

## 2018 AVF Research Priority Survey - Respondent Comments

### Viticulture research priorities – respondent write-in comments:

1. Vine fertility and nutrient needs
2. Parameters affecting sugar accumulation in grapes
3. Smoke impacts - evaluation of smoke during fire events (levels of volatile compounds) and risk assessment of smoke taint
4. Virus elimination in plant material would be useful work.
5. Overcoming resistance via plant breeding
6. With the uptick in wildfires across the entire winegrowing region, research and understanding of grapes affected would be beneficial. This would include remediation techniques and research to minimize effected fruit/wine.
7. Vineyard robotics
8. Managing agriculture in midst of a changing climate
9. Non-chemical alternatives to pests, water efficiency since we are all farming unsustainably with the current water demands, even though we may be certified sustainable.
10. Further development of real time sensing in vineyards, improved remote sensing techniques, increased investment in organic practices
11. AVF should consider a push to develop a state certification program for fungal diseases similar to virus certification. While viruses in new planting materials are declining thanks to industry-wide efforts, fungal diseases are on the rise in new planting materials. Something needs to be done to protect growers.
12. Impact of vine nutrition (particularly nitrogen) on fruit phenolics
13. Must have better information regarding drought tolerant rootstocks for both valley and hillside soils. We must develop rootstocks that use less water.
14. Genetic manipulation of existing varieties to make them resistant to currently problematic diseases to reduce/eliminate the need for some fungicide sprays
15. Improved technology for mechanization
16. Powdery mildew
17. How we can act against climate change and protect the long term sustainability of our industry
18. Pierce's disease complex-habitat/vector interaction
19. Nutritional needs and timing of application for optimal benefits
20. Resistance issues regarding disease and insect control
21. Definitely linking viticultural practices with wine quality -- & how to improve
22. Application of biotechnology to management of diseases and pests
23. Although a part of Disease and Insect Control, I would like to see special emphasis placed on study of Leafroll and Red Blotch viruses. Hopefully someday a cure for infected vines!
24. Potential methods of control of the Brown Marmorated Stink Bug
25. Although mentioned, mechanization is a priority. Also improving the machines now available to do a better job.
26. Biocontrol, water management to include ground water recharge
27. Ensuring the efficacy of existing products
28. Soil microbiome, organic viticulture
29. Environmental mitigation in a warming climate ( including smoke taint, high heat and low humidity suppression)
30. Influence of canopy management practices on grape quality, effects of leafing on wine grape quality in warm climate growing regions
31. Water stressing
32. Glyphosate in wine

### Viticulture research priorities – respondent write-in comments (*continued*):

33. Organic disease and pest control and organic herbicides
34. Smoke taint
35. In the 30 years that I have been in the vineyard industry, a large number of diseases have infected the vineyards. All have come from certified nursery stocks. We have had to replant our vineyard up to 3 times due to purchase of certified plant materials. This is an industry disaster. If we as an industry, are making wine from infected plant material, we will not be able to compete with other countries that have clean vines and better wine. Please solve this problem.
36. Cultural practices to mitigate effects of climate change.
37. Water
38. Water usage
39. Mechanization
40. Smoke taint research
41. Easy to graft rootstock research for fan leaf sides
42. Biological pest control
43. Gene editing for disease resistance
44. Pierce's disease, new invasive pests, powdery mildew, water management
45. Improved color yield
46. Sour Rot, Japanese beetle control
47. Functional genomics and gene discovery.
48. Wage and labor issues
49. Drought effects on vine age
50. Development of improved propagation techniques to allow delivery of high quality vines derived from difficult to propagate rootstock selections
51. Soil health naturally like biodynamics and eutypa elimination
52. Site studies and management
53. Shade cloth - quality and yield improvements
54. Use/accuracy/efficacy of technology for vineyard monitoring, crop estimates, pest and disease identification...google glass, NDVI, IOS tech. What are the latest and greatest tools and which ones are the best. New varietal development for the adaptation to the changing climate. Climate adaptation methods and techniques.
55. Irrigation efficiency including subsurface drip to eliminate evaporative losses
56. Plant mechanisms that control ripening and flavor development
57. Red blotch vector and virus infection etiology, and management
58. Irrigation management & efficiency

## Enology research priorities – respondent write-in comments:

1. Protection from oxidation
2. Optimize wine chemistry to perform best in aluminum can packaging. Or research the effect of different epoxy liners on wine shelf-life. Further research on tracking redox potential and its practical use in winemaking. Research new ways to make 'truly free' SO<sub>2</sub> measurement more accessible to wineries. What levels of truly free SO<sub>2</sub> are recommended for red wines vs white wines in terms of shelf-life and sensory?
3. Capacity for yeast to ferment with lower alcohol yield per gram of sugar
4. Wildfire and their effect on grapes/wine
5. Use of mechanization and reduction of manual labor, specifically in regards to barrel work, cleaning
6. Dealing with taints and potential spoilage
7. Understanding of wine microbiology and spoilage prevention
8. We need to better understand the tastes the consumer desires. I think the wineries and wine makers are not in touch with the consumer.
9. Development of yeasts that produce lower alcohol during fermentation and how to eliminate smoke taint
10. Definitely linking viticultural practices with wine quality -- & how to improve
11. Can software be developed for more efficient use of tanks so that harvest will not be held up until tanks are available?
12. Cork taint and closure research for effect on wine quality
13. Smoke Taint - More work needs to be done on what compounds make up the smoke taint issue in wine ID what those compounds are and quantify the levels that effect wines then remedial tools to remove it.
14. Smoke taint
15. Smoke Taint – filtration
16. Microbial management
17. Vineyard adaptation to climate change
18. Control of microbial spoilage
19. Technology and applications in winemaking (contact membrane as an example for dissolve gas management and aromatics increase)
20. Winery microbiome studies aimed at practical management
21. Smoke Taint research
22. Explore remediation techniques for smoke, heat or other damaged wines
23. Tannin extraction and retention in low tannin wines
24. Today's tendency of winemakers to bottle wines with too much alcohol and too little acidity bugs the H out of me, but I don't know how to prove that these are bad for both wine drinkability and wine age-ability. Dick P
25. Red and white concentrate: flavors, aromas, color (browning, anthocyanin) stability
26. Combination of ecological and viticultural research to show CO<sub>2</sub> generation is an annual closed loop and then education of bureaucracy about same
27. Alcohol reduction, i.e. reverse osmosis, etc.
28. Flavor profiles and characteristics of new grape varieties...varieties that are disease/pest resistant and more suited for the changing climate. Suitability of new or non-commercial/rare varieties to the different climactic regions of California...Where is Cab going to grow best now with warmer temps? What varieties are best suited for Sonoma County given the changing climate conditions...What should forward thinking people be planting and where?

## What is the single most important industry research need from your point of view?

1. Biotechnology fungus and PD and insect control in the vineyards
2. Mechanization, precision farming of wine grapes
3. Automation and energy use
4. Genetic resistance to powdery mildew
5. Factors contributing to lower alcohol levels in wines
6. Wildland fire
7. Inoculations against and cures for viral or fungal pathogen infected plants
8. Vineyard longevity and health
9. Develop powdery mildew, PD, resistance in plant material
10. Wine and grape quality in regards to vineyard yield
11. Viticultural and enological practices to prevent or reduce smoke taint
12. Extend the health and life of vineyards
13. Continuing to keep ahead of invasive pests and diseases
14. Vineyard diseases, invasive pests, climate change
15. Protection against the spread of Grapevine Redblotch Virus
16. Sustainability and soil fertility management
17. Continue to focus on precision viticulture. Follow harvested fruit into winery and analyze interaction of viticulture practice, winemaking on wine components.
18. Possibly not the most important, however, I see a large void in the knowledge of virus and fungal pathogen interactions in wine grapes.
19. Hard to say. Interestingly, I can think of many things that are NOT the single most important thing, but I'm having a hard time singling out one subject.
20. Biological and/or environment friendly control methods of important grapevine diseases such as powdery mildew, red blotch and LR3. Current practices based on heavy use of chemicals would not sustain.
21. Removing smoke taint
22. Marker assisted clonal selection
23. Mechanization to reduce labor costs that have gotten out of control
24. Develop varieties that require less inputs
25. Broader understanding of the impact of Viticulture Practices (vine nutrition, fruit exposure, etc) on fruit composition and, ultimately, on wine "quality"
26. Clean plant material
27. Yields quality
28. Pierce's disease
29. Usable information relating to actual applications in winemaking
30. Disease prevention
31. Research on plant pathology
32. Pests and disease control
33. To develop more root stocks in case pests (phylloxera, nematodes) adapt and find less intrusive/more efficient ways of keeping pest and weed populations down.
34. Precision Agriculture including improved mechanization, sensor development, imaging and mapping, autonomous implements.
35. Disease identification, treatment, control
36. Resistant materials (rootstocks and scions)
37. Determine the distance needed to maintain clean planting stock free of viruses and their vectors
38. Clean wood, water sustainability
39. Addressing climate change
40. Sustainability. Set up to be profitable and successful in 100 years.
41. Vine mealybug

42. Alternate disease control measures and climate control measures including smoke taint issues
43. Future diseases and threats
44. Adaptation to changing climate
45. Vineyard sustainability and water use
46. Disease and pest management
47. Red Blotch
48. Implementation of mechanization without compromising wine quality
49. Virus elimination
50. I'm an investor owner trying to "catch" up on all that relates to my vineyard.
51. Right now I believe that clean planting stock should be pursued.
52. Smoke taint removal re grapes/must/wine
53. Sustainability
54. Link vineyard management to wine sensory then you can fill the voids with wine chemistry
55. Water conservation
56. Maintaining yield and quality characteristics using less water
57. Water conservation and ground water recharge in ag with a grower friendly approach if possible, not all tubes and wires.
58. Planting material
59. Timing and intensity of applied resources in vineyards for maximum effect and efficiency.
60. See oenology above
61. Soil health without the use of synthetic products
62. DTC sales
63. Control of viruses and vectors that spread them
64. Control of mildew naturally or organically
65. Vineyard Efficiency - Producing more high quality grapes with less inputs and fewer people
66. Logistics and economics of replanting a vineyard (block)
67. All things related to labor shortage: Minimizing labor hours in the vineyard and winery.
68. Sanitation
69. Stronger organic materials for the industry especially in the vineyards
70. Identification of Red Blotch vectors
71. Smoke taint
72. Developing an educated workforce to use the knowledge we have.
73. No more surprise vine infections that seem to be discovered every 5 to 8 years but all the plant material in the nurseries have it.
74. IPM
75. Controlling virus spread through clean plant initiatives and vector control.
76. Red Blotch!!!!
77. Heat stress - IE grapevines response to high heat (and how to best manage it) as it is the new "norm"
78. Sustainability in and out of the winery
79. Water conservation
80. Disease prediction models
81. Control of VA in wine
82. Achieving vineyard profitability via increased yields while also critically maintaining profitability
83. Disease resistance
84. Fungal and disease
85. Being able to produce grapes anywhere in the world by use of genetically modified vines
86. Alternative to sulfur dioxide
87. Smoke taint
88. Clean plant material and carbon sequestration of vineyard floors and canopies

89. Grapevine virus management
90. We are using vine clones that date back hundreds of years, same genes.. But pests are evolving. What to do?
91. Powdery mildew resistance
92. Water use
93. Lower alcohol content for better drinkability
94. improving quality of valley fruit; more color more tannin
95. Disease control
96. Virus related issues
97. Anticipating the challenges from anthropogenic climate change
98. Maintaining quality with less labor, climate change
99. Pest & disease
100. Vine disease management- multiple infections are common, sanitation in the field is non-existent
101. Virus free stock
102. Effective and efficient use of water, both in the vineyard and in the winery.
103. Research how to get the State of California to stop its anti ag & anti employer regulations! Joke!
104. Sustainability for both vineyard and winery operations
105. Development of leafroll disease resistant selections
106. Mechanization and water use
107. Disease control and prevention
108. Disease resistant cultivars
109. Resistant plant material
110. How to stay competitive with the rest of the world given the environment in California for business today
111. Prevent Pierce's Disease from spreading, develop resistant rootstock or grapevines.
112. Less rot , lower sugar to harvest
113. Research into red blotch origins and solutions
114. Insect, disease and virus control. To include invasive species. In our connected world there exists ever greater possibility for the introduction new invasive species.
115. Forging grower and winery agreement on adopting more widespread mechanization practices in premium winegrape production.
116. Effect of irrigation techniques on wine quality
117. Mechanization of vineyard management
118. No. 2 above
119. Virus management
120. The failing quality of mass produced, assembly wine produced wines.
121. Mechanization across vineyard and winery platforms
122. With technology and changing climate...how does the farming community proceed? What tech can be used to help with vit practices? What should we be planting given the rising global temps? Forget what the market demand is now, what should we be planting for the future that will be pest and disease resistant and commercially marketable/taste good? I don't think that Bio Tech is the answer. Good farming and breeding techniques have always worked well over the ages. Bio tech is an unknown/potentially dangerous course given the fact that breeding works so well. Basically, the most important research is how do we use technology and new/rare/non-commercial varieties to adapt to our changing/warming environment?
123. Irrigation efficiency
124. Vineyard cost control, mechanization
125. Disease/pest control in vineyard
126. CO2 release during fermentation
127. Vine disease resistance
128. Long term understanding the effects of climate change

129. As above
130. Climate change impacts on grape physiology
131. Rootstocks
132. Red blotch virus management
133. Improving water use efficiency

**Please provide any general feedback, comments or suggestions that you may have regardless of any specific research topic.**

1. I believe there are various tracts in the industry and the research interests of say the high Napa Valley growers are not closely aligned with more bottom line oriented large scale producers. One exception to these divergent interests is the area of pest management which is of utmost importance to everyone. I do also want to clarify my responses to 5, 6, and 7. I do not see GMO grape scion varieties ever getting any sort of traction although I believe that there may be room for some GMO rootstocks.
2. I think the topic of genetically modified organisms in wine production is very confusing. Need more specific examples to give better answers. For example, genetically modified fermentation yeasts are probably fine but genetically modified grapevines are probably not okay.
3. GMO's have no place in this industry. If it's corn, soy, etc, sure - feed the world, I get it. But wine doesn't feed the world, and really nor do table grapes. So many of the ideals we subscribe to as an industry exist "because it's always been done like that." And while I will concede that this statement is an argumentative fallacy founded on circular reasoning, it's not like industry decision makers really care to be challenged on anything so why try now?
4. 1. Funding agencies usually set a budget limit in their RFP. Currently, there is no funding limit specified in the AVF RFP. As a result, one researcher can receive 3 ~ 5 times more funding than another peer researcher to do similar work. In the future, funding cap should be considered. For RFPs in areas of emphasis, budget limit can be set higher. 2. Research symposia and research summaries are effective ways to disseminate research results to growers. AVF is doing a great job in this area and these activities should obviously continue. Some areas of enhancement could be considered. One is to include a grower's forum in the symposia to give growers a direct voice in the research process. This could be given by key grower leaders and/or growers groups/associations. Second is to invite key technology leaders to address the symposia, who may not have been funded by AVF. For example, one expert could talk about the CRISPR technology and its potential. And another expert could talk about nano antibodies and its application, etc.
5. We need not to duplicate research efforts.
6. 1st: We must have clean plant material. 2nd: We must have or develop rootstocks that will use as little water as is possible. 3rd: We must development yeasts that have a less efficient conversion of sugar to alcohol. 4th: Develop a means for eliminating smoke taint. IMHO, all other interests/research are secondary to these four.
7. I support biotechnology research and feel it is a question of time and public education leads to its commercial implementation. I only support AVF funding if there is an upfront negotiation of Intellectual Property Rights such that the value of industry funding is recognized in the future licensing expense of the technology.
8. Finding practices that increase the ability to mechanize and improve quality at the same time
9. Genetic enhancement
10. Eutypa, Measles
11. My answer to number 5 is, I guess so.....
12. AVF needs better outreach to industry. Too many people don't know who you are.
13. I appreciate your willingness to support research wherever it is effective.
14. Mealybug/virus control
15. Genetic analysis of plant response to various threats

16. Outreach of new discoveries needs to be quick and widespread. I continue to come across members of this industry who are not well informed.
17. Biotech is a valuable research tool but should not be proposed as a magic bullet, as it too often is.
18. Alcohol management (through yeast selection: lower sugar/alcohol conversion ratio) and/or distillation
19. Lower the pH values for greater longevity and less spoilage.
20. Mechanization
21. Providing practical research that is effectively and widely communicated to the industry is of paramount importance. Research dollars that disappear into a black hole without resulting in moving the industry forward are wasted.
22. Need more info on wildfires and smoke taint, smoke taint compound ID and removal, soil health
23. GMO work should target non-native problems or things like heat/drought tolerance (i.e., Climate Change) so that there is a strong defense.
24. Preventing eutypa is a big expense and time use. Eliminating chemical use into the soil and using manure and natural products to build up carbon and fertility in the soil is my No. one task! Ted Nagel
25. Wine should be produced in many very small lots each monitored to maintain its specific qualities/nuances and aged and bottled accordingly.
26. Automation usage in wineries and vineyards
27. Public perception needs to be informed in a big way.