

The Platform Factor – Labor Positioning Machines Producing Good Results for NY Apple Industry

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Apple growers around the world are motivated to plant tightly spaced orchards for a variety of reasons, but the driving factors in the Lake Ontario Region, of New

“The recent widespread adoption of the Tall Spindle system in NY State is giving impetus to adoption of worker positioning platforms. Platform machines can be used for nearly all orchard tasks that involve ladders: dormant pruning, hand thinning, trellis building, leader selection, tree-training, summer pruning and picking. Our work indicates that these platforms improve labor efficiency, reduce annual costs and increase orchard profitability over a 20 year orchard life.”

York, are the rapid attainment of high yields, good fruit quality, long-term productivity, high profitability, and higher labor efficiency. The Tall Spindle system has proven to be an excellent orchard design for more than 40 NY apple growers in our region. This system has achieved high early yields, high sustained yields, and excellent fruit

quality while combining high tree planting densities, highly feathered trees, minimal pruning at harvest and over the first three years, branch angle manipulation, constant limb renewal during dormant pruning, and strict crop load management techniques. In addition, it is the best orchard system design in the Eastern United States with the potential for partial or full mechanization for several orchard tasks and higher labor efficiency. In the past few years, interest in using platforms for Tall Spindle orchard systems has grown in Western NY.

The Reasons For Mechanization

The first attempts at orchard mechanization of high-density orchards began more than 50 years ago by European growers (mainly Dutch, French and Germans). Today the Italian apple industry in the South Tyrol region of Italy is a good example of how orchard platforms have been successfully adopted by a majority of apple growers. According to Kurt Werth (personal communication), 60% of these growers are using platforms (self-propelled or pulled by a tractor) for 6 to 10 orchard tasks per year. In the US, the use of platforms is being investigated by Washington apple growers, and there is currently great interest in mechanical harvesting aids all along the West Coast (California, Oregon, and Washington) and in the citrus industry in Florida. Commercial harvest aids have been in limited use in Europe for more than 20 years (Peterson, 2005).

Until recently, only a handful of NY apple growers have felt the need to use mechanical aid equipment (such as platforms or hedgers) because of a relatively abundant labor supply. However the increasing uncertainty surrounding the labor supply, the expense of labor, and the need for more intensive labor when using higher orchard densities has changed the outlook of many Western NY apple growers (and a few in other regions in the State). In addition, many apple growers are transitioning from low-to high-density apple production systems by adopting the Tall Spindle system, which is highly suitable for mechanization. The uncertainty over the labor supply plus the inherent advantages of the Tall Spindle system for partial mechanization have motivated many apple growers in NY State to examine ways to reduce labor costs by using labor-saving motorized platforms.

Advantages of Using a Self-Propelled/Steered Orchard Platform

The main advantage of a worker positioning platform is that it saves time and labor because no one has to carry ladders through the orchard, or climb up and down them to perform various tasks such as pruning, hand thinning, trellis building, leader selection, tree training and harvesting. There are two additional potential advantages to using an orchard platform.

- It encourages the same pace of work for an entire work crew, which increases productivity and prevents over/under pruning or hand thinning of trees that can occur when the pace down the row is NOT controlled (as with ladders).
- Physical exertion is reduced (if managed well), allowing a more diverse labor pool. Individuals who could not climb up and down a ladder repeatedly during a day's work, may now be able to do this work.

There may also be disadvantages to a platform. If the person managing the platform crew and setting the pace of the work is not experienced the pace may be either too slow resulting in idle workers, or too fast resulting in excessive stress on the workers. If jobs are not rotated throughout the day and care is not taken to prevent repetitive motion injury there may be more injuries from work on a platform. If there are no provisions for worker comfort or conflicts within the crew that are not addressed in a timely manner, effective worker satisfaction may be poor. Using an experienced team manager on the platform is critical to successful platform productivity and worker satisfaction.

There are numerous jobs that can be completed using a platform: stringing and fastening multiple trellis wires, installing wire tighteners and vertical support wires, fastening trees to the wires, dormant and summer pruning, hand thinning, harvest, and



Figure 1. Single-worker positioning machines (Hydralada from New Zealand) used for dormant pruning of low and medium density orchards.



Figure 2. Tractor-pulled orchard platform (designed/built by grower Paul Wafler, Wolcott, NY).



Figure 3. Self-propelled orchard platform (N Blosi from Italy) imported by grower Tom De Marree, Williamson, NY.

installing mating disruption dispensers. U-Pick operations can harvest the tree tops with platforms while allowing the bottoms to be harvested by the U-pick customers. This will help avoid customers falling off ladders or ruining fruit and trees while trying to reach fruit in the upper portion of the tree.

Recent Developments of Platform Use in Western NY

Worker positioning equipment has been used in NY for a long time for pruning with the most common piece of equipment being the single person positioner such as the Brownie from Phil Brown Welding in Conklin, MI. These one-man positioner machines have been used in low- density and medium-density plantings for several decades (Figure 1). However, the recent interest in platforms began in 2004 during the European tour of the IFTA where several NY growers saw how the South Tyrolean growers were using self propelled, multi-person platforms that do work in high-density orchards such as the Tall Spindle. After that tour several growers built homemade platforms that they began using for dormant pruning (Figure 2). In 2008, the Lake Ontario Fruit Program organized a trip to Mo and André Tougas' farm in Massachusetts' to observe a factory-made platform (N. Blosi Zip 25) manufactured in Italy. They were using their new platform to pick the upper portion of U-pick trees as well as to prune and train young trees and hand thin peaches. The Blosi platform is a self-propelled vehicle with variable drive and auto-steering and leveling on up to a 10 percent slope. The platform has adjustable height from four to seven and a half feet off the ground. In addition, it can pick up empty bins at the front of the machine and bring them up to the level of the platform for filling by pickers, after which the bin can be lowered to the ground through the rear of the machine. The width of the platform is adjustable from four to eight feet. Two Western NY apple growers decided to import the self-propelled Blosi platforms from Italy (Figure 3) and a dealership for North America was established by R.E. & H.J. McQueen, Inc., in Wolcott, New York.

The widespread interest in platforms has resulted in other manufactures developing prototypes. Automated Ag Systems, of Florida, USA is one manufacturer that has developed a self-propelled platform, which a few NY growers have purchased. R.E. & H.J. McQueen, Inc is also a dealer for this platform manufacturer.

A viable alternative to multi-person platforms is the individual man positioner such as the Brownie from Phil Brown Welding in Conklin, MI or the Hydralada (Figure 1) from New

Zealand, which is available from a dealer, Hydratec in Rochester, NY. Both the Brownie and the Hydralada also are available in multi-person models suitable for use in the Tall Spindle system. This coming winter several of the Hydraladas will be available in Western NY and their performance will be evaluated against other platforms for several orchard tasks. This type of equipment promises versatility, easy maneuvering, and a lower investment (approx. \$20,000-\$25,000 dollars) with potential use for medium density orchards as well as high density orchards.

Several different types of platforms (pulled by a tractor or self-propelled), have also been developed by growers in Western NY. Most of the platforms are pulled by a tractor with the inconvenience of having a driver specifically assigned to this task. Paul Wafler of Wafler Nurseries came up with an innovative design; it is mounted on a tractor and positions four workers in hanging baskets (Figure 4). This machine allows the pruning of two Tall Spindle rows from both sides of each row. The tractor speed and steering is managed by one of the workers in the baskets thus eliminating the need for a dedicated tractor driver. A low platform on the front of the tractor allows a 5th worker to operate a pole chain saw to remove larger limbs in advance of the workers in the baskets who use loppers. In addition to the self-propelled two-row platform designed by Paul Wafler, two more growers have been able to design self-propelled platforms as shown in Figures 5 and 6.

Even though some NY growers don't have compatible training systems for the use of platforms at the moment, many of them are considering buying, designing/retrofitting, or are planning to adopt platforms in the future. The adoption of the tall spindle system has exploded in NY State over the past two planting seasons and we have observed many more growers who are adopting the Tall Spindle system and are exploring the use of platforms for higher labor efficiency.

Proper orchard design and tree planting is critical for mechanization. Two growers thinking to maximize future mechanization for their future high-density orchards used GPS technology during tree planting this past spring in Western NY. Evenly spaced rows planted with GPS technology will maximize the benefit of using platforms (and hedgers) with the Tall Spindle system.

Does Platform Use for Dormant Pruning Lead to Higher Labor Efficiency?

Soon after one of the new Italian platforms arrived in Western NY, a preliminary dormant pruning study to measure labor efficiency



Figure 4. Self-propelled two-row orchard platform (designed/built by grower Paul Wafler, Wolcott, NY). A five-man pruning crew is using a self-propelled two-row platform. The worker in the middle makes all big cuts with a pole chainsaw from the moving platform.



Figure 5. This simple design allowed a worker standing in a platform (not pictured) to drive this tractor and pull a platform for dormant pruning.



Figure 6. Grower Steve Knapp standing behind his new self-propelled platform in South Sodus, NY. He successfully used this platform for dormant pruning this past winter and is planning to build a second platform in the near future.

(without snow on the ground), compared the labor efficiency of four workers with ladders against the same four workers using a self-propelled platform (N-Blosi 25), or a self-propelled grower-built platform, or a tractor-pulled orchard platform atop a bin trailer. On average, the pruning time (minutes/tree) decreased from the standard treatment (with ladders) of 1.26 minutes/tree to 0.92 minutes/tree when the same workers utilized a platform to prune mature Gala and McIntosh's tall spindle apple trees in Wolcott, NY. The pruning platforms reduced labor costs by about 27-30 percent. There was little difference in labor efficiency between the types of platform used.

We utilized this data and conducted an economic analysis of investment in a platform, which we presented this past winter at the 53rd IFTA annual conference in Grand Rapids, Michigan. We estimated that there are significant labor savings per acre when using orchard platforms versus ladders for several orchard jobs performed by hand labor. Economic comparisons in a tall spindle planting of 1,320 trees per acre showed that the use of orchard platforms could save \$102/acre, \$140/acre and \$45/acre for dormant pruning, hand thinning and trellis wire installation, respectively (Table 1).

When long-term orchard profitability using Net Present Value of Accumulated Profit (NPV) was evaluated comparing a Tall Spindle system using orchard platforms versus ladders, orchard platforms increase profitability (Table 2). NPV was estimated to increase by \$492/acre after 10 years and rise to \$1127 after 20 years if platform use was a part of the management of a tall spindle orchard.

The examples shown in Tables 1 and 2 are for annual use of platforms for three jobs; trellis wire installation and tree tying, dormant pruning, and hand thinning. There are other jobs that orchard platforms can be used to perform such as summer pruning, fruit harvest, placing mating disruption dispensers in tree tops to name a few. There may be years where hand thinning is not necessary, but where the platform is used to perform other jobs.

Educational Activities For Higher Labor Efficiency

Over the past two years we conducted several educational events including the Cornell Cooperative Extension summer tour in 2009 (Figure 7) and the Winter Fruit Schools and the Empire State Fruit and Vegetable EXPO in Syracuse in 2010 where we stressed

how important mechanization will be for the new high-density orchards planted in our region. Paul Wafler of Wafler Nurseries, Wolcott, NY (who has built several mechanized devices for his apple operation along with the self-propelled two-row platform used for our dormant pruning study), stressed in his talk that growers will need to match orchard design with machines and recommended using multiple row (two or four rows) planters if possible for easier mechanization later on, and to use a platform for everything that is above normal working height. He said "never get a ladder out of the barn, keep the crew on the platform moving by knowing where you want to be at the end of the day and get there." He stressed the importance of a pruning platform that can also be used for support system construction. His pruning platform (Figure 4) is at a fixed height and can go over the row on both sides. Because of our snow conditions during the months of January and February, the pruning platform should be able to navigate deep snow without plowing, and the trimming of the bottoms should be finished early in the spring. He indicated that

Table 1: Comparison of cash expenses without discounting for 3 jobs performed by hand labor in a mature Tall Spindle apple system when using an orchard platform versus ladders.

Tall Spindle Comparison	Annual Cost (mature planting)		Labor savings (3 uses)
	With Platform	With Ladder	
Dormant Pruning (30%*)	\$238	\$340	\$102
Hand Thinning (40%*)	\$211	\$351	\$140
Trellis Wire Installation (15-20%*)	\$128	\$173	\$ 45
Total Annual cost (3 jobs)	\$577	\$864	\$287
Accumulated cost Year 2-Year 20	\$7801	\$9765	\$1964

*Time savings using an orchard platform

Table 2: Long term orchard profitability of a Tall Spindle orchard using an orchard platform versus the use of ladders for 3 orchard jobs performed by hand labor.

NPV value at end of,	Net Present Value of Accumulated Profit **(\$/acre)		
	With Platform	With Ladders	NPV increase
10 years	\$1,897	\$1,405	\$492
15 years	\$13,882	\$13,026	\$856
20 years	\$22,837	\$21,710	\$1,127

**6% discount rate



Figure 7. Demonstration of a self-propelled and self-steering, multi-worker platform (Italian made N-Blosi model) owned by Tom De Marree, Williamson, NY at the 2009 Summer Tour conducted in Wayne County on July 23rd, 2009. Growers had the opportunity to see a working crew install wire stabilizers in a new Tall Spindle planting.



Figure 8. A hands-on pruning workshop where growers had the opportunity to work on a platform with pneumatic pruning tools to prune the top portion of Gala trees trained as Vertical Axe system in Appleton, NY. (This tractor-pulled platform was designed by grower Peter Russell.)



Figure 9. Platform machines can be used for nearly all orchard tasks that ordinarily involve ladders: dormant pruning, trellis building, leader selection, tree training, summer pruning and picking. The use of a platform can facilitate peach harvest (left) and peach hand thinning (right).

there is a need to design auto steering for snow conditions with perhaps a guidance system for the platform based on the trellis wire. He is currently working on a design for a pruning platform which will be able to go over four rows at once.

This past winter we also conducted two pruning workshops for mechanization and higher labor efficiency in Western NY. At both sites, growers had the opportunity to use self-propelled and tractor-pulled platforms for dormant pruning to gain more hands-on experience (Figure 8). More than sixty growers attended these meetings. Growers utilized platforms, different pruning tools, and pruned Tall Spindle and Vertical Axe apple systems.

Challenges with Adoption of Platforms

There are several challenges to incorporating platforms into an existing fruit farm operation. The first one is the capital outlay required to purchase the equipment. Self-propelled, factory built platforms can cost \$45,000 to \$50,000. Grower-built platform designs (pulled by a tractor) can cost between \$5,000 and \$10,000 dollars. Self-propelled platforms built by growers have cost between \$15,000 to \$20,000 dollars. Adapting auto-steering mechanisms to platforms pulled by a tractor is possible (but not approved or recommended) and costs approx \$3,500. It is important to mention that many grower-built platforms with

self-designed auto-steering mechanisms (shown in this article) have not yet been approved by OSHA.

Each platform can cost several thousand dollars, which is a significant investment even if there is a known payback over time. Growers are accustomed to investing in tractors, sprayers, mowers, tillage equipment, tree planters, bin trailers, forklifts and other equipment which is now considered indispensable for a modern orchard to save labor. Similarly an orchard platform will soon be considered indispensable in orchard systems designed for its use. Consider the cost of a platform in relation to the cost of other orchard equipment (price of a tractor). The labor savings realized over several jobs usually justifies the initial capital outlay for one or more orchard platforms.

Depending on the platform (self-propelled or not), pruning crew experience, tools available, orchard design, rain, and ground conditions with or without snow, dormant pruning productivity can be increased between 20-35%. We may even see labor efficiencies of up to 40% or more in the future as platform workers gain more experience. The functioning of the workers as a team will be critical. New workers will need to spend some time on the platform to become comfortable with it. Currently, there are platforms that can handle crews of four to six workers. Dormant pruning work should be less physically demanding for workers when they no longer have to climb ladders while carrying tools. You can also keep a selection of tools (pneumatic pruners, a chainsaw on a pole) close at hand to facilitate the work of your pruning crew. The use of platforms for dormant pruning should appeal to a more diverse and broader range of employees (younger or older, unskilled workers).

The GPS technology will bring a new level of precision, confidence and efficiency to planting trees for high density orchards. Exact distance between each tree will mean that branch development will be uniform for each tree. If trees are not planted exactly at the same distance apart, branches of both trees can cross, and limb renewal pruning efficiency can be decreased when using platforms. Such new orchards have even greater potential to fully mechanize their operations and offset future increases in labor costs.

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Summary

Platform machines can be used for nearly all orchard tasks that involve ladders: dormant pruning, hand thinning (Figure 9), building trellis, leader selection, tree training, summer pruning and picking. The recent widespread adoption of the Tall Spindle System in NY State will provide continuing impetus to adoption of worker positioning platforms. This Tall Spindle system is a high density system with a very narrow canopy and simple pruning rules that is ideally suited for management using platforms. Currently many NY growers are benefiting from increased labor efficiency in dormant pruning and tree training using platforms in this system but few are using platforms to improve harvest efficiency. We hope additional technological advances will allow partial mechanization of harvest. It is our belief that increased mechanization can lead to higher labor efficiency and that acceptance of orchard mechanization will increase over time with platforms designed specifically for the needs of our industry. We are confident that there will be new platform models (from Europe, New Zealand, or the US) available in our region at lower prices as growers gain more experience with benefits of platforms. In the coming years as more high-density acreage of the Tall Spindle system is planted in New York and other Eastern States, the use of platforms for many orchard tasks will become commonplace. Finally, many growers are beginning to realize that mechanization is a way to keep up with the competition as labor costs rise and the supply of workers gets tighter every year. So

the more efficient you are, the better you will be able to contain production costs over the next 5-10 years.

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