Revisiting the Principles of Integrated Weed Management in Vineyards.
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Herbicides are an important component of weed management in vineyards and have contributed to the economic production of raisin, table, and wine grapes for several decades. However, in recent years, the evolution of several herbicide-resistant weed species have compelled researchers, educators, and growers to explore alternatives to chemical weed management in vineyards. Although an alternative mode of action may be available for the control of weeds that have evolved resistance to a certain herbicide, it is important to remember that there are only about 25 different herbicide families based on their site of action and less than half of these are actually labeled and registered for use in vineyards. Additionally there are none to very few new herbicide modes of action in the development pipeline. Therefore, it is important to protect the herbicide resource we have and prevent the onset of new herbicide-resistant weeds. It is not only essential to rotate herbicide families but also important to revisit the principles of integrated weed management in vineyards.

Integrated weed management advocates the use of several weed control tactics including physical, cultural, biological, mechanical, and chemical weed control. Again, sole-reliance on one particular technique will select for weed species that will become adapted to the method of control. Further, cost-effectiveness of one particular method can also be an impediment to adoption as the sole method of control. Therefore, these techniques should also be used in a truly integrated manner. There are several principles of integrated weed management that have been developed for annual cropping systems that can be adapted to vineyards and other perennial cropping systems. For example, it is very important to start clean with good weed control during vineyard establishment as the critical period for weed control in vineyards is the first 12 weeks of vine growth. Uncontrolled weeds during this period can reduce and stunt vine growth and serve as a refuge for various invertebrate and vertebrate pests, and pathogens for vine diseases. Care should be taken while selecting appropriate control tools during this phase of vineyard establishment as the vines can be susceptible to damage by chemical and other methods of weed control. Once the grapevines have been established, they are more tolerant to weed competition and can withstand greater weed densities. Although certain densities of weeds in established vineyards may not directly result in yield or quality loss in the grape berries, the weeds can again be an impediment in surface irrigation systems, harvesting machines, and refuges for pests. Also, it is important not to let weeds set seeds as a single weed can produce thousands of seeds that increase the size of the seedbank where the seeds can live for several years.

Other tools for weed management in vineyards include mechanical and thermal weed control methods, to name a few. Mechanical and thermal (flaming in particular) tools can generate dust and smoke and this can have implications associated with air quality regulations in the San Joaquin Valley (SJV). Also, their application timing and efficacy can be affected by soil moisture levels. However, mechanical methods in general can be very cost-effective and can provide excellent weed control. Again, reliance on mechanical weed control alone can cause weed species shifts. For example, continuous reliance on implements that control weeds by shallow cultivation tends to select for grassy weed species and sedges that become the dominant weeds in consecutive years. Therefore, mechanical tools should also be combined with other strategies such as spot-treatment with herbicides, etc.
Monitoring is also an important component of integrated weed management. Proper monitoring of vineyards is essential for the evaluation of weed management methods and for the development of future weed management strategies. In summary, integrated weed management is not a new concept but it is time to revisit its principles to prevent the evolution of new herbicide-resistant weeds and protect the existing herbicide families registered for use in vineyards from becoming ineffective, prevent the adaption of certain problem weeds to a particular method of weed control, and manage weeds in an ecologically sound manner.