By Richard Smart

Cordon or cane pruning?

I am frequently asked "which is the best way to prune — cordon or cane?" This column will try to give an answer to this perennial question, which is probably as old as viticulture itself. I typically suggest that the answer is not always clear cut and depends on one's definition of best.

What are the issues? For most vineyard managers, the answer they seek is an economic one. Which system will give the most profit? What are the costs of pruning, and what will be the effects on yield and, perhaps, quality (should it be affected)?

Some definitions

To begin to answer these questions, we must first agree on some terminology.

In winter, *cordon pruning*, commonly called *spur pruning* in many countries, relies on cutting canes back to two buds. With *cane pruning*, there are longer *bearers* (the generic term for the pruning unit); depending on the system, canes are typically cut to 10 to 15-bud length bearers, as compared to two-bud lengths for cordon pruning.

An interesting question about counting buds on bearers is *do we count the basal buds?* Look closely at a winter cane, and you will see several whorls of buds around the base, within a few tenths of an inch of the older vine wood. These are the buds which are initiated in the previous growing season but are close together because the basal internodes do not expand much in the following spring.

Professor Nelson Shaulis of Cornell University (New York) taught me a "rule of thumb" which he learned from Professor A.J. Winkler of UC Davis. The first bud to be counted should be distinct and about a finger's width (say about one-half inch) above the base of the cane.

Bud fruitfulness is defined as the amount of grape yield per bud, measured in weight of grapes. Remember that the grapevine bud is a compound bud, and in fact, there are three small "baby" shoots in each bud: the primary, secondary, and tertiary. Bud fruitfulness depends on the number of shoots bursting from the bud, on bunches per shoot, and then also on the number of berries per bunch and their weight.

The number of shoots per bud varies (the range is zero to three, but usually is one), and so does the number of bunches per shoot (for *vinifera* wine grape varieties, the range is from zero to three and rarely four, usually two). Fruit set determines berry number per bunch; the seed number and supplies of water and sugars from photosynthesis determine the berry weight.

Some vine physiology revisited

There is a two-year cycle for grapevine yield. In any one spring, new buds are being formed at each internode as shoots develop. At around bloom time, each developing shoot in the bud literally makes a decision as to the number of bunches it will produce next year, as infloresences are *initiated*. That is, a small piece of tissue is formed which is destined to become a bunch. Once the small infloresences are formed, they will continue to develop in the bud — during the summer and autumn, in the following spring around bud break, and as they appear on the developing shoot.

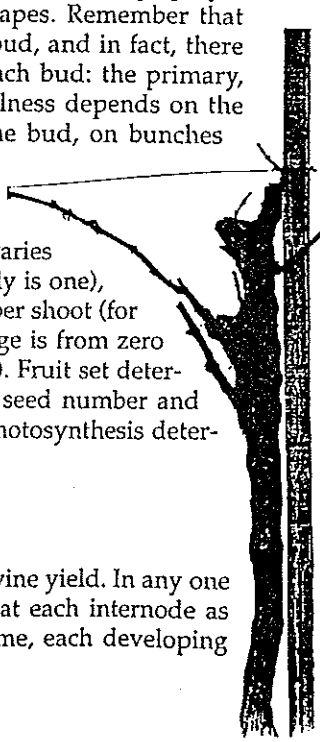
Studies for many varieties have shown that fruitfulness increases from the base of the cane (bud position one) up through about bud number 8, and then is constant. For many varieties the curve is not too sharp, so the fruitfulness at the base of the cane is not much less than at the maximum. There are a few varieties however where the fruitfulness of the lower bud positions is very low. Probably the best known is Thompson Seedless, known as Sultana or Sultanina in the rest of the world. Shoots arising from basal buds on this variety are notoriously of low fruitfulness, because there are few bunches per shoot.

Apart from this inherent varietal effect, what else can affect bud fruitfulness? Low temperatures and low sunlight conditions at the time of bunch initiation are known to cause low fruitfulness. The critical timing is around bloom in the year before the bud bursts. Significantly, shade in the vine canopy can also reduce fruitfulness.

At around bloom, the basal eight buds or so will be more or less shaded, depending on canopy density. Shoots at this growth stage have about six to eight full-size leaves, and then about six smaller leaves of varying size which are still growing. So buds at the base of shoots will be more shaded than those towards the tip of the shoot, and this fact likely explains, in part, the gradation of fruitfulness we see from the base up to the middle part of the shoot.

The proportion of buds which burst also has an important effect on yield. Whenever we make a pruning cut, the last two buds are inclined to burst. This is why we prune to two-bud spurs, and not three (have you ever thought about that?). So, even though we are pruning to less fruitful buds with spur pruning, we avoid the problems of low bud break inherent with pruning to longer bearers.

Knowing these facts, we can now begin to decide which pruning method to use.



Cane-pruned vine

Advantages and disadvantages of cane pruning

Cane pruning has the advantage of retaining the most fruitful buds, around the center of the cane. Generally, cane pruning gives a yield advantage over cordon pruning for this reason. Experienced pruners can select fruitful canes by sight, and avoid those of low fruitfulness.

Careful cane selection includes, for example, using canes of moderate diameter, and those well-ripened in appearance and with laterals present. Avoid poorly ripened canes, which have pale color, either very thick or very thin diameter, and no laterals.

There are some significant drawbacks to cane pruning, however. This method takes longer to do by hand, and it cannot be readily mechanized. For vigorous vines, the labor

requirement of cane pruning is around 50 hours per acre. This time includes making the cuts, removing the brush, and then laying down the replacement canes.

Also, buds tend to break at the base and end of the cane, but not so much in the middle. I come across growers around the world who worry about this, thinking it is a phenomenon unique to their region. I try to reassure them that it is a natural process, caused by hormone flows in the vine.

Another disadvantage of cane pruning is that vine spacing down the row is necessarily regulated so the maximum vine spacing for a vineyard pruned with canes to each side is about six feet. Normally, if we use canes with up to 15 buds, they are about three feet long. This may be too close for many moderate to high potential sites.

Cordon pruning, advantages and disadvantages

The principal disadvantage of cordon pruning is that the buds which are retained are less fruitful. This will obviously be more of a problem for some varieties than for others and in those regions where conditions are cooler and less sunny in early summer when bunch initiation occurs. Similarly, if canopy shading is high, as for vigorous vines like Chenin Blanc, bud fruitfulness will also be low.

Continuing to spur-prune to low fruitfulness buds encourages *the vicious high vigor cycle* explained in my book, *Sunlight into Wine*. The shoot growth increases as the yield declines; as a consequence, the shading becomes worse, and in turn, fruitfulness declines even further. Soon the vineyard is producing mostly shoots and leaves, with no fruit. I tell growers who own vineyards like this that now is the time to buy a saw mill!

However, if your vine canopy is open and not shaded, then bud fruitfulness is not low for many varieties of commercial importance, apart from Thompson Seedless. So spur pruning is not precluded. With open canopies, cordon-pruned vines can be equally as productive as cane-pruned vines, if not more so because of higher bud break.

What are the advantages of cordon pruning? It is considerably faster, and can be speeded up even more by the use of hydraulic shears. Shoot growth is more even, which makes for easier shoot positioning. Rates of less than 30 hours per acre are not uncommon, which include cutting and removing brush.

Previous columns have discussed the importance of bud and shoot spacing. This relates to Golden Rule of Viticulture #2. For vines of moderate vigor, a bud spacing of five buds per foot of cordon is suggested to give an open canopy. This can be readily achieved by leaving two to three two-bud spurs per foot of canopy. Once set up during vine training, inexperienced pruners can retain the correct spacing.

Further, the process of cordon pruning can be more or less mechanized. A variety of machines can be used, mounted either on tractors or within harvester frames. Circular saws and reciprocating cutters can be used; the former is especially useful if one cuts older than two-year-old wood.

There are different approaches to whether or not to do *hand clean up*. In many Australian vineyards, there is no hand work after the machine passes which may take as little as two hours per acre. Bearer length is from zero to five buds length, hopefully most around two.

Because of high bud density with mechanical pruning, there can be several hundred buds on a vines, which can lead to 100 or so shoots per vine. Because so many buds are left, not all burst. Invariably this leads to a dense canopy for medium to high vigor vines.

I favor following up by hand after mechanical pre-pruning. With less than 10 hours of labor per acre, one can cut out unwanted spurs and also reduce them to a uniform, two-bud length. So the total labor input is still much lower than for cane pruning, but the finished job resembles cordon pruning by hand.

Another advantage of cordon pruning is the opportunity to use wider vine spacing in the row. Where soils are deep, and well-supplied with water and nitrogen, vines grow vigorously. Thus they need to be spaced widely apart (despite the rumors that one should use tight spacing on fertile soils!).

Under some circumstances, I might suggest vine spacing down the row of 10 feet or more, and why not 20? The vine can cope with it better than can the psychology of the vineyard owner! If you doubt me, look at a wild vine growing up a tree sometime.

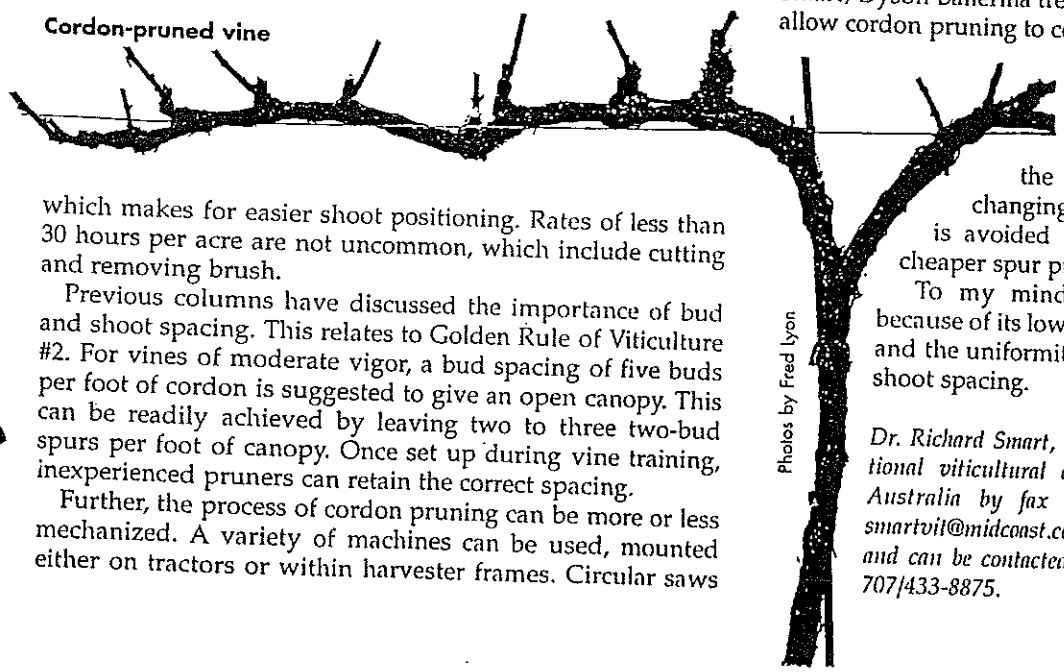
Conclusion

I hope the reader can see that there is no clear-cut answer to whether cordon or cane is better. No universal answer applies to every situation.

There are a few situations you should avoid, however. These include spur pruning with very dense, non-shoot-positioned canopies, which will require expensive hand shoot thinning and have reduced yield potential. Sadly, perhaps the majority of vigorous California vineyards are in this situation. They could be improved simply by using the Smart/Dyson Ballerina trellis, which will reduce shading but allow cordon pruning to continue.

I would also avoid cane pruning on very low vigor and very high vigor sites. For the former, you might as well spur prune. For the latter, you should be looking at changing your trellis system so that shade is avoided and then maybe you can adopt cheaper spur pruning.

To my mind, cordon pruning is preferred because of its lower cost, the ease of mechanization, and the uniformity of bud break facilitating ease of shoot spacing. ■



Cordon-pruned vine

Photos by Fred Lyon

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