Management of High Density Orchards

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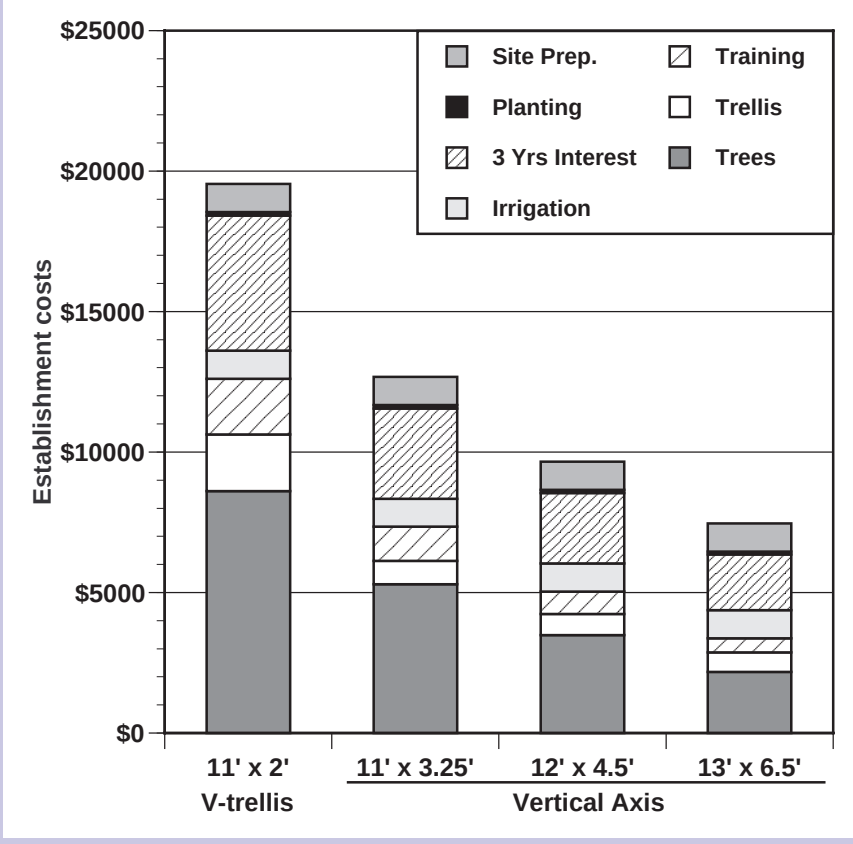
The apple industry is facing many changes. Worldwide overproduction and changes in technology will have profound impacts on everyone in the tree fruit industry. In times of change we should embrace the challenges and make them work for us. A poor option is to continue "business as usual" with the belief that the industry will return to the way it was, and **my** business will be unscathed.

New plantings of high density orchard systems can become the profit center of the orchard enterprise. Business tactics such as planting new varieties, having minimal acres out of production, speedy recapture of the replant investment and hitting the high end of the "new variety" market may increase the profitability of the farm. No planting of apples can pay back the investment if the market value of the fruit is at breakeven with production costs when the planting is made.

Plant small trials—every year if possible—learn to walk before you have to run.

FIGURE 1

Establishment costs per acre for four production systems.



However, if the variety is profitable, a high density planting can increase dramatically the return on investment.

I would like to touch on the following topics of high density management based on my experience with high density plantings of 400 to 7000 trees per acre (990 to 17,300 trees/ha) on replant sites in central Washington State: 1) business aspects of high density plantings; 2) horticultural considerations and 3) combining progressive horticulture with good business.

BUSINESS CONSIDERATIONS

In 1992 Trout, Inc. established a 5-acre test orchard. On 2 acres we planted the following four production systems: V-trellis, 11 x 2 ft (1980 trees/acre; 4893 trees/ha), vertical axis (11 x 3.25 ft (1200 trees/acre; 3000 trees/ha), vertical axis, 12 x 4.5 ft (800 trees/acre; 2000 trees/ha) and vertical axis (13 x 6.5 ft (500 trees/acre; 1250 trees/ha). We wanted to compare the economic performance of the systems (Fig. 1). We established some economic business constants. One

constant is the make up of variable and fixed costs. We have found that in the Lake Chelan area of Washington State most farms are small, averaging about 40 acres. We found that the fixed costs of the business are about $3000 per acre. We added $25 ($1 per bushel per bin) in variable costs for each bin. We charged each system 10% annual interest on the establishment and production investments. NOTE: The interest for establishment costs for the first three seasons and the production interest for the 1994 crop were "capitalized" and added to the investment cost. There was no overhead charged for the first two seasons, as costs were very nominal such as mowing, irrigation and herbicides were less than $100 per acre per year and were the same for each system. The training costs were $1 per tree. No pruning was done until third season. We did not place an opportunity cost on the land because it was the same for all systems. We used a return of $250 per bin (FOB of $20 per packed box) to the orchard as a revenue constant. An FOB decline of $5 would cut the per bin return to $125 per bin. Due to the stiff interest rates and overhead costs, none of the systems would pay off at the $125 per bin revenue level, but the two lower density systems would lose much more revenue. I believe that we need $150 per bin to maintain business viability of the smaller orchard operation.

We recognize, of course, using such large "fixed costs" is a bias in favor of the high density plantings. For our economic conditions in northcentral Washington, we have found that many of our costs have become fixed in nature, meaning they do not vary with production level.

The production of the different systems was directly tied to the number of trees per acre (Fig. 2).

The per box cost of production is directly tied to the production level (Fig. 3). The higher debt service cost of the high density planting is more than offset by its higher yield. In very high fixed cost situations the production level is the real key to profitability. The production level of the 500 tree per acre system (13 x 6.5 ft) will tend to suffer with poorer yields, thus being difficult for the planting to become profitable.

Figure 4 shows the power of production and profitability. Even if the gross sales dollars were less, the plantings able to cross 30 bins per acre the quickest will be the most profitable if production levels are sustained. In this trial, the payback was best on the 11 x 3.25 vertical axis system. This system at 1200 trees per acre is the lower risk investment.

One of the key differences in the economic performances of these systems is the ability of the higher density plantings to have higher production levels resulting in significantly lower per unit costs. During the tough years of 1997, 1998 and 1999, we have seen a real need to have production above 30 bins per acre. We can have fairly tight per unit cost control if our production is above 40 bins per acre.

FIGURE 2

Relationship of four systems with varying tree density and fruit production during four seasons.

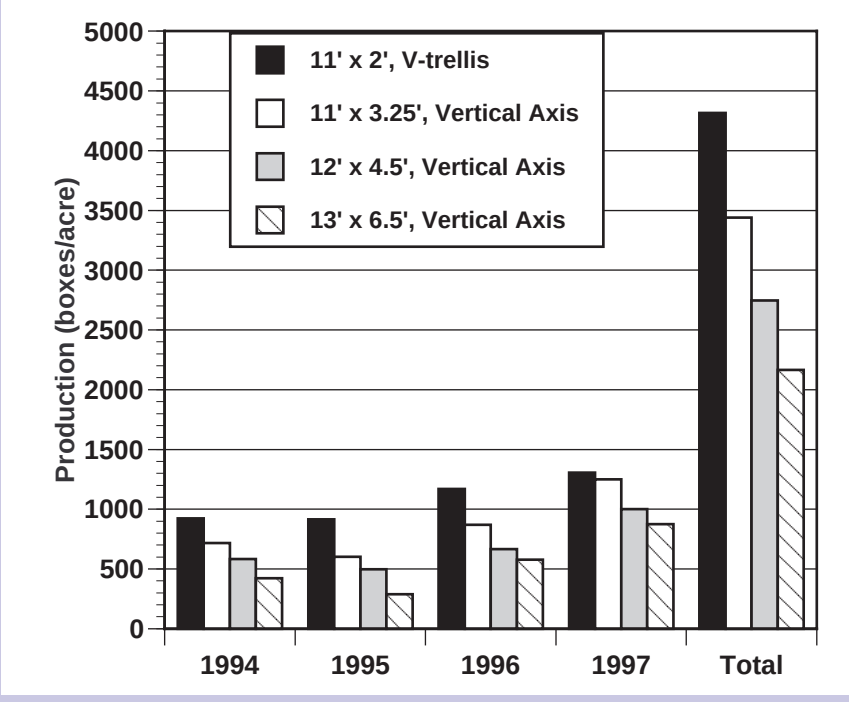
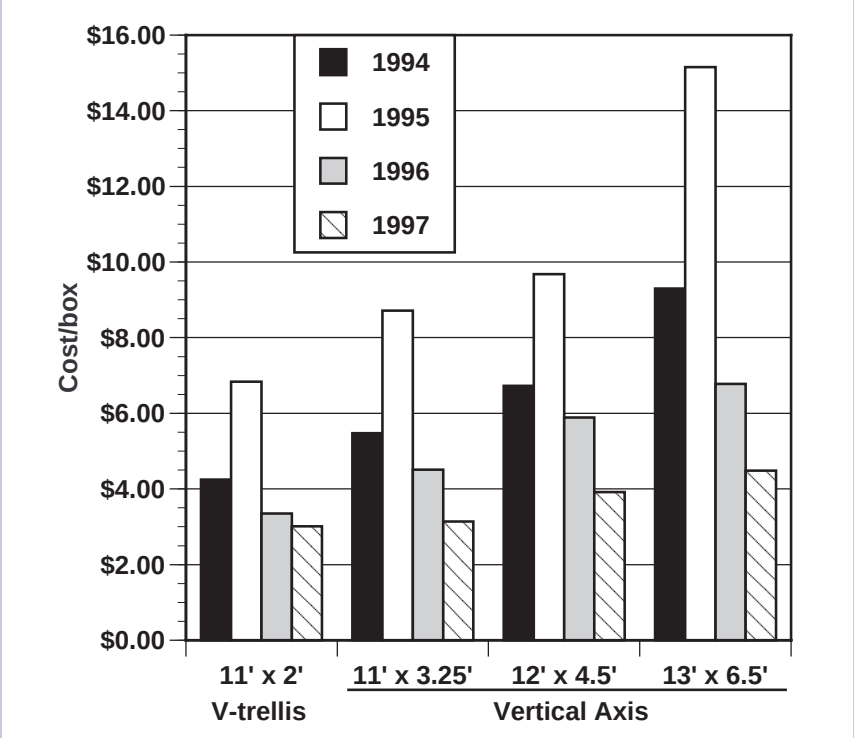


FIGURE 3

Per box cost of production during four seasons was directly tied to production level.



There is no place to hide (cannot reduce cash expenses enough to be profitable) if production is below 20 bins per acre, especially if low yield is compounded by mediocre fruit quality as occurred in many orchards in central Washington in the 1998 season.

It is important to note that the laws of diminishing return are indeed applicable to high density planting. The 1980 tree per acre 'V' trellis had the same payback period as the 1200 tree per acre vertical axis planting, but the cost of establishing the system was 56% more. For this trial, the high density 'V' has a much higher element of financial risk than the highest density vertical axis planting.

HORTICULTURAL CONSIDERATIONS

Nursery Stock

Planting densities less than 1000 trees per acre (2500 trees/ha) need larger trees of excellent quality to provide high early yields on replant sites. Plantings of more than 1000 trees per acre can have lesser quality trees and still be very successful. In fact, in plantings with more than 1500 trees per acre (3750 trees/ha), unbranched or whip trees may be desirable. After years of requesting branched nursery stock, some growers are now seeking unbranched trees and lower costs. Quite a number are attempting to grow their own trees.

Planting Depth of the Union

Planting depth of the trees has been discussed at many meetings. This year I had the opportunity to see some older blocks of super spindle, ages 4 to 7 years, in British Columbia that were planted as sleeping eyes or bench grafts. The trees consistently had a bud union height of 4 inches above the ground. The plantings had much less variation in vigor than lower density plantings made with traditional stock. In the very high density plantings this detail becomes very important. Some nurseries do not provide enough shank to put in the ground with the graft union higher than 3 inches from the ground and have the top remain upright. Some trees have been rooted right up to the union at the nursery and have to be planted with some roots out of the ground.

Caliper of Planting Stock

Larger trees at planting will be larger trees until the bearing surface has been filled. In some cases, we have planted large trees at very high densities and have not brought the block into production because the trees were too vigorous. I have been trying to establish a relationship between caliper size and planting density in the row. Currently I would try the following in-row planting distances for Gala on M.9 on replant sites in central Washington: 1/2 inch nursery tree caliper at 1 to 2 ft; 5/8 inch at 2 to 3 ft and 3/4 inch at 3 to 4 ft. I would plant Spur Red Delicious at similar distances on replant sites but on MM.106 or Bud.118. With Braeburn, I would use M.26 rootstocks with these caliper sizes/densities. If soils are weak, I would increase either the trees per acre with the same size trees, plant larger caliper stock or plant a more vigorous rootstock. In most cases, planting M.9 rootstocks is the best practice.

Angled vs. Vertical Systems: Horticultural Practices

Systems will not substitute for horticultural management. In other words, a system will not cure too much vigor or not enough vigor.

Angled systems have their place and purpose. It seems harvest efficiency is a key advantage to the angled canopies. However, establishment, pruning and tree management are less expensive in the vertical systems. Angles flatter than 65˚ in V trellis systems will increase suckering and management difficulties. Branches should not be allowed to develop in the upper one-third to one-half of the canopy.

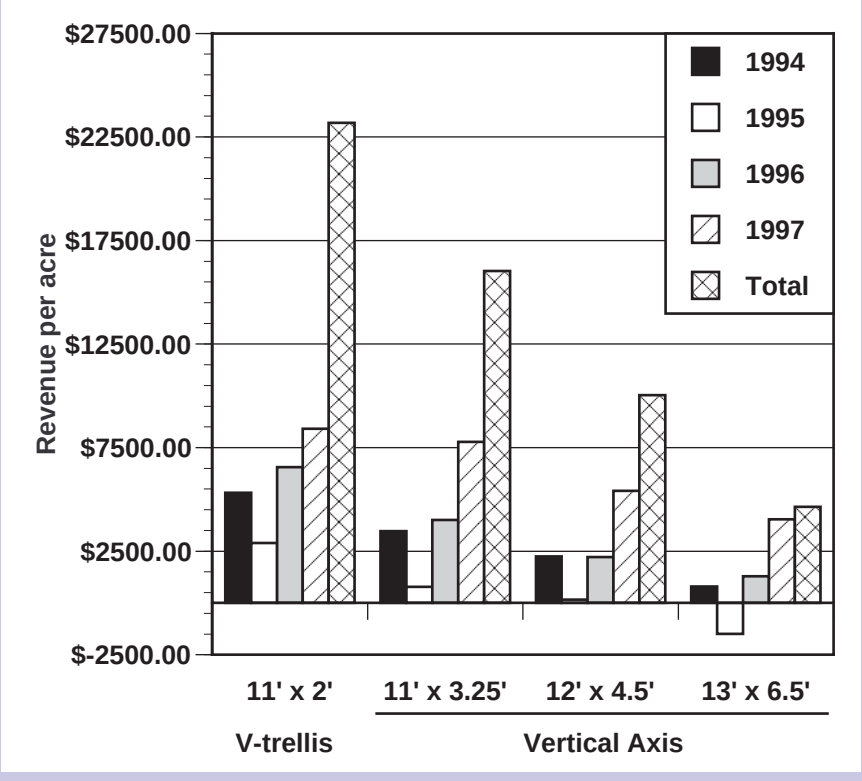
I believe that bringing trees gradually into production with the following production levels—10 to 20 bins per acre (equivalent to tons/ha) in the second leaf, 25 to 35 bins in the third leaf with more than 40 bins per acre in the fourth leaf—will allow the orchard to have annual production without extensive chemical thinning. Timely pruning will reduce wild vigor and help control trees. Adequate pruning will provide crop load management, encouraging much more consistent yields.

The time is at hand for packing house on-line quality detection for sugar content and firmness. Fruit grown in less than 50% full sun will not have full access to the market and will be discounted. Our more traditionally branched medium density plantings have 30 to 60% of the fruit grown in less than 50% full sunlight. As new packing house technologies are implemented and marketers begin to use them as a sales tool, the old plantings will be swept from the orchard business.

The vertical axis format provides lower cost management of the canopy because it is a strict regimen of removing shading structures from the trees in a single cut. No heading, no cutting limbs in half and

FIGURE 4

Net revenue per acre from four production systems during four seasons.



total removal of the largest wood in combination with crop load management by pruning down the bearing surface to 100 to 110% of the spur count (many orchards have 400 to 1000% of the spur count) needed to raise 50 bins per acre will provide the size, color and quality with minimal hand labor inputs.

Rootstock Selection

Plant precocious rootstocks. We are paid for fruit, **not** wood. It seems each rootstock has a drawback or shortcoming that can impact the financial success of the business. Rootstocks will influence fruit size, canopy volume and tree management expenses. Growers who work with M.9 clones are insistent that there is no substitute. I think that is correct.

Each of us must learn what each variety will do on a given rootstock in our environment. We should not underestimate the details such as tree caliper, planting depth, planting density, crop load and soil type on the performance of a planting. All of these factors can add to or subtract from performance. As growers, we can make all of these increase or decrease vigor in a planting. The trick is to balance these factors into an easy to manage and very productive orchard.

COMBINING PROGRESSIVE HORTICULTURE WITH GOOD BUSINESS

The marketplace seems to be more competitive than ever. We may find the growers who replace 5 to 10% of their ground every year with the best varieties and growing systems will be the survivors of the current business environment. This is the strategy at our farm: replace the worst performing assets with the best we can find. We may not get ahead, but we will be less likely to fall behind.

Dealing with change is a two-edged sword. Change too slowly, and you will be left behind with poor varieties or inefficient operations. Change too quickly, and you may leave money on the table from previous investments and/or costs of development of new technology/products may be more costly than necessary. It appears to me that the greatest risk is being left behind.

Plant small trials—every year if possible—learn to walk before you have to run. Evaluate new varieties and rootstocks from many perspectives. Perspective #1: is the variety good to eat? Perspective #2: will the variety size to 3 inches (76 mm) and larger? Perspective #3: will the variety produce at least 500 packed boxes per acre? It is desirable to have 1,000 packs per acre. I use the word packs because some varieties such as Honeycrisp do poorly in the heat in northcentral Washington and will seldom give us more than 500 packs per acre due to bitterpit, sunburn and oversizing. Sometimes new rootstocks do not behave as intended, creating situations with too much or too little vigor, excessive tree losses due to transplant shock and/or sensitivity to diseases.

I have been privileged to live in an area where progressive and innovative growers have embraced change and made it a part of their businesses.

I have heard my uncle Grady use the following adages: "I am in business to make money, not save money," "I am in the fruit growing business, not the nursery business" and "It is easier to increase revenue $100 than to save $100."

Doyle Fleming has had the following on signs in his office: "Don't bother arguing with me, I have already changed my mind" and "Will those who say it cannot be done kindly get out of the way of those who are doing it?"

Mark Gores has encouraged me with the following when snowmobiling in terrain where no one has any business being unless you are a mountain goat: "Look (focus) on where you want to go, not where you might end up!"