



## Plastic Viticulture

I never imagined that the big viticulture story for me in 2011 would be plastic. My father was a polymer chemist so may this was inevitable. As I wander around the country and even in my backyard, I am seeing plastic at work in creative ways in vineyards.

I think the story begins with wine growing being done in places that have been traditionally inhospitable for vine culture, not just *vinifera*, but any species of vine. As new technologies, such as cold hardy hybrids, push the limits to further extremes of environmental conditions, of course the stubborn and innovative grower asks, “well why not *vinifera* (or whatever)?” Where plastic appears means that viticulture is being practiced on the climate margins and the practitioners are probably pushing their varieties too hard, which seems to be the nature of wine growing. The question is how far can technology push the limits of fruit maturity?

To catalog my experience this year I encountered the rather large scale use of Haygrove high tunnels on the Old Mission Peninsula in northwest Michigan where four acres of Merlot and Cabernet Franc are under plastic. Then, in the Wine Islands of British Columbia I was introduced to plastic tents that cover individual vines. Right here in Lancaster there are two Haygrove trials, the most significant is 1/8<sup>th</sup> acre (4 rows) of Cabernet Sauvignon and Petit Verdot. In his recent lecture Daniel Roberts explained how growers in the cool Sonoma Coast district are covering the fruit zone with plastic to trap heat to improve fruit set. Also, on the North Fork of Long Island, Bedell Vineyards has used black plastic to cover the vineyard floor on its reserve Cabernet Sauvignon to divert late season rainwater from the vines.

There is a lot of environmental manipulation going on here and that, too, is no surprise, perhaps an inevitable form of viticulture management cool wine regions. Instead of going where it's warm, growers are trying to bring warmth to where it isn't. John Gladstones and every manner of viticulture researcher has explained how important temperature is to all functions of vine and berry so we know it is the key to unlocking wine quality. The uncharted territory was how the environment could be artificially altered to improve fruit ripening conditions. There have been experiments with reflective ground covers but those have only had some success. We can lower the fruit wire to pick up heat from the ground. But maybe it was only a matter of time before the vineyard was placed under a bubble. With the tunnel there could be viticultural benefits at the front and back ends of the growing season.

Here are the possible pluses and minuses that I can think of for tunnel winegrowing:

+

- Greater consistency achieving mature fruit
- Earlier budbreak and fruit ripens sooner than uncovered grapes
- Control of vine-water relations, ability to use regulated deficit irrigation
- Finer control of nutrition using fertigation
- Less disease problems
- Possibly less insect problems
- Longer and better acclimation period resulting in enhanced cold hardiness

- Better spring (and possibly fall) frost protection
  - Gee whiz... this sounds a lot like California!
- 
- Costs limit amount of vineyard that can be treated
  - Limited area to cover

All of this begs the question when is enough too much? Personally, in cold areas where vines were removed from the trellis and buried for the winter, then dug up and trained anew, that's the limit of viticultural effort needed to grow wine. But the new cold hardy hybrids have made this essentially unnecessary. The equivalent in wine is interventionist technology like reverse osmosis and other gadgets that tweak wine quality. When does the wine become more of a widget than a natural product? And we have genetic engineering in the pipeline to further aggravate the issues. I suppose it will ultimately be up to the consumer to decide, i.e. will anyone drink a GMO or tunnel Chardonnay, or are they too "artificial"? That's marketing and not really my area.

In my imagination the plastic technologies look pretty good, especially in marginal climates, which Pennsylvania has plenty of, from the frozen north to the frosty southeast. Here's how I would envision it working in Pennsylvania. A wine maker decides he wants to make a very high quality Bordeaux red blend but we know that Cabernet Sauvignon achieves full maturity only 2-3 years in 10. What if putting it in a tunnel will increase that frequency to 7-8 vintages in a decade, and offer better cold hardiness to a cold tender variety like Cabernet Sauvignon? A reliable portion of the blend would be available for an expensive wine. Varieties in the tunnel are strategically selected for maximum quality and price return. It is probable that only high value grapes will survive the economics of tunnel viticulture. I don't know if anyone has run the numbers yet.

A recent visit to Cramer's Posie Patch (<http://www.cramersposiepatch.com/index.html>) in Mt Joy, PA was the catalyst for these thoughts. You shouldn't be fooled by the cute name, Ralph Cramer, the Eastern rep for Haygrove (<http://www.haygrove.co.uk/>) and his son, Keith, operate a farm with very serious, diverse agriculture in and out of tunnels. In a sense, this whole farm is one giant experiment. The vineyard experiment is well established and in its second year. The vines are very happy and photos below show the kind of growth they are getting, although both Cabernet Sauvignon and Petit Verdot have a reputation as big vines. The vineyard is well designed on 6' x 4' spacing, the rootstock is 101-14 on a standard VSP trellis with drip irrigation. 6x4 is tight for this area and it will be interesting to see how it works in the tunnel. About the only change I would make is to use Riparia Gloire. The ground is covered with a breathable black fabric that does an outstanding job of suppressing weeds. The tunnel covers four rows but with limited access to the outer half row. Tunnel sides can be variable adjusted to open or close. While Keith is not a viticulturist, he is an excellent farmer and has done a good job of training and managing the vines. I saw only a little bit of potassium deficiency and some downy mildew on a few leaves but otherwise the vines were clean and healthy. He explained that leaf wetness is reduced and fewer spray applications are needed despite some condensation inside the tunnel. Unfortunately, they are not monitoring climate data inside and outside of the tunnels. For frost protection, Keith said the tunnel gives 5-6°F of benefit, which is equivalent to the range of a well-placed wind machine. The top of the tunnel is opened up during the winter so vines are exposed like a normal vineyard. I did not see any Japanese beetles, which are showing up in other vineyards. Keith said for some reason JB's do not like the tunnel environment.

I asked Ralph about the light effects of the poly cover and he noted that there are no shadows inside the tunnel. He cited research has shown that light scatters into a more diffuse form that actually enhances PAR to more areas of the plant than direct sunlight. Tunnels hasten ripening of vegetables and small fruits, why not grapes?

There are a ton of unknowns with this technology so much more research is needed. How does the tunnel affect temperature and humidity at different times of the growing season and the day and nighttime hours? How is photosynthesis affected, the diffuse let a net plus or minus? Exactly what are the costs and the potential rewards and benefits? Will high tunnel wine growing really enhance cold hardiness? Lots of questions and intuitive answers but before growers plunk down a lot of money on tunnels they'll need some evidence to back up the hype. Or maybe growers like Marsh Farm Services in Michigan and Ralph and Keith Cramer will prove that the tunnels can really help to make better wines. Wine regions that can possibly benefit from tunnels include New England, Quebec, Nova Scotia, British Columbia, northern tier states (MI, WI, MN, Dakotas). More marginal states in the Mid-Atlantic and Midwest include Pennsylvania, New Jersey, Ohio, Indiana, Illinois, Missouri, Iowa, and Nebraska, perhaps even Colorado and Idaho.



Looking into the tunnel



View from outside of the tunnel with sides partially open



Inside the tunnel



Cabernet Sauvignon vine



Mainly a veggie farmer but also an experimental winegrower, Keith Cramer

Mark L. Chien  
Viticulture Educator  
Penn State Cooperative Extension  
<http://pawinegrape.com/>  
July, 2011