

GMO's and the US Wine Community

Vineyard Views

By Cliff Ohmart

Given the controversies swirling around the topic of GMOs (genetically modified organisms) in agriculture it is surprising how little talk there has been in the wine community about it. I am not sure why this is the case. One possible reason is since there are no genetically engineered (GE) grapes nearing commercial availability people in the wine community may be taking the attitude of 'let sleeping dogs lie'. Why stir up a hornets nest when you don't need to. However, with global competition continuing unabated and as rumors abound of other countries working to develop GE grapes I think it is important that members of the US wine community become conversant on the subject of GMOs and begin to figure out where they stand on the matter. Besides, it turns out there are two GE yeasts already commercially available for use in winemaking.

A good place to start any discussion is with some basic definitions. What are GMOs? The genetic makeup of virtually all agriculture crops has been significantly altered through centuries of selective breeding by humans. So, in a broad sense, all crops are GMOs. However, with the advent of genetic engineering technology a generally accepted definition of GMO is a species which has had one or more foreign genes, i.e. ones that are from another species, spliced into its DNA using genetic engineering techniques. A gene is a section of DNA on a chromosome that contains the code that, ultimately, is used in the making of a specific protein which in turn is used in a particular cellular process. The discovery of the simplicity of DNA unnerved a lot of people. We like to think of ourselves as immensely complex, which in a sense we are, but how cells function and how inheritance operates comes down to simple but elegant chemistry. Genome is another common term and refers to the entire hereditary material or DNA in a species. Genomics is the study of the genome.

Part of the challenge in discussing GMOs is dealing with the terminology. For example, it turns out that transgenic, genetically modified, or genetically engineered pretty much refer to the same thing and the terms are often used interchangeably. Dive much deeper into the topic and the terms can get mind numbing; e.g. recombinant DNA, proteomics, DNA chips, cassettes, polymerase chain reactions, etc.

Many remarkable things have been discovered about DNA since Watson and Crick described its structure in 1953. For example, it turns out we share a lot of the same genes with other organisms. Did you know that a certain type of gene is in fruit flies, mice, geese, snakes and people? It was recently discovered that insects and humans use the same genes to tell cells in their embryos to become photoreceptors, cells that are sensitive to light. Another fact that I find fascinating is a large portion of DNA is considered 'junk' because it has no known function. It is this junk DNA that is often used in genetic 'finger printing' to identify people from their DNA. The take home message is that our ability to identify genes on chromosomes, to determine their function, and to manipulate them, has increased rapidly in the last 50 years and the rate of increase is accelerating. As is the case with many other new technologies, our ability to do genetic engineering is

outstripping our ability and/or our willingness to use GMOs in every day life, as well as to identify any unintended consequences arising from their use.

Grape Genomics and Genetic Engineering

All the major grape growing countries in the world are studying the genomics of grape, including Australia, Chile, France, Germany, Italy, South Africa, Spain, and the US. It is important to realize that genomics does not mean GMOs. As mentioned above, genomics is the study of the entire genome, in this case the grape genome. One of the most important reasons to study the grape genome is to identify all the genes and their functions. Nevertheless, once gene functions have been determined it is natural to then want to manipulate the genome and genetic engineering is the method of choice.

It is likely that the first commercially available GE grape will be one that has been engineered for disease resistance. Powdery mildew, Pierce's Disease and bunch rot organisms are the primary targets at this point in time. A quick internet search revealed that the following US universities have some type of disease resistance research programs based on GE technology: University of California Davis, University of Florida, Cornell University, and the University of Missouri. Disease resistance is also an area of focus for many overseas research centers. A bit more searching revealed that some genomic projects are also focusing on things such as bud fruitfulness, fruit quality, drought tolerance, tartaric acid accumulation, color development and antioxidant and vitamin levels in the grape.

One would have had to been living in a cave over the last few years to not be aware of the social issues that have arisen around food crops and GMO's. Much of the concern seems to revolve around food safety. Another is GE crops contaminating nearby non-GE crops through accidental pollination. Both of these issues are relevant to grape.

I am not going to offer an opinion on whether GE crops are safe to eat. What I will do is to point out why this is such a difficult issue to resolve. Let's take a GE tomato because it was the first GMO item to be available in the supermarket. Remember the Flavor Savor tomato?. The question asked by safety conscious people at that time was "Is the Flavor Savor tomato safe to eat?" This is an extremely difficult question to answer because no regulatory body has tested whether a regular tomato is safe to eat. Historically, whenever a food crop has been developed through conventional breeding and made available to the public, food safety testing has never been done. Therefore there are no protocols for carrying out this kind of testing and benchmarks for comparison. Unless a GE crop is downright toxic it will be very hard to provide definitive data that indicates a GE food is unsafe. Proving a negative is very difficult. To complicate matters, some chemicals in food plants are good for us while others are not. This is because over evolutionary time plants have evolved 'toxic' secondary chemicals in their plant parts to discourage animals like us as well as insects, diseases, etc. from eating them. The wine community is lucky that the grape evolved to be attractive to animals so they would be eaten and the seeds inadvertently spread. Therefore grapes

have much fewer numbers of these secondary chemicals in them than other plant parts like leaves, stems and roots.

Another concern often expressed about GE winegrapes is that they will ruin the terroir of a vineyard. While I can understand why some people express this concern it made me sit back and think about terroir as a concept in relation to GE grapes. My understanding of terroir is that it is a combination of vineyard, grape variety, soil, climate, weather, and wine making that create the particular personality of a wine. If this is true then a GE winegrape will not ruin a terroir but will result in a different terroir. Whether it is good or bad is up to the individual wine drinker if one can get past the food safety aspects of a GE winegrape. This is no different to a vineyard of one variety being taken out and replanted with a different variety, clone or rootstock.

Yeast Genomics and Genetic Engineering

Yeasts are single-celled organisms that are classified as fungi. They have been the subject of genetic studies for many decades because of their ease of rearing and manipulation. Unbeknownst to many in the wine community there already are two commercially available GE yeasts. One does a better job of degrading urea during the wine-making process and the other does a better job of malolactic fermentation, producing fewer biogenic amines, such as histamines, which cause headaches and asthmatic-type reactions in some people. The benefit of the first yeast is that the resulting wine contains less ethyl carbamate, a chemical considered by some regulatory bodies to be a human health risk. The benefit of the second yeast is that people who normally cannot drink red wine without getting headaches can now enjoy them without the unpleasant side effects.

Some people may be concerned with food safety issues related to the use of these GE yeasts. However, the laboratory that produced them¹ went to great lengths to prove they are safe. While it seems it is unlikely that there are health risks related to drinking wine made from these two yeasts the reality is that there are some people who will not want to drink wine made using these yeasts. Unfortunately, if a wine is filtered, no trace of the yeast remains so there is no way of testing what yeast was used to make it. Since there are no regulatory requirements in the US regarding the use of GE yeasts or labeling wines made with them consumers are left in the dark.

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It is clear that like it or not GMO's and the US wine community will have a day of reckoning. So far concerns about GMO's in agriculture are long on hyperbole and short on facts. I am a big believer in using science-based knowledge in forming opinions and ultimately policies. Therefore I highly recommend that all of us in the US wine community begin to educate ourselves about GMOs. There many good places to find information about GMO's and wine community. Here are two of them; the International Genomics Program's website at www.viaceae.org and Missouri State University's

¹ Dr Hennie van Vuuren, University of British Columbia.

website on genetic and genomic research on grapevine (*Vitis* spp.) at <http://library.missouristate.edu/paulevans/grapegen.shtml>.