Adapting Concord Canopy Management to a Hedging Machine

By Roger Dellinger[1] 02/26/2004

Introduction

Ten years ago, I started with a vineyard that had been minimally pruned for several years. Cane overlapped neighboring plants as well as zigzag back and forth across the canopy. Convinced that the vineyards would deteriorate if the practice were continued, I set out to gradually convert them back to a balance pruned appearance. But I ended up going a different direction when Washington State University published their cultural studies on Concords. The studies helped to clarify for me why my effort to reduce the excess material from my plants also resulted in reduced plant productivity. I started experimenting with machine designs to promote a canopy management strategy that I thought would promote the university findings and also solve my concern for a stable long-term canopy. Eventually this effort matured and for lack of a better name I will simply refer to it as "Controlled Hedging."

Argument for Hedging

The wild North American Concord vine is very aggressive and when man decided to domesticate these plants, it was only natural to adapt historical traditions for wine and table grapes that provided canopies suited to economical harvesting. It made good economic sense to employ more intense pruning effort and a smaller crop in favor of a less robust plant that provided larger clusters and minimum wood that interfered with finding and hand picking the crop. In modern times we accept this canopy style as the standard and improved strategies such as "balanced pruning" still assume an objective to limit the robustness of the vines.

With the advent of mechanical harvesters, there is no longer a need to manage an organized canopy simply to make it more accessible to hand pickers. But many of these pruning practices remain the same today. Our efforts continue to employ procedures such that what little wood that left on the plant require special care to ensure there will be adequate buds and fruit wood for the following seasons. Tradition now dictates a list of other reasons why we manage the plant this way, perhaps forgetting along the way that we initially had the simple need to be able to hand harvest.

Fifteen years of research, conducted by Dr. RL Wample and others at the Washington State University experiment station located at Prosser, convinces me there is need for change. Here is my synopsis of what impressed me.[2]

> While the goal for traditionally hand-pruned concords is in a range of 65-100 buds per plant, University research suggests healthy plants can sustain and mature 200 buds.
>
> When there is an abundance of buds, over the following year, the plant will shift from 2.3 clusters per bud, to fewer clusters, perhaps 1.5 clusters. Simple math, (65x2.3= 150 clusters vs. 200x1.5 = 300 clusters) suggests not only potential for more crop at bud counts higher than our tradition, but also there appears to be a crop regulator within the plant that we are not taking advantage of.
>
> While there were variations detected by the research in such things as berry count, cluster size, and soluble solids per berry, in the final analysis, product/acre increases.

---

[1] Roger Dellinger is inventor of the Valley Vine Pruning Machine. It was developed with the assistance of Battelle Memorial Laboratories at Richland WA and is now manufactured under their name by the J.E. Love Company. The purpose of this paper is to promote an alternate canopy management system to be called "Controlled Hedging Technique." This system involves a machine design and a training procedure that will promote both increased production and reduced operating costs in the process of growing Concord Grapes. Roger resides at 685 SW SR22 HWY, Prosser WA. 99350. Ph. (509)-786-6711. J.E. Love Company is located at 309 California St. P.O. Garfield, WA 99130 Ph. (509) 635-1321 Email: JELOVECO.COM.

Dr Markus Keller summarized these cultural studies of concord grapes in a recent news article.[3]

"Mechanical pruning:

Improved yield potential.
Did not induce alternate bearing.
Did not reduce fruit quality.
Did not reduce cold acclimation.
Did not induce vine decline.
Compared to Mechanical pruning, balance pruning reduced Concord potential."

I concluded it appears the plant has self regulating characteristics for managing a larger crop load if we allow it to have the resources to do so. And many of the concerns we have for changing our canopy management practices may be unfounded.

The challenge of hedging for 200 buds

I think it is safe to say Dr. Kellers' conclusions address the difference in the amount of retained wood and buds that the two canopy styles provide for and did not intend to imply that use of a machine instead of hand labor made the difference. But, if it turns out that it would be almost impossible to achieve the same results by using only hand labor, then perhaps the statement is profoundly more accurate.

The first thing to consider is that it is hard to achieve 200 buds using only hand labor. Set out to reduce the plant to with only hand shears and the cuts you instinctively want to make will most likely leave you with less than 100 buds. By the second year, with the additional shoots the plant wants to establish, it becomes a truly undesirable task. The advantage of a machine is, it can be designed to hedge a consistent canopy shape in only seconds per plant. Mechanical devices therefore offer an option for an alternate canopy style not available to those who established pruning traditions before the advent of machinery.

Efforts to develop mechanical devices have met with resistance because it is difficult to mechanize the selective cutting done in traditional hand pruning practices. But, is it possible that mechanical devices offer advantages so significant that warrants a reevaluation of our traditional canopy management? Can we justify changing the rules simply to take advantage of a machine's efficiency? Is there a specific mechanical design suited best for Concord plants? I believe so.

Controlled Hedging principals. The following are my conclusions of what a modern Concord canopy should provide for.

- The plant works all year positioning the next years cane and buds. It stores much of the nutrients and energy and primary buds in those locations. To cut the shoot off at the cordon simply to reduce bud count or to achieve a more orderly canopy structure stunts the plant's potential for the next year. The goal should be for leaving as much nutrient rich wood as possible when attempting to reduce the bud count. *University of California literature on studies of stored carbohydrates concluded a statement, "less severe pruning increases vine capacity for both growth and production"*[4]

- If the goal is for 150-200 buds, the count will be under this if all the new cane is reduced to the first five or so nodes customary in traditional pruning. So, there is room for error by using a non-selective cutting machine and some of the cane is left considerably longer. Why micromanage this? Let the plant decide if it needs to adjust the cluster count to meet its available resources and genetic code for fruit bearing.

- Plants shed unwanted wood naturally. The so-called "dead wood" the plant decides to retain results in a wider canopy that can accommodate more exposure to sunlight and support for grape clusters. If conditions change for the plant, such as a spring frost or over pruning, the

plant will return much of this material to service. If it has value to the plant, it is counterproductive to spend labor to remove it.

The challenge I think non-selective cutting creates, is that we probably want the cordon to remain in tact as the primary source of new wood if we are going to maintain the vineyard over the long haul. For instance, a traditional sickle bar cuts a shoot running down the cordon at say, 18 inches. The next year a new shoot originating on this second year wood grows back the other direction and is cut at 18 inches. If this is continued, by the fourth year, sap flowing to and from the fruitwood and cordon may have to travel through 8 feet of cane. Also, cane from one plant, left to develop in the canopy of its neighbor results in a battle for sunlight and future prosperity.

We are left with two conflicting goals. 1) Promote plant robustness through less intensive cane management. 2) Promote long term consistency in the shape of the canopy. What do we do?

1. If enough shoots are produced and retained at about 18 inches, we achieve our fruit objective through increased bud count
2. If we minimize removing any wood within say, 12 inches of the cordon, we have retained most of the nutrients and replacement wood necessary for the plant to achieve maximum vigor in the next season.
3. If ultimately, all the cane never gets longer than 18 inches, we promote long term consistency in the canopy.

The resulting mature canopy looks like this: A single cordon congested with several years of cane, 6 to18 inches in length. It is allowed to grow upward, or outwards from the trunk. Never back towards the trunk. The canopy is wider at the trunk and tapers towards the ends of the cordon. A layer of older wood forms about 2 feet wide that supports a canopy of cane that hangs mostly straight down. There is little lateral growth except above the cordon. Little or no fruit will be found directly below the cordon.

Machine design:

The machine manufactured by JE Love Co. achieves this by four stages

Stage 1 is a simple arm that lifts the year's growth away from the canopy and draws the surplus cane towards the machine.

Stage 2 is a set of six blades that shears the excess canes at the rate of thousands of cuts per minute.

The concave shape of these blades helps to shape the canopy so that the wood can expand in width. Thus promoting older wood to develop that is necessary if the plant is going to reach its potential for storing nutrients, producing more primary shoots and buds, and for expanding its exposure to sunlight.

Stage 3 is two drums with flexible "fingers" that gathers the now shorter cane and draws it away from the cordon and aligns it for cutting.

When the fingers reach into the canopy, it grips the new growth and aligns it for cutting. If the growth is attached to two or three year old wood that escaped the previous years cut, the machine will act more aggressive in pulling in the cane and the cut will be made within the older wood, thus reducing it. This means that precise grooming of the canopy from year to year is not critical to long term management of the canopy. For instance, if some of the young fruitwood needs to be left longer one year to achieve desired count, it becomes much more a target for the machine the next year. (This fits in with our discussions above that some of the cane must be longer than the 18 inch if we want to achieve a full 200 bud count.)

Stage 4 cuts this cane off, leaving much of it 6-18 inches in length.

For more detail about the machine design, go to WWW. JELoveCo.com or contact them at (509) 635-1321 in Garfield, WA.

Training of the hedged Canopy. Some handwork is required to convert to this canopy configuration. It will take two, possibly three seasons to achieve the mature configuration. The bud count should be increased gradually to allow the plant's vigor to decrease in relationship with the increased bud count. This will help to avoid slow crop maturity and brix readings if your vineyards have been traditionally pruned at the lower bud counts. Shoot for 130 buds the first year, 150-160 the second year. On the third year, adjust to what your particular vineyard environment will support. Once achieved, handwork to maintain the canopy will be minimal.

All the cane should be pointed away from the trunk. If the shoot is growing towards the trunk, don't eliminate it. Cut above the 1st or 2nd node in hopes that the new shoots to grow in another direction. We do this to encourage them to fan out into a wider canopy. When the plant is trained in this way, the machine described above can more effectively peel 2nd year wood that was left longer the year before and having served it's purpose, needs to be reduced in length.

Discourage growth under the cordon. When starting out, any fruitwood growing directly below the cordon should be cut to 1-2 nodes. We need these buds in the early years to get the higher bud count. Also, some of the cane from these buds will grow upward above the cordon and become a productive part of the future plant structure. In time there will be no buds or shoots here.

During the first year, plants should be separated by a 6-9 inch space. The cordon can be blunted on the end to eliminate any buds located there. With this spacing, the machine will make easy work of future cane that wants to grow into neighboring plants.

Manage the fruitwood at the top of the canopy. In time, most of the prime fruitwood will be located on top of the cordon and to obtain the high bud count, the machine design should be is less aggressive in this area. It is where the canopy expansion can be adjusted if the grower desires. This is best done by lifting a clump of cane in one hand and make the appropriate snips to release the clump leaving at least three nodes on each cane. Never cut at the base of the cordon.

Closing remarks

Once the structure of the canopy matures to a wide plant mass, and the plant has adapted to the availability of additional buds and nutrients, you will notice some differences. The cane that is produced is not as vigorous but more numerous. The nodes are closer together and there is very little bull cane and tendrils that bind up the canopy. Most of the new cane doesn't grow past reaching the ground and there is little lateral growth.

I use these indicators, to decide how aggressive I need to prune for the next growing season.

While the WSU estimates I could be using 200 buds, I have kept my count closer to 150 buds. I am accustomed to production greater than 12 tons/acre, averaging 2-4 tons/acre greater than surrounding vineyards that I try to monitor. Delivered brix readings are usually equal to or higher than the average. The plants still seem to turn out 2 clusters per bud

I have conducted time trials for doing the canopy training described above. It consists of a walking pace up and down a 500-foot row including removing suckers from the base of the plants. Based upon 25 minutes to treat 66 plants per row at a labor rate of $7.50/hr., the results were 23 seconds and a cost under 5 cents/plant. (A younger person does this faster than I can.)

There is a wealth of writings related to the concepts presented in this paper. I have listed some in the below footnotes.[5]

[2] Cultural Studies of Concord Grapes Project No: 5480 Project leader, RL Wample Horticulturist, WSU- Prosser. Reporting period: January 1994-November 1994.
ACKNOWLEDGEMENT: I cannot say enough good about the people at WSU who conducted this research. It had major impact on the development of the machine and process described in this paper. This statement does not imply that there is any endorsement by them for this particular mechanical device or process described

[3] Good Fruit Grower Jan. 15, 2003 volume 54, NO.2 page 8. Dr. Markus Keller is a viticulture scientist at WSU's Irrigated Agriculture Research and Extension Center in Prosser WA.

[4] General Viticulture by A.J. Winkler and others, 1962, University of California Press. Page 294.

[5] First Vincent E. Petrucci Viticulture Symposium topics: Mechanization of Winegrape Production in Australia by P.R Clingeleffer pg. 39, Mechanical Pruning and the Influence on Yield Components and Nutritional Factors in Grape Production by R.L. Wample pg 59. Also, Crop Load Management in Concord Grapes Using Different Pruning Techniques by Markus Keller and others. All these documents can be obtained at the Washington State University Research center at Prosser WA.