

The Tall Spindle Planting System for Apples in the Northeast

Steve Hoying¹, Terence Robinson², and Mike Fargione¹

Cornell University Cooperative Extension

Hudson Valley Lab, Highland, NY¹ and NYSAES, Geneva, NY²

The Tall Spindle planting system is an apple planting system particularly suited for the Northeast. It maximizes profitability through early yield, improved fruit quality, reduced spraying, pruning, and training costs, and the ability to rapidly establish new orchards with more profitable apple varieties.

Essential components of the Tall Spindle system include:

- **High density** – 1000-1500 trees per acre. Planting systems research in NY has shown that the optimum economic planting density is approximately 1000 trees per acre (Figure 1). Proper selection of density for this system depends on consideration of the vigor of the variety and rootstock and the soil strength. The maximum spacing between trees should 4 feet and 12 feet between rows. The optimum Tall Spindle spacing for an average vigor variety and soil is 3 feet by 11 feet.
- **Full dwarfing rootstocks** – The most successful Tall Spindle orchards established to date have been on M.9 and B.9. Precocious dwarfing stocks are important since early cropping is essential. The yield efficiency and precocity of the Geneva rootstock series justifies their use especially where fireblight is a concern. Geneva 41, G.11, and G.16 are all appropriate rootstocks for the Tall Spindle. More vigorous rootstocks than these should only be used with the weakest growing varieties such as Spur Delicious.
- **Highly feathered nursery trees** – Nursery stock will ideally have from 10-15 feathers per tree. Transplant shock caused by a high scion to root ration helps keep trees within this tight spacing. It also contributes to significant fruit bud differentiation the year of planting. Trees with scaffolds provide bearing surface for production in the second leaf. Early bearing is essential to help pay for increased tree numbers and establishment costs.
- **Minimal pruning at planting** – Significant pruning at planting is a common practice with most planting systems to provide balance between the scion and root to encourage growth to fill the allotted tree space. Since the Tall Spindle system is planted with very little growth needed to fill the available space, very little pruning is needed. Remember that one of our objectives is to actually cause some transplant shock! Pruning is limited to only the removal of larger branches along the leader that are out of balance with the remainder of the tree. Generally, those that are more than ½ the diameter of the leader at the insertion point are removed using a cut that stimulates the development of a renewal branch from an adventitious bud.
- **Support System** – This planting system requires a support system to carry the crop and support potentially brittle rootstocks. Although individual metal tree stakes supported by a single high wire are ideal, the cost can be prohibitive. Alternatively, a three wire trellis with an inexpensive training stake at each tree substitutes well. The training stake (4 to 5

foot long $\frac{1}{2}$ inch bamboo) is used to support a rapidly growing leader with some fruit load. The leader should be supported to 10 feet in height and be achieved by the 3rd leaf.

- **Branch devigoration** – Upright scaffold branches are devigorated by bending below the horizontal through bending. Branch weights, rubber bands, or tying can all be successful. Branch bending controls vigor, keeps trees within allotted space, and encourages the production of fruit buds for the following growing season.
- **Limb renewal** - ALL scaffolds are renewed by complete removal as they become too large for the available space and become out of balance within the tree. Renewal cuts are made using the standard “bevel cut” method which encourages new shoots to form as replacement fruiting limbs. The Tall Spindle differs from most other systems in that there are no permanent limbs within the tree.
- **Early fruiting** – Fruiting in the second and third leaf is essential to keep a low tree vigor level and provide income from early fruit sales. Aggressive pest management practices are essential starting in the second year since marketable crops are expected and necessary for optimum profitability (Table 1). Crops in the early years must also be carefully managed to prevent biennial bearing. This is the only system we have ever tested that achieved a cumulative production over 1000 bushels in the 1st five years! This resulted in approximately a 40% increase in crop value compared to the Slender Vertical Axis and Sol Axis planting systems.

Simplified Training Plan

- **Year of Planting** – Plant quality nursery tree with 10-12 feathers and rootstock shank 4-6 inches above ground level while tree is completely dormant at no more than 3 feet apart. Remove feathers that are more than $\frac{1}{2}$ the diameter of the leader where they insert using a bevel cut. Only remove dead or broken ends of the leader and feathers. Irrigate or water trees as necessary to maintain excellent soil water status. Apply $\frac{1}{4}$ # of Calcium nitrate after the soils settles with a soaking rainfall. Apply another $\frac{1}{4}$ # CaNO_3 4 weeks later after shoot growth starts. Select the leader and remove all competitive shoots 4 inches below the selected leader. Install a support stake shallowly and attach each tree to stake with a Max-Tapener. Install support posts and wire as soon as possible and attach previously installed stakes to wire with a potato bag tie. Alternately use a 4 wire trellis using 12 foot end and inline posts, with a small bamboo training stake which runs from the 2nd to the 4th wire. If necessary, weight or tie upright scaffolds to below the horizontal. Control all foliar feeding pests throughout the season ensuring near perfect foliage condition and growth.
- **2nd Leaf** - At dormant, remove scaffolds that are more than $\frac{1}{2}$ the diameter of the tree at the insertion point using a bevel cut. Single the leader removing any competitive shoots. Single scaffolds by removing forks. Bend, tuck, or weight uprights along the scaffolds that are appropriate for fruiting wood to weaken them. Remove an occasional exceptionally strong sucker. Weight or tie down scaffold branches missed last year that are too vigorous and upright to below the horizontal. “Pinch” back all shoots in the top half of last year’s leader when they reach 3-6 inches by removing the growing tips.

Repeat this operation as new shoots appear or previously pinched shoots regrow. This may take three passes for vigorous varieties. Thin crop to single fruit spaced 6-8 inches apart. Install permanent tree ties to stake or wire to help support fruit on the leader. Keep all insect and disease pests under complete control with frequent scouting and appropriate pest management practices. Control of foliage feeding pests such as aphids, mites and potato leafhopper are extremely important to ensure continued tree growth and fruit bud development. This year's crop is very important to help ensure the profitability of this planting system. Crop can approach 100-150 bushels/acre on precocious varieties.

- **3rd Leaf** – Remove only large scaffolds and broken branches using renewal pruning concepts. Select the leader by removing competitive shoots if it can be reached from the ground and single the ends of the scaffolds removing all forked ends. Remove all vigorous upright suckers from along scaffolds. Prune up ends of scaffolds to appropriate shoots that will not interfere with herbicide applications and support the crop load. “Pinch” back new shoots in the top ½ of last year's leader that can be reached from the ground. Thin fruit to singles by hand so that they are 4-6 inches apart or appropriate for the tree size and condition. Tie tree to stakes or wire with permanent tree tie at the top of the stake to help support crop load on the leader. Irrigate as needed to maintain tree growth and optimize fruit size. Lightly summer prune removing just a few shoots to open up tree. Keep all insect and disease pests under complete control with frequent scouting and appropriate pest management practices.
- **4th Leaf** – Remove all broken branches, cut up low hanging scaffolds to facilitate herbicide applications. Remove large branches that do not fit the system. Remove uprights and weak hanging shoots and suckers. Tie tree to the top of the stake or top wire with permanent tree tie if not done in the previous season. Use appropriate rates of chemical thinner and follow up with hand thinning. Summer prune when necessary to open canopy and optimize fruit quality when seasonal growth has stopped. Keep all insect and disease pests under complete control with frequent scouting and appropriate pest management practices.
- **5th Leaf to 20th Leaf** - Remove bottom scaffolds as appropriate until 3 or 4 remain. The remaining scaffolds are permanent and should only be cut back to facilitate the movement of equipment through the orchard. Remove other limbs throughout the canopy using only renewal concepts. Manage the tree top by allowing crop to bend leader above the support stake or wire. When broken or bent below the horizontal, leaders can be cut back to new upright, NOT BEFORE. Manage the crop load through chemical and hand thinning to ensure annual bearing.

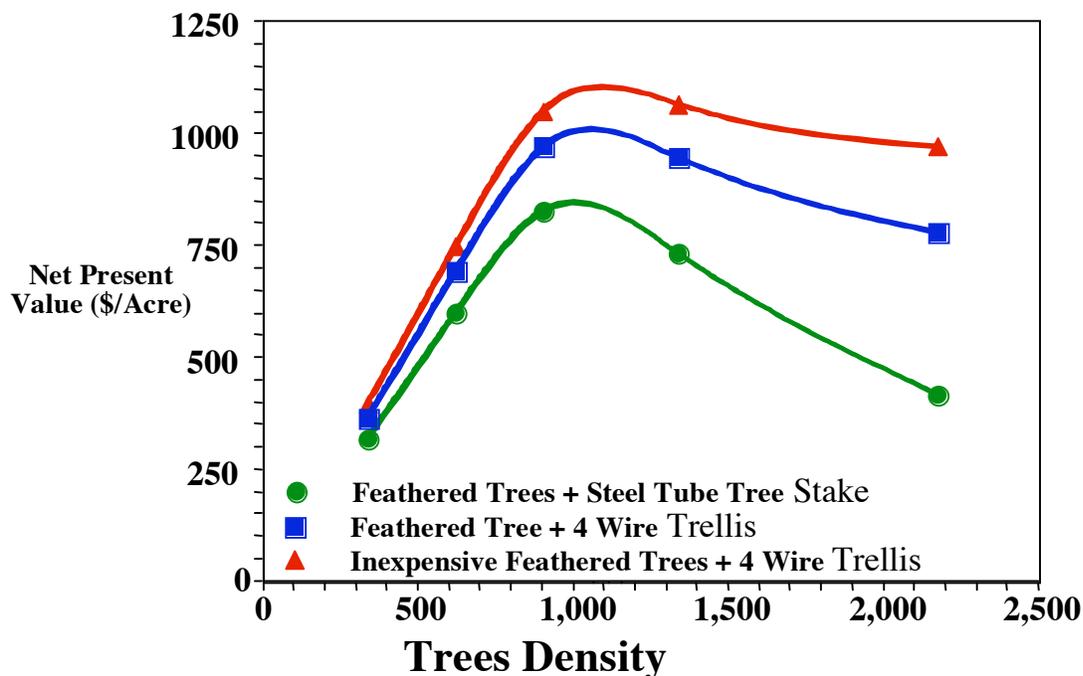


Figure 1. Optimum tree density using Net Present Value analysis of profitability indicates that systems using 900 to 1200 trees per acre maximize profitability.

Table 1. 2007 Yield and fruit size from 2nd leaf Tall Spindle Planting Systems trial in the Hudson Valley by rootstock (Dressel Planting).

Variety	Rootstock	Yield (Bu/A)	Fruit Size (gms)
Gala	M.9	228.7	140.3
Gala	B.9	148.5	120.6
Gala	G.11	380.7	87.6
Gala	G.16	112.1	121.1
Gala	G.41	151.7	141.7
Fuji	M.9	130.5	159.1
Fuji	B.9	170.1	151.1
Fuji	G.11	250.2	163.9
Fuji	G.16	179.1	166.5
Fuji	G.41	24.0	182.2