fertigation**) with each irrigation (100ppm=0.4g N per gallon of irrigation water)
- These applications encourage maximum and safe leader growth

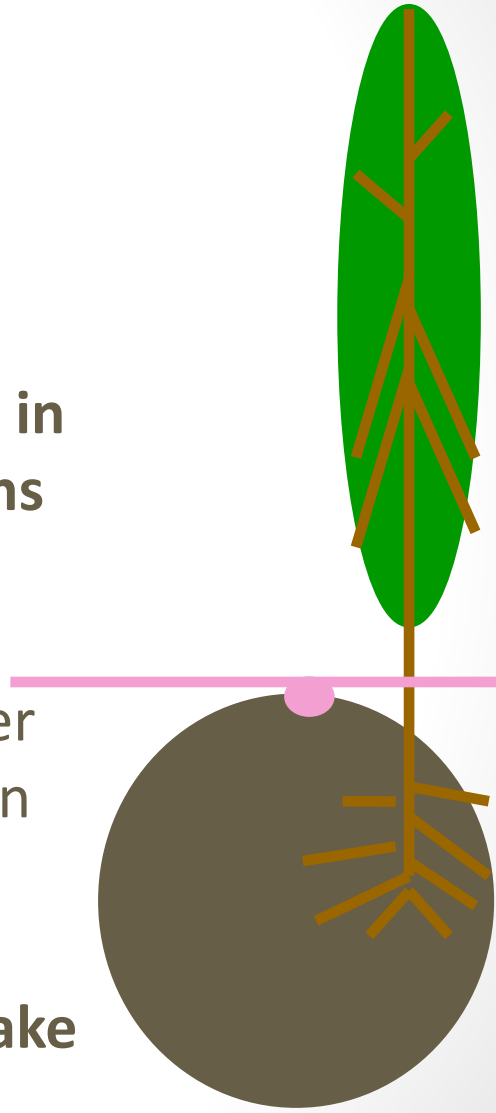
Water Stress with Young Trees (Lakso-Dragoni Irrigation Model)

Limited root system due to digging in nursery
Transplant **shock**
Rapid Leaf area development with branched trees

Highly feathered trees experience **water stress in late May and June** due to **limited root systems** and **extensive leaf area**

Water must be applied **frequently** to limit water stress on newly planted trees. Trickle irrigation must be installed within **2 weeks of planting**

Newly planted trees have **limited nutrient uptake** due to **damaged** root systems



Feed the tree to promote optimum growth

- **Apply ¼ lb. of Ca nitrate per tree** after the soil settles carefully applied in a doughnut shaped band around each tree
- At about 3-4 weeks after the first fertilization the trees receive a **second small dose of nitrogen (1/4 lb. of calcium nitrate)** carefully applied in a doughnut shaped band around each tree
- Flowers can sometimes be manually removed (first year)

You Support the Tree to Grow Quickly and Vertically to the Top Trellis Wire

- The trellis should have **3 wires** if there is a vertical supporting element such as a conduit pipe, a bamboo, or a wire stabilizer
- It should have **4-5 wires** if no vertical supporting element is used
- The leader should be attached to the trellis with a **rubber band** or a **wire loop** as soon as it **reaches each successive wire**

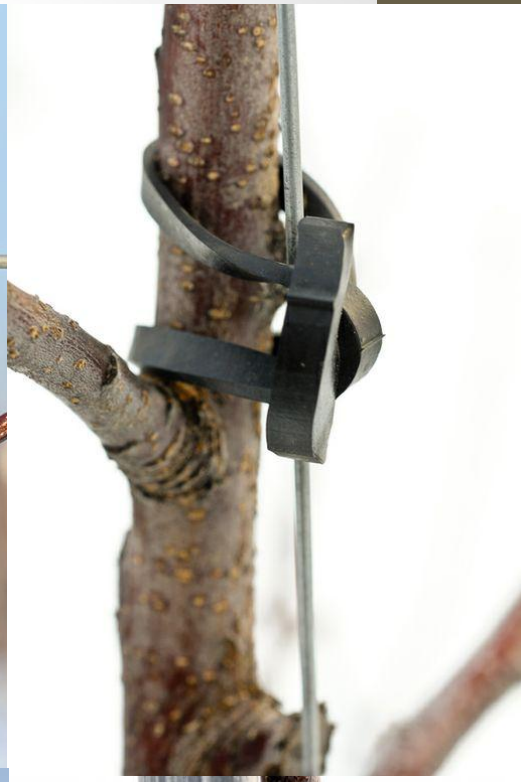


Table 2. Yield and fruit weight comparisons among 4 support systems for 5 varieties.

Variety	Systems	Average # Fruit/Tree	Average Fruit Wt. (g)	Estimated Yield Bu/Acre
Royal Empire	3-Wire	13.5	168.4	144.3
	5-Wire	18.1	174.5	200.4
	3-Wire with Bamboo	17.7	168.7	189.5
	3-Wire Stabilizer System	10.8	179.9	123.3
Gibson Golden Delicious	3-Wire	10.2	192.7	124.7
	5-Wire	8.7	186.6	103
	3-Wire with Bamboo	15.4	203	198.4
	3-Wire Stabilizer System	12	197.2	150.2
Striped Red Fuji	3-Wire	19.4	222	273.3
	5-Wire	19.4	201.1	247.6
	3-Wire with Bamboo	21.9	205.9	286.1
	3-Wire Stabilizer System	20.9	205.5	272.5
NY 1	3-Wire	15.3	208.1	202
	5-Wire	17.8	205.6	232.2
	3-Wire with Bamboo	19.8	207.4	260.6
	3-Wire Stabilizer System	18.5	207.2	243.2
NY 2	3-Wire	18.4	241.3	281.7
	5-Wire	16.3	260.3	269.2
	3-Wire with Bamboo	14.1	258.5	231.3
	3-Wire Stabilizer System	22	254.2	354.9

*The significant cost in purchasing the air tool, generator, and/or compressor to install wire clips is not included in this figure.

Table 3. Cost of Support Systems

	Posts	Wire & Staples	Training Stakes	Installation Labor	Total
3Wire	$1,123.66	$205.50	$0.00	$367.00	$1,696.16
5Wire	$1,123.66	$340.50	$0.00	$387.00	$1,851.16
3Wire plus Bamboo	$1,123.66	$205.50	$648.00	$495.00	$2,472.16
3Wire plus Stabilizer	$1,123.66	$205.50	$211.20	$495.00	$2,035.36
1Wire w/Conduit Stake	$1,123.66	$68.50	$2,420.00	$495.00	$4,107.16

Source: Steve Hoying, 2012


4 wires

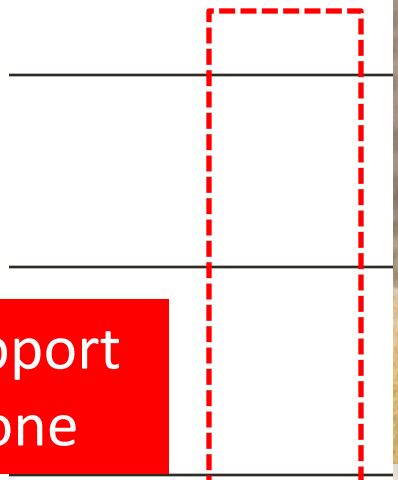

5 wires

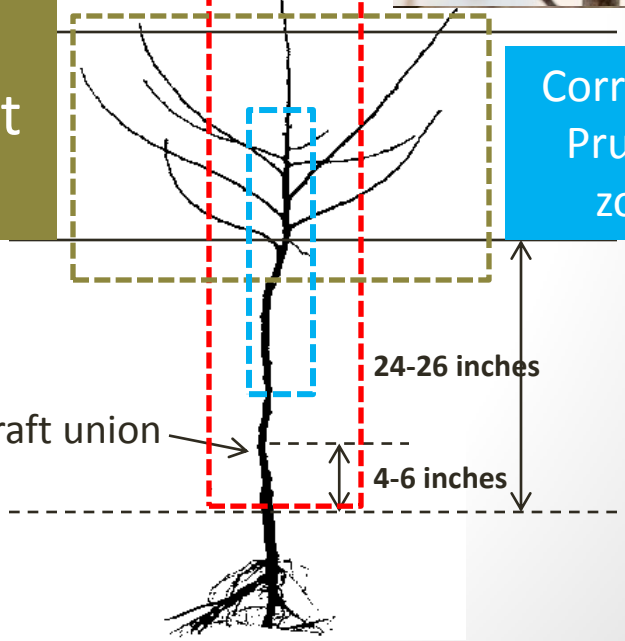
1 wire w/Conduit Stake

3 wires plus Stabilizer

Trellis clip

- With young weak trees that have crop the **unsupported terminal portion** of the leader above the last wire should be **defruited** for maximum shoot growth and good lignification during years 2, 3 and 4





Support zone

Leader is not headed, instead it is selected

Branch management zone

Corrective Pruning zone

24-26 inches

Graft union

4-6 inches

Branch Management Is Critical for Moderate and Highly Vigorous Apple Trees

- You must invest the necessary time and effort to manage feathers of a young Tall Spindle orchard if the trees are growing vigorously (Fuji, Macoun situations)

Materials to be Particularly Suitable for Tying Down Feathers Below Horizontal for the Tall Spindle System

- A **strip** of 5/8”-wide **Avis-strap** nailed or tied from the base of the trunk then split into strands and tied to each of the lower feathers

Corrective pruning for zone below 24-26 inches


JULIET / GENEVA 935

A 4-inch long ghent **rubber band** (six-month-life with 880 rubber bands per bag) can be tied on the trunk and the feather is placed through the band when it is stretched out



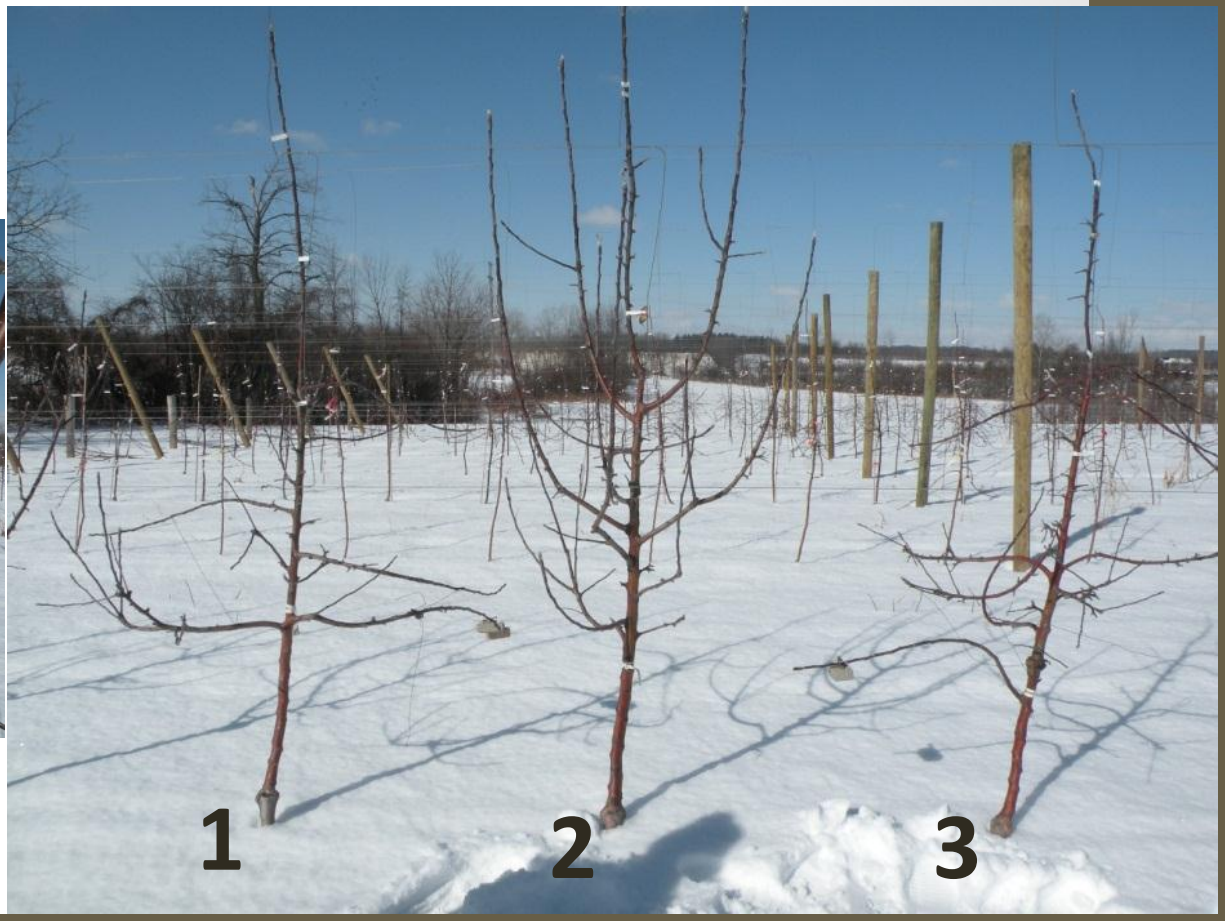


A pre-cut 20-inch black annealed **wire** (sold as a 1000 pieces/bundle) can be hooked around the feather directly down to the trellis wires, the conduit pipe or bamboo supporting pole, or the main trunk


GENEVA 935

Best materials

- After about 4-6 months the rubber band **stretches** and is **less effective** for strong feathers while **Avis-strap strings** and the **pre-cut black annealed wire** are suitable for bending both weak and vigorous feathers



- A failure to tie feathers below horizontal soon after planting resulted in limbs **too vigorous** in a two-year-old Macoun trees (central tree). Feathers were tied down in trees 1 and 3 (left and right side corners) soon after planting. The pendant position resulted in a weak fruiting branch instead of several strong, arched, upward branches as observed in the central tree # 2

- Bending 5-10 feathers below horizontal after planting has significantly **increased the number of spurs** developed in Gala, Honeycrisp, Macoun, Jonagold and Fuji Tall Spindle trees

Final thoughts : Heading versus Not Heading

- Even if a whip is planted, **the leader is not pruned or headed at planting** for the Tall Spindle System
- The heading of the leader of a young apple tree is **undesirable** as it removes a significant portion of the tree structure already produced in the nursery
- Heading the leader **disrupts**, **unbalance, and changes forever** the natural growth and branching patterns of a young apple tree on a dwarfing rootstock intended to be grown as a Tall Spindle Tree
- We instead recommend **applying Maxcel** to stimulate branching of an **"unheaded"** whip so a more **"calm tree"** can be developed in the orchard

Final thoughts to avoid "unnecessary" mistakes

- With higher density plantings, the **impact of a mistake on your part** (or the lack of not doing the important things) is **higher** than with lower density plantings
- **Do not head the leader!** when planning to grow a Tall Spindle tree
- Remove any feathers larger than 2/3 diameter of the leader with a **bevel cut**
- If there are less than three feathers remove them with a bevel cut and treat the tree as a whip and use **Maxcel 15-20 days after budbreak** to promote branching
- A young TS tree mainly needs to grow **quickly and vertically** to the top trellis wire – without much need to fill lateral spacing. It will happen magically!
- Early, early **good support is critical**
- Early, early **good irrigation is critical**
- Trickle irrigation has its **largest impact** in the first few years. It should be installed early in the first year
- In **drought years**, the application of water should **begin in mid-May**. In other years, the application of water can be delayed **until late May**
- Bending of feathers is also important, **especially for vigorous apple cultivars, or for more vigorous growing conditions (the Mid-Atlantic conditions for apples?)**
- Tie down the feathers below horizontal **before mid June**

Acknowledgements

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Orchard Labor Force

A Human Resource
for efficient orchard work