Vineyard Views
by Cliff Ohmart

As I write this column eggs that were laid by over wintering leafhopper adults are starting to hatch and spider mites are becoming noticeable in a few vineyards. Once again it is time to start thinking about pest problems in vineyards. While talking to growers and PCAs this spring I discovered that quite a few are applying SAR's on some vineyards. What is an SAR? It is a new class of chemical that has been under development for a while and several are now out in the marketplace. Like any new product, many growers and PCAs are wondering what they are and what they might do for them. This column will be devoted to describing the meaning behind the name, the theory behind their mode of action, and conclude with a few comments about their role in pest management and viticulture.

What are SARs?

SAR is short for systemic acquired resistance. Systemic means that the chemical is taken up by the plant and its affect is spread through the entire plant's system. Acquired resistance refers to the fact that these materials are thought to stimulate the plant to resist pests more effectively than they were able to before they took up the material. You may hear some people say that SARs enhance a plant's immune system. This is not really a correct analogy because plants do not have immune systems like people do, i.e. white blood cells and other such anti-bodies. What plants do have are many different chemicals, some of which are bad for the insects, fungi and other herbivores that ingest them.

I am pretty sure the idea for the commercial production of SARs comes from an area of science labeled insect/plant interactions. Plants contain many different kinds of chemicals that, before scientists began to study them in detail, did not seem essential for the plant's survival. In other words they did not play a role in growth or reproduction. These chemicals were labeled plant secondary chemicals. They were called secondary because they were by-products of essential plant processes, such as photosynthesis and respiration, and were felt to be unessential to the plant. In the 1970's and 1980's scientists began to realize that some of these chemicals were bad for insects and diseases that fed on plants that contained these chemicals. After much research it became clear that over evolutionary time there has been an 'arms' race between plants and the animals that feed on them (including people!), with plants developing chemicals to resist herbivores and the herbivores developing ways to overcome these chemicals. Therefore these chemicals are not secondary but play a very important role in the plant resisting animals that feed on them. Phenolic compounds, like tannins and essential oils, are one important class of plant secondary chemicals.

Secondary chemicals in plants can affect herbivores in different ways. Some are toxic and debilitate or kill the herbivore outright. For example, when some diseases attack a plant, the plant mobilizes secondary compounds at the site of infection and the fungal hyphae are killed. A similar reaction occurs when a bark beetle attacks a healthy pine tree. The tree releases pine resin at the attack site 'pitching out' and killing the beetle. On the other hand, many secondary chemicals do not have the capability of killing the organism feeding on it outright but instead have deleterious effects through interference with the it's digestion. In other words it is renders the plant a poor quality food. The negative effects are that the herbivore takes longer to reach maturity, may not produce as many offspring and these offspring may be less vigorous. The end result is that the herbivores reproduction is reduced and its population growth is slowed.

In all of the above cases the secondary chemicals reduce the quality of the plant for the herbivore feeding on it. Many of us are very familiar with the concept of biological control and that natural enemies can control the populations of many pests. However, it is very important to realize that some pest species are controlled more through the quality of the plant food they eat rather than by their natural enemies. In other words, when the quality of their food is good the pest flourishes and when it is not so good the pest does not do as well. This is a very important concept to understand because natural enemies will not be effective for pests whose populations are regulated by food quality. That is one of the reasons that biological control does not work in every case, some pest populations are food regulated.

Much of the research on insect/plant interactions has been done on forest insect pests. There are several forest types around the world that are subject to periodic epidemics of pest insects over thousands of acres and in some if these cases it has been shown that food quality may the driving factor behind these population cycles. Over time the trees in the forest either become better food, causing the insect population to become epidemic, or a poorer quality food, causing the insect population to collapse. One example is spruce budworm that attacks the spruce-fir forests of eastern Canada. Another example and is mountain pine beetle in Lodgepole pine forests of the Rocky Mountains.

Maybe the most extreme claim/hypothesis in the field of insect/plant interactions was proposed by one researcher in the late 1980's and was given the name 'talking trees'. He suggested that trees being damaged by insects released a chemical into the air which was then picked up by trees some distance away. This chemical then stimulated the receptor trees to produce secondary compounds, thereby increasing their resistance to the pest before it got there. Although this concept caused quite a stir when it was proposed the idea died away after a while and I have not heard much about it since.

Do SARs Work?

As the field of insect insect/plant interactions matured it was natural that scientists conjectured that if food quality could regulate pest populations maybe a plant could be stimulated to produce the chemical or chemicals that cause it to be a poor food for its pests. If this stimulant could be made in chemical form it could then be applied to crops and used in pest management. That is where the idea of SARs came from. Unfortunately, research to prove or disprove the importance of a specific plant secondary chemical on the dynamics of a pest population is very difficult to do and even if this chemical can be identified it is even more challenging to figure out how to get the plant to produce this chemical on demand. Moreover, since food quality is the mechanism affecting the pest and it does not kill the pest outright, measuring its effects on pest populations is tricky because there are no dead bugs to see or count. Judging the efficacy of these materials will be very different from that of traditional pesticides.

Manufacturers of some SARs claim they improve plant growth and/or health and through this maybe the crop will be more resistant to pest problems. Therefore some people are applying them mainly for their positive effects on plant growth and health. This seems to be a more realistic goal than strictly apply them for their pest management benefits. In any case, anyone using SARs should try their best to have control blocks that can be used to compare to SAR treated blocks. My hunch is that these materials may work in blocks where pests are on the borderline of being an economic problem but will not work in blocks that historically have severe pest problems.

One thing that bothers me about using SAR's to combat pest problems is that they need to be used as a prophylactic. In other words they must be put on before the pest attacks the plant. This is great if you are a chemical manufacturer because the vineyard will always need to be treated. However, this goes against the IPM principal of monitoring and only treating when necessary. I think it is great to see some practical applications of some pretty esoteric hypotheses and research. However, remember the old adage that if something seems too good to be true, it usually is.