



Arizona Statewide Commercial Viticulture Needs Assessment

Matthew M. Halldorson, Jeremy Weiss, Josh Sherman, and Valerie Rauluk

Summary

The inception of any good Cooperative Extension program requires direction. While an agent may have extensive experience working in a specific program area, every community is different and owns a unique set of challenges and concerns. The best resource to learn more about these issues is generally the community members, who know better than anyone about their own needs and priorities. From December 2022 to May 2023, the University of Arizona conducted a 49-question needs assessment throughout Arizona, directed at vineyard managers, viticulturists, and vineyard owners in order to develop a Commercial Viticulture Extension Program. Respondents stated that having a programmatic area agent for viticulture was their greatest priority, with top programming priorities for growers being irrigation, pest and insect management, disease management, soil fertility, weather, and weed management.

Introduction

The purpose of Extension is to support stakeholders with objective, science-based information developed through research and educational programming. The first step in providing this kind of assistance is to ask the community directly about their challenges and priorities. In Extension, there are two primary sources of community information. The first is the Advisory Board, a group of individuals appointed with the express purpose of supporting and consulting with local Extension to ensure that current and future programming is in fact meeting the needs of the stakeholders. The second source is the needs assessment, a survey which is designed to help the agent understand the community that they are working with, and the type of support that said community would like to receive from the university. Once these factors have

been identified, the agent can design programming to address these stakeholders' specific needs by identifying desired outcomes, the outputs to be produced, and the inputs necessary to achieve them.

Although grapes have been cultivated in what is now known as the state of Arizona since at least the eighteenth century, recent decades have ushered in a renaissance for the state's industry (Berg, 2018). From 2012 to 2021, the Arizona wine industry has roughly doubled in both planted acreage and number of bonded wineries (Bickel et al, 2021). One indication of this growth has been the recent addition of two federally recognized American Viticultural Areas (Willcox established in 2016 and Verde Valley in 2021), which join the longstanding Sonoita American Viticultural Area (established in 1984). In response to this development, the University of Arizona Cooperative Extension has increased its viticultural programming in recent years, and in 2022, hired a statewide programmatic viticulture agent to enhance its support of this growing industry. To properly support an industry, an agent must understand who the members of this industry are, how they do business, and what types of traditional practices they use. Further, it is key for the agent to be aware of the needs and priorities of industry in order to maximize their effectiveness while delivering programming and creating scholarly contributions. The results of this assessment are organized by first describing the Arizona grape growing community and then expounding on the needs and priorities that the University can support. Within the later section, it is clear that the top priorities for Extension programming include irrigation, pest and insect management, disease management, weather, and weed management.

Materials and Methods

Members of Cooperative Extension conducted the survey from December 2022 to May 2023 throughout Arizona using Qualtrics Software in an entirely online format accessible by web link or QR code. Respondents were contacted through the Yavapai College Viticulture and Enology Program, The Arizona Winegrowers Association, and word of mouth, including advertisement while the agent was out in the community delivering programming. The survey questions (see Appendix) were developed through the lead author's previous knowledge of the U.S. wine industry and review and input from all authors. As this survey deals exclusively with viticulture (as opposed to winemaking or grape processing), it was advertised "Attention all growers, viticulturists, and vineyard owners!" in order to ensure that the correct demographic was solicited. Ultimately, 56 people responded to the survey, though not every question was answered by all respondents, and some questions gave the option for multiple selections within a single question.

Results

Description of the Arizona Viticulture Industry

Demographics of Respondents

The survey results indicated that the majority of vineyards (by count, but not necessarily in terms of acreage) in Arizona are planted in *Cochise* County as this was the answer given by 43% of responses to the question "Please choose the county that your vineyard is planted in...". This was followed by *Yavapai* County at 22%, *Santa Cruz* County at 20%, and *Pinal*, *Pima*, *Navajo*, *Graham*, *Gila*, *Coconino*, and *Apache* counties all at 2% (Figure 1A). Respondents did not report viticultural activity in the balance of the counties throughout the state. The majority (93%) of respondents identified as *first-generation growers* (Figure 1B). Regarding years of experience growing grapes, the most commonly selected choice (49%) was *more than 10 years*, with 26% reporting that they had been growing *between 5 and 10 years*, 16% *between 2 and 5 years*, and 9% *between 0 and 1 year*.

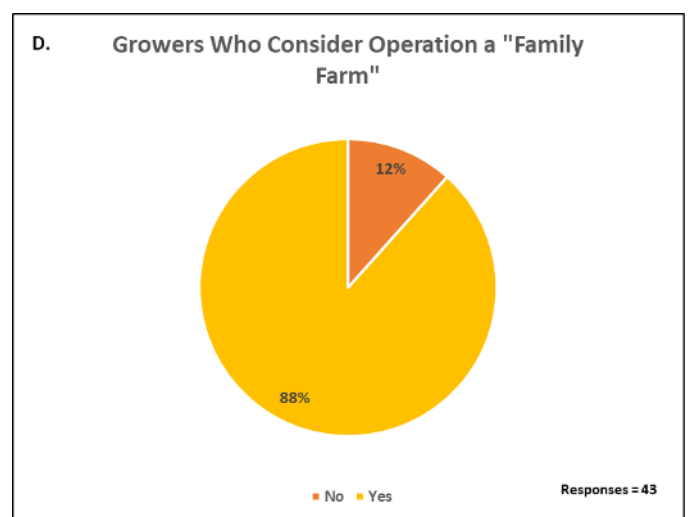
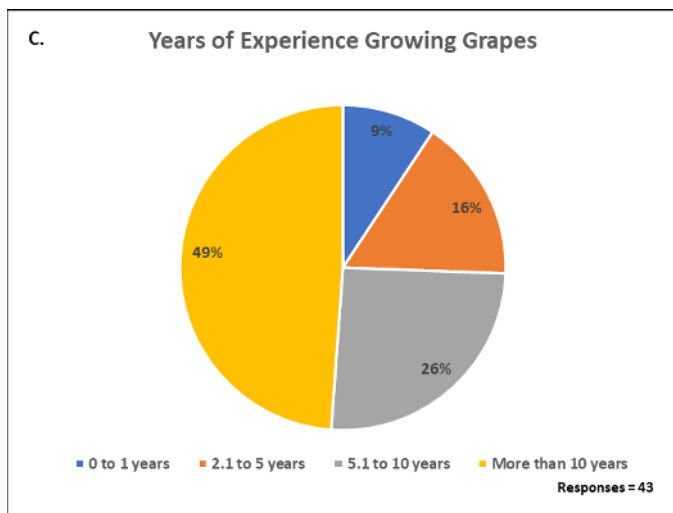
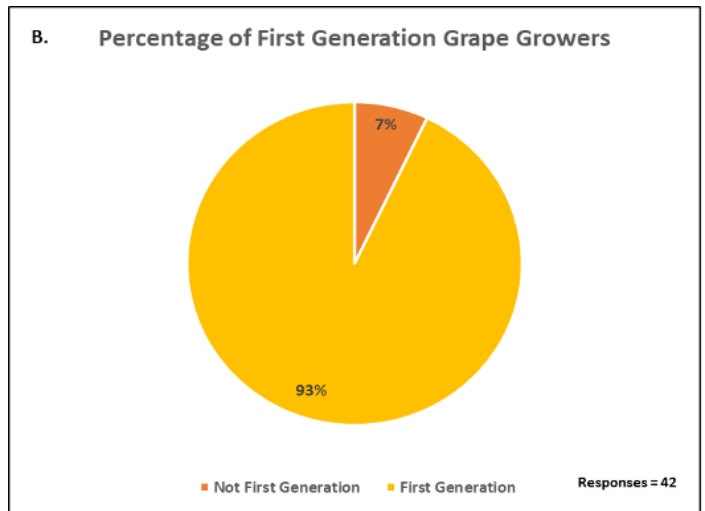
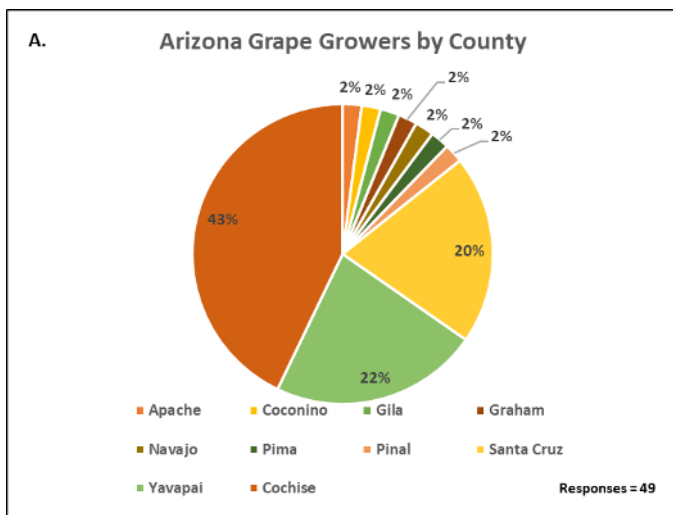


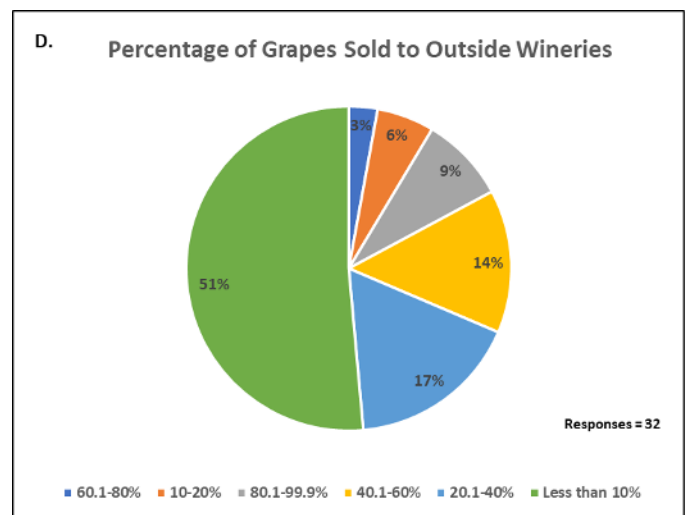
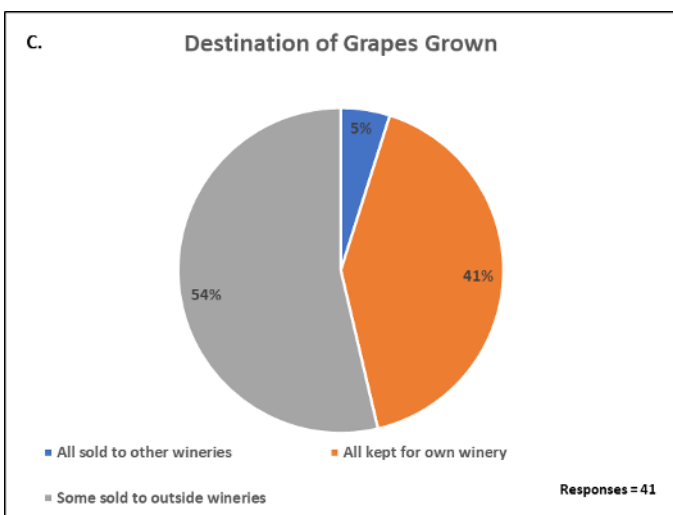
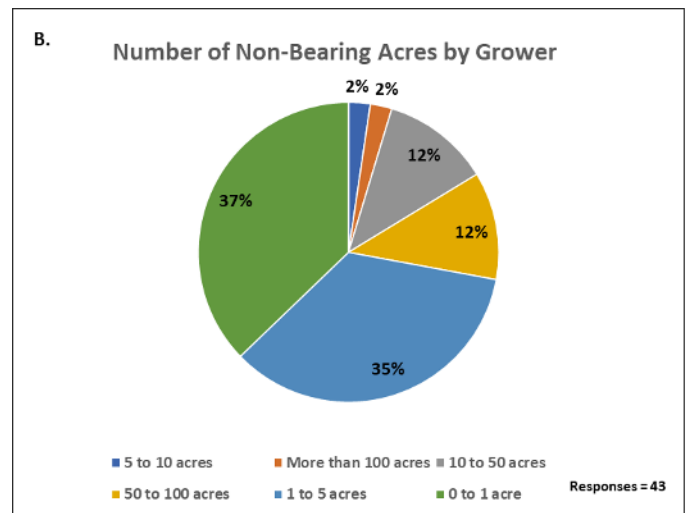
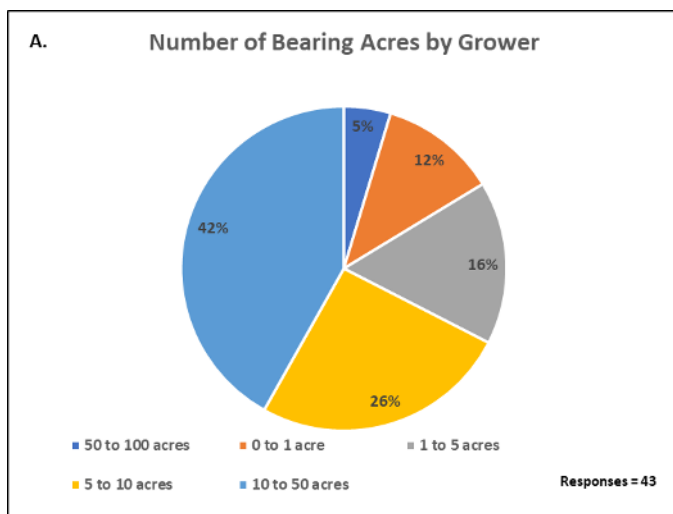
Figure 1: Demographic data describing Arizona grape growers

and 9% at one year or less (Figure 1C). 88% of respondents reported that they considered their operation a “family farm” (Figure 1D).

Grape Production and Sales

10 to 50 acres was the most common size of vineyard in production (planted and currently bearing fruit), the answer selected by 42% of respondents. This was followed by 5 to 10 acres (26%), 1 to 5 acres (16%), 0 to 1 acre (12%), 50 to 100 acres (5%) (Figure 2A). Zero respondents stated that they had more than 100 acres currently in production. In terms of non-bearing acres (planted acres, that are not yet producing fruit), 37% say that they had 0 to 1 acre, followed closely by 1 to 5 acres (35%). Responses of 50 to 100 acres and 10 to 50 acres were equal at 12% each, as well as More than 100 acres and 5 to 10 acres at 2% each (Figure 2B). When inquired as to the amounts of their grapes that they sold, 54% of growers said that they sold some of their grapes, while 41% said that they did not sell any of the grapes they grew, and 5% of growers said that they sold all of their grapes (Figure 2C). Of those growers that said that they did sell

some of their grapes, the overwhelming majority (51%) said that they sold less than 10% of their fruit, followed by 20-40% at 17%, 40-60% at 14%, 80-99.9% at 9%, 10-20% at 6%, and 60.1-80% at 3% (Figure 2D). When inquiring about the destination of sold grapes, the majority of responses (56%) indicated that they sent less than 10% of their grapes to outside counties, while 31% said that they send more than 80% of their grapes to winemakers in other counties. Small numbers of respondents (6%, 3%, and 3%) stated that the percentage of grapes sent to an outside county was 10-20%, 60.1-80%, and 40.1-60%, respectively (Figure 2E). 97% of growers are paid by the ton (2,000 lbs.), as opposed to the acre (Figure 2F). Grape sales contracts were used by the majority of respondents (56%), while 44% did not (Figure 2G). In order to estimate the size of the crop for a given vintage, about a third of responses included cluster counts (31%) and /or estimating by sight (28%), while lesser amounts used Bud counts (12%), Historic yields (7%), Each row should equal an estimated quantity of fruit (7%), Berry counts (6%), Lag weights (4%), and Whole-vine weights (3%) (Figure 2H).



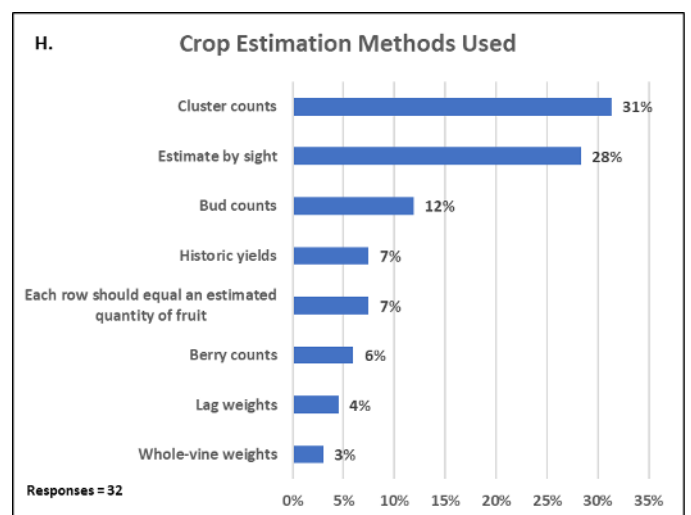
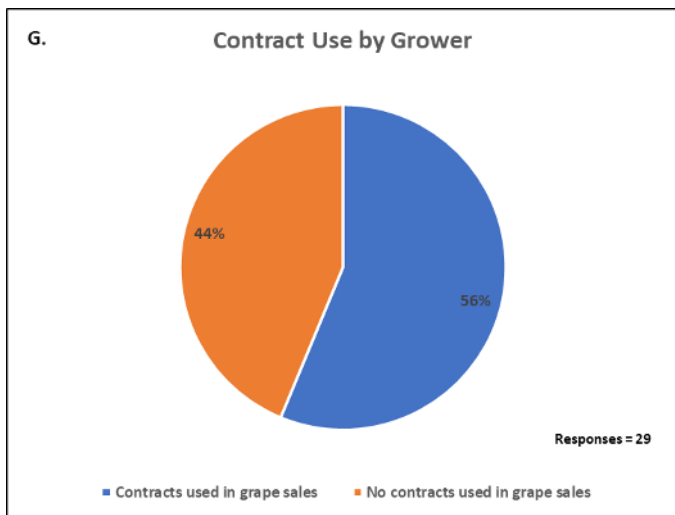
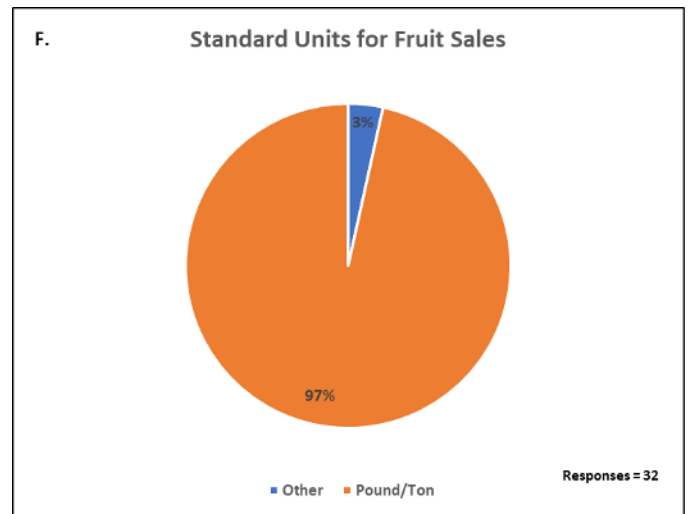
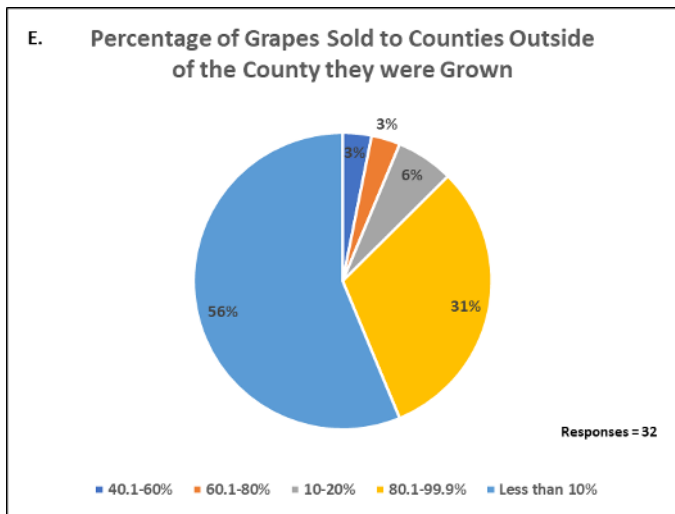
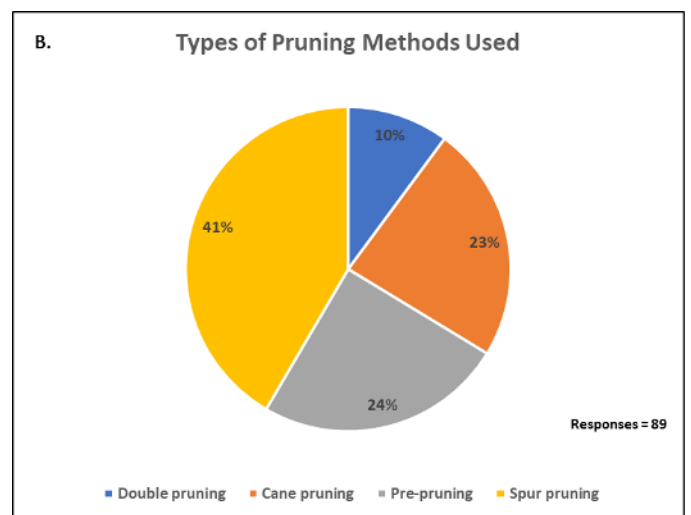
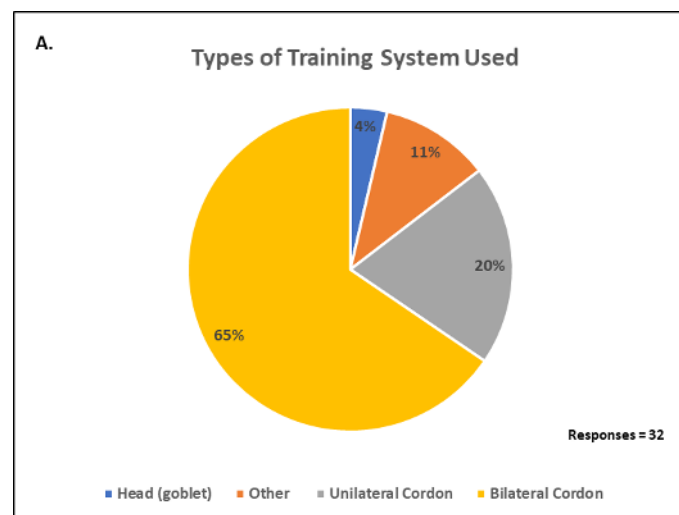


Figure 2: Grape production and sales data

Cultural Practices

The *bilateral cordon* (permanent wood that is trained along a trellis wire) accounted for 65% of the chosen training systems used in the vineyard, with 20% selecting *unilateral cordon*, and 4% *head-trained* (Figure 3A). 41% of

the responses indicated that their vines were spur-pruned, while about a quarter said that they used *pre-pruning* (24%) and/or *cane pruning techniques* (23%) (Figure 3B). Growers used multiple canopy management techniques,



including *shoot-thinning* (27% of responses), *leaf removal* (23% of responses), and *hedging* (14% of responses). Only 5% of respondents stated that they used *deficit irrigation* to manage their canopy (Figure 3C). Regarding grafting and propagation, 40% of respondents stated that they use

certified clean material from a nursery, while 21% propagate from their own stock in order to supply planting materials. 28% of grower respondents use *own-rooted vines* (Figure 3D).

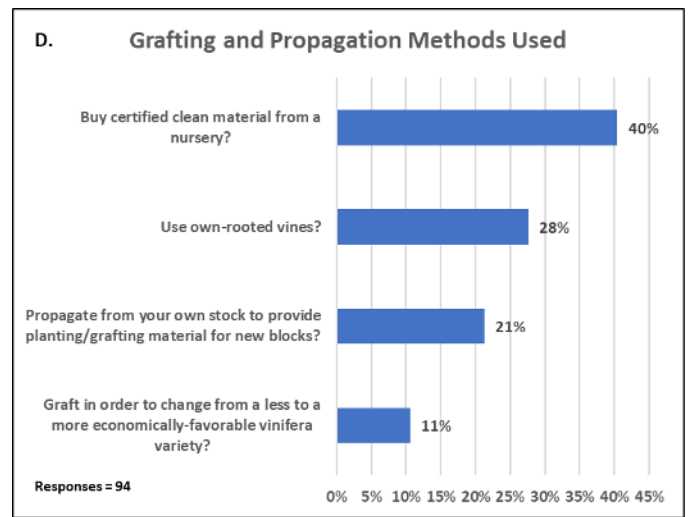
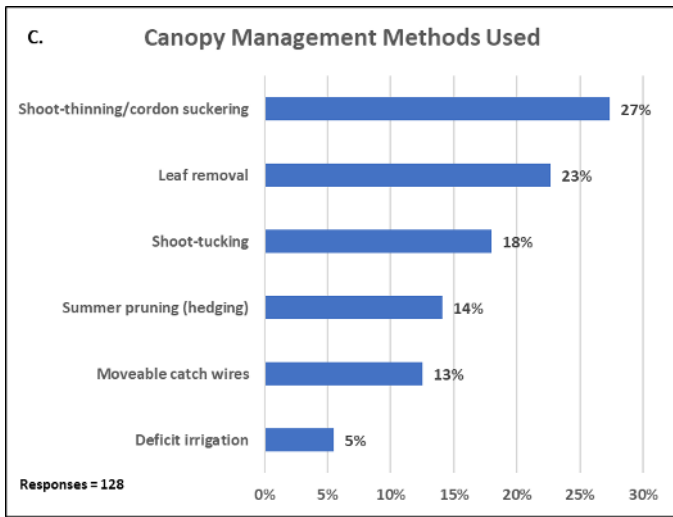
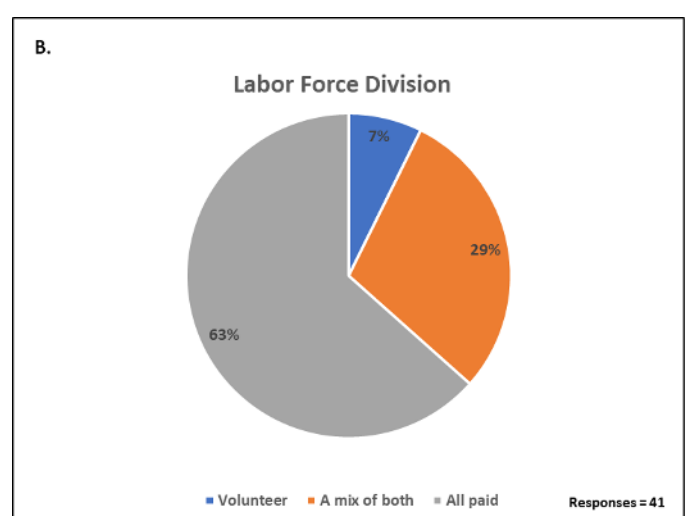
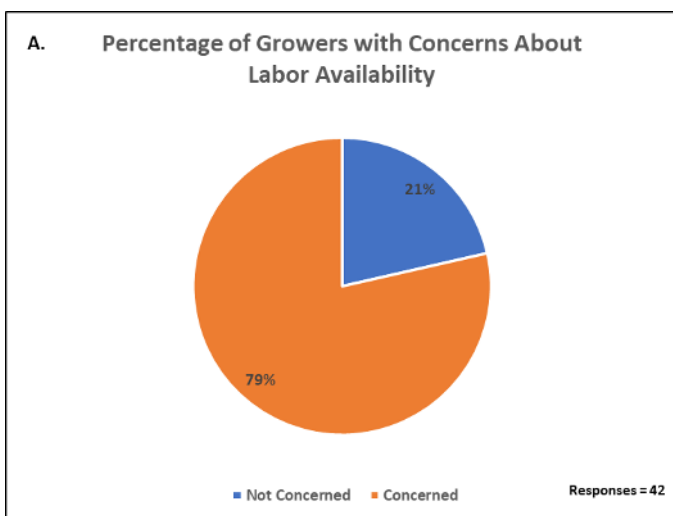


Figure 3: Cultural practice data

Labor and Mechanization

79% of respondents indicated that vineyard labor is an issue of concern for them (Figure 4A). The majority (63%) of growers use an *all paid* labor force, with 29% choosing a *mix of both* and 7% using all *volunteer* labor (Figure 4B). Wages were paid *by the hour* by 85% of respondents, with a small component stating that they used *contract, volunteer,*

and *salary* regarding means of compensation (Figure 4C). Mechanization of one form or another was used in the vineyard by most growers (81%) (Figure 4D), with *mower* (18%), *spreader* (16%), *tow-behind pesticide sprayer* (15%), and *cultivator* (14%) being the most commonly employed machines (Figure 4E).



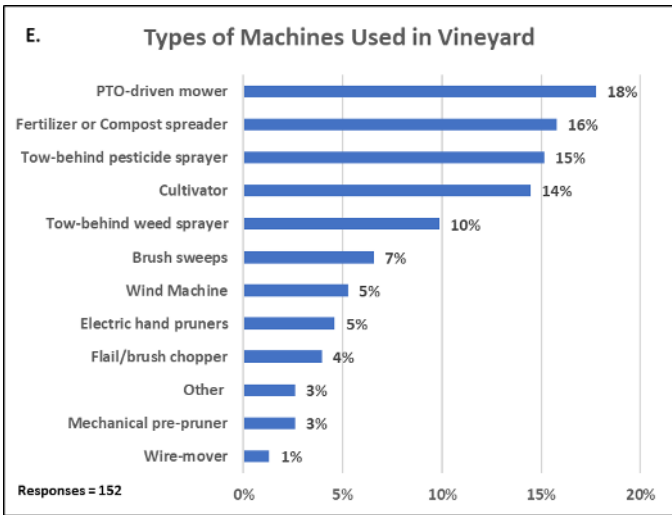
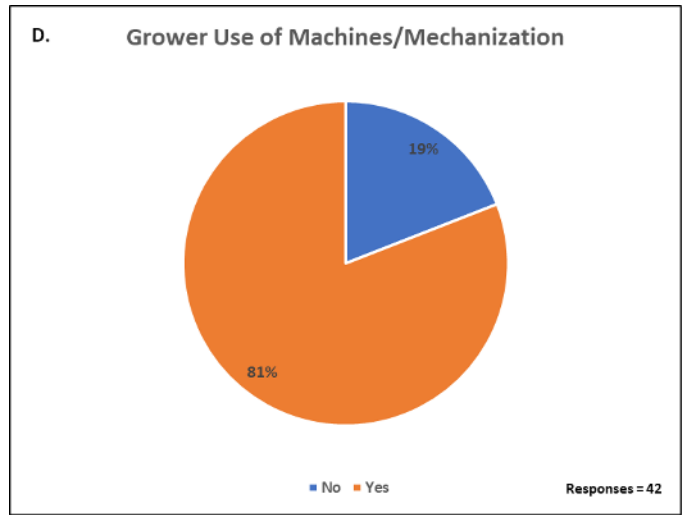
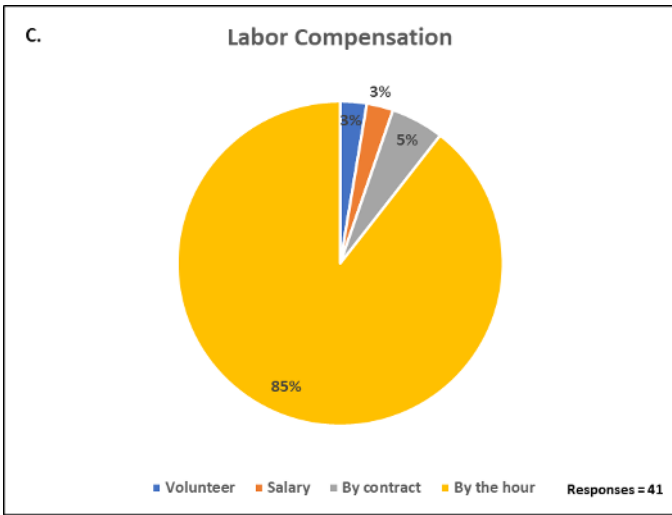


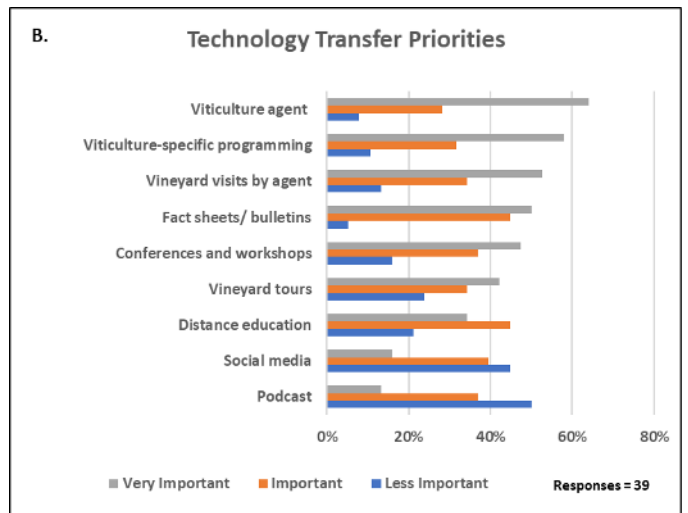
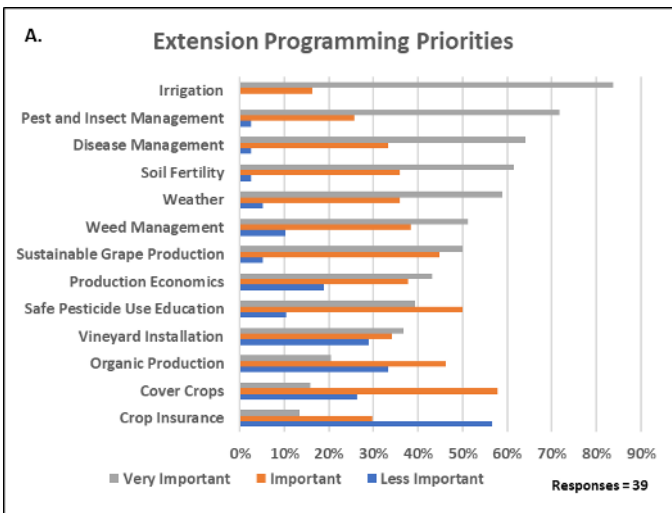
Figure 4: Labor and mechanization data

Industry Needs and Priorities

Extension Programming

When asked how important specific viticultural Extension programming was to growers, the top choices for “Very Important” program topics were *irrigation (84%)*,

pest and insect management (72%), *disease management (64%)*, *soil fertility (62%)*, *weather (59%)*, and *weed management (51%)* (Figure 5A). Growers stated that their highest



priority for Extension/technology transfer was "...having an area agent for Viticulture..." (64%). Other "Very important" Extension/technology transfer priorities included *viticulture-specific programming* (58%), *vineyard visits by agent* (53%), and *fact sheets/bulletins* on viticultural practices (50%) (Figure 5B). 72% of respondents said that they would be "likely" or "very likely" to use a *web-*

and map-based site selection tool (Figure 5C). Concerning potential varietal evaluations performed by the University of Arizona, *fruit quality* was found to have the greatest percentage of "very important" responses (85%), followed closely by *phenological timing* (82%), *disease resistance* (72%), and *yield* (69%) (Figure 5D).

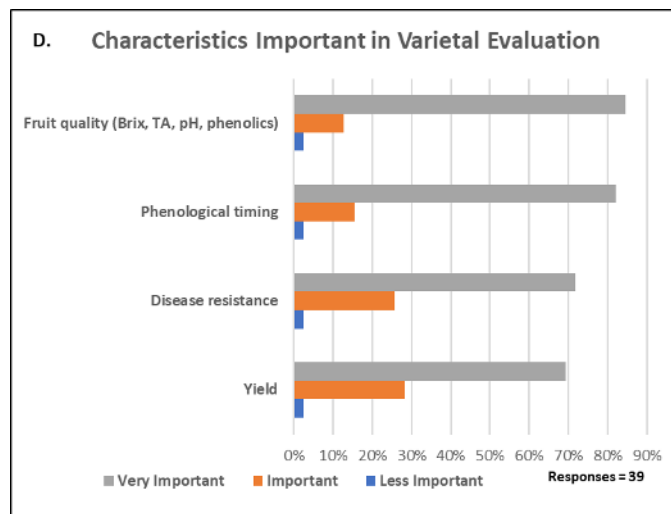
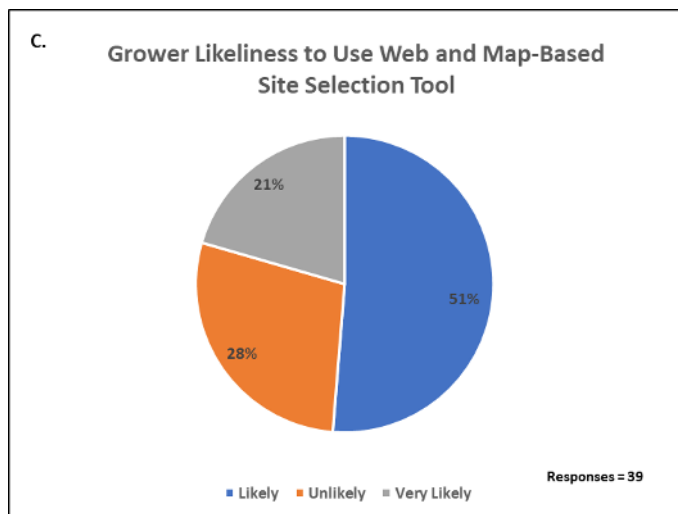
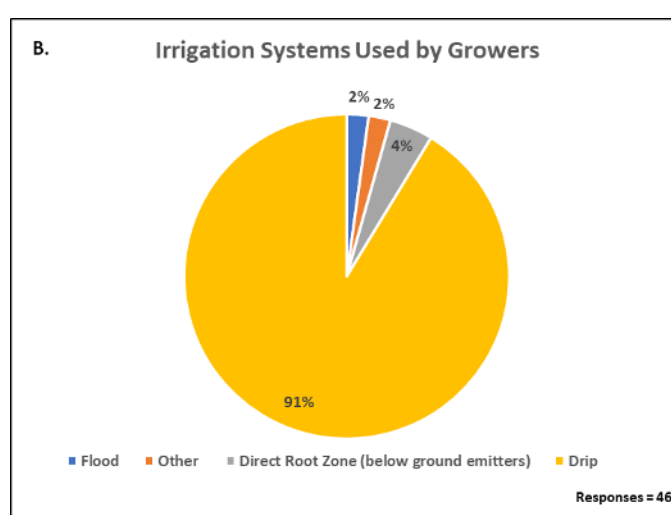
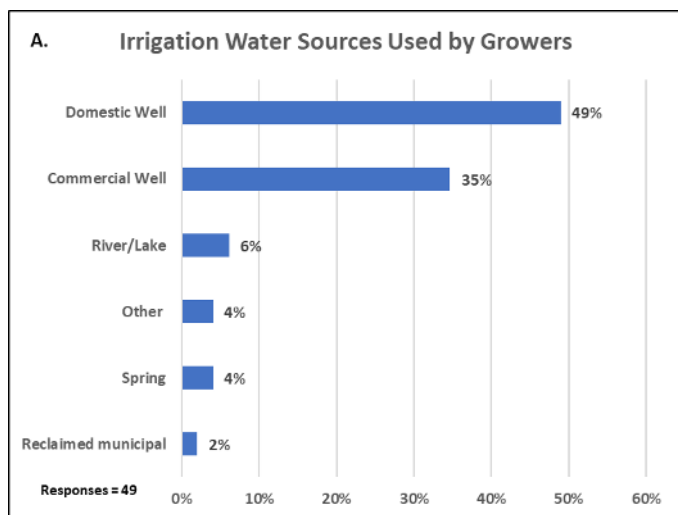


Figure 5: Extension programming data

Irrigation

Wells (49% domestic and 35% commercial) were the most common source of water for Arizona grape growers (Figure 6A) with *drip irrigation* (91%) serving as the primary system type (Figure 6B). With regard to irrigation strategies, growers relied heavily on their ability to schedule water on both *plant-based cues* and the *time of year* (both 24% of responses) to decide when and how much water to apply, though *phenology* and soil condition also played a large role (17% each). *Evapotranspiration* accounted for 4% of

responses (Figure 6C). When asked about their level of concern for *future water availability*, 86% of respondents stated that they were at least *somewhat* (if not very) *concerned* (Figure 6D). This question was followed-up by asking growers how they are or are planning to respond to these concerns. Responses varied, though *drilling another well* (17%), *passive water-harvesting* (12%), *improved water efficiency* (10%), and *active participation in water legislation* (10%) were among the most common answers (Figure 6E).



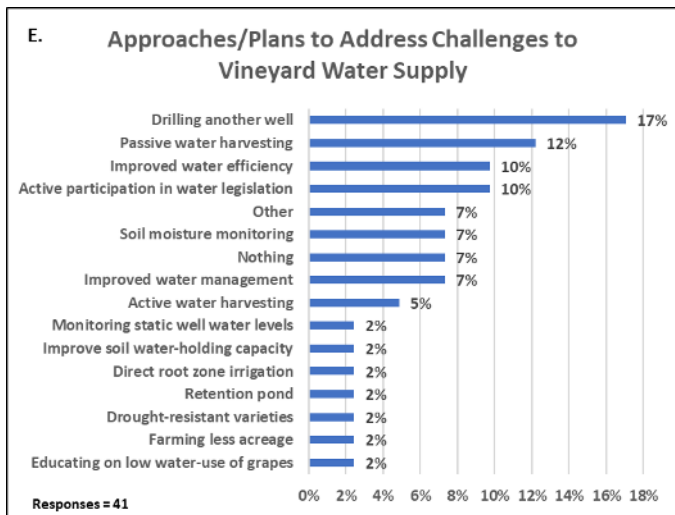
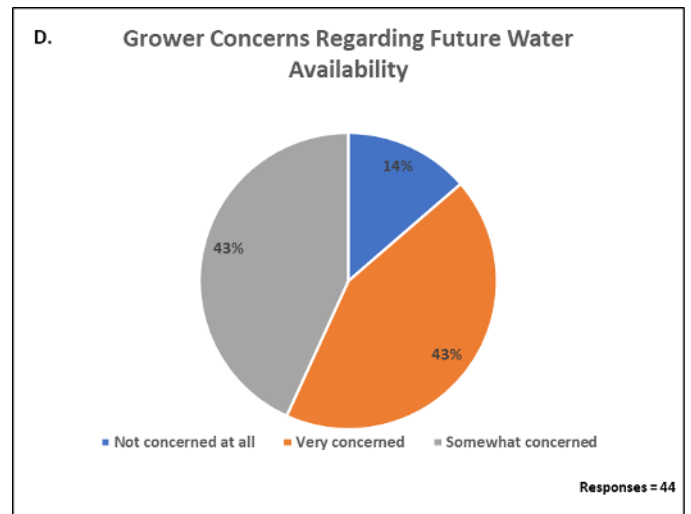
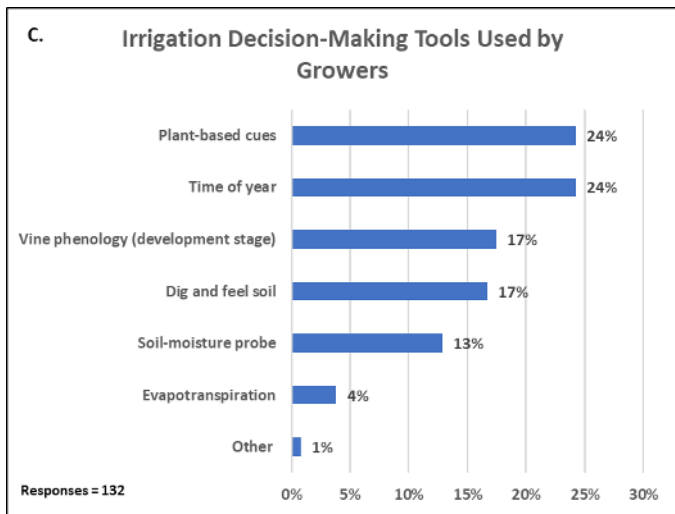
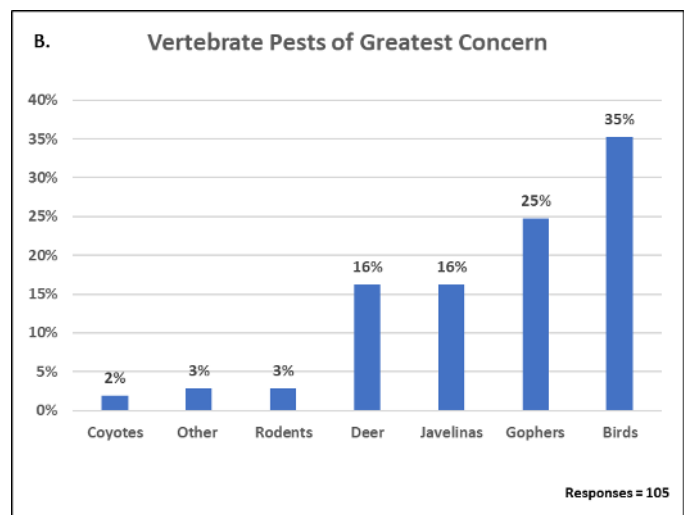
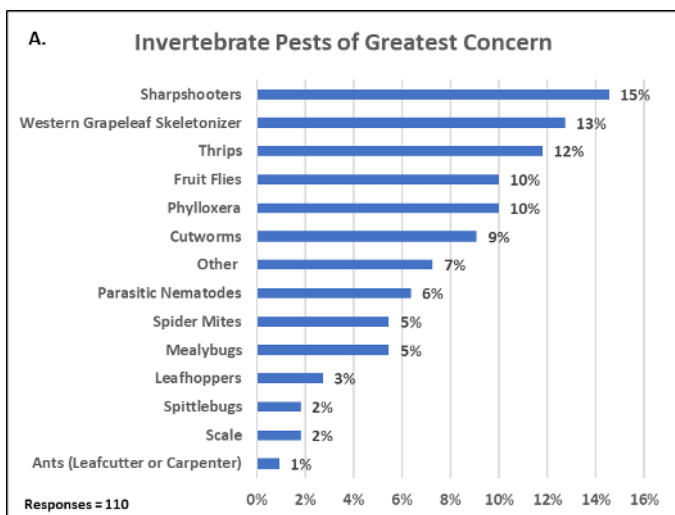


Figure 6: Irrigation and water management data

Pest and Insect Management

Pests of greatest concern to respondents included *sharpshooters* (15%), *western grape leaf skeletonizer* (13%), *thrips* (12%), *fruit flies* (10%), and *phylloxera* (10%) (Figure

7A). Among vertebrate pests, *birds* (35%) and *gophers* (25%) were the greatest concern for growers, with *javelina* and *deer* both representing 16% of responses (Figure 7B).



When deciding when to treat for pests, the most common response was *any detectable presence of the pest* (31%), followed by *in-house scouting and recommendations* (21%), and *calendar date* (22%) (Figure 7C). The principles of integrated pest management most commonly used were *monitoring and identification of pests* (28%), *cultural practices*

that deter pest establishment (22%), and targeted treatment where pest pressure is highest (22%) (Figure 7D). The most important management practices employed (considered “very important”) were *pest scouting* (54%), *integrated pest management* (46%), and *beneficial insects used for biological control* (38%) (Figure 7E).

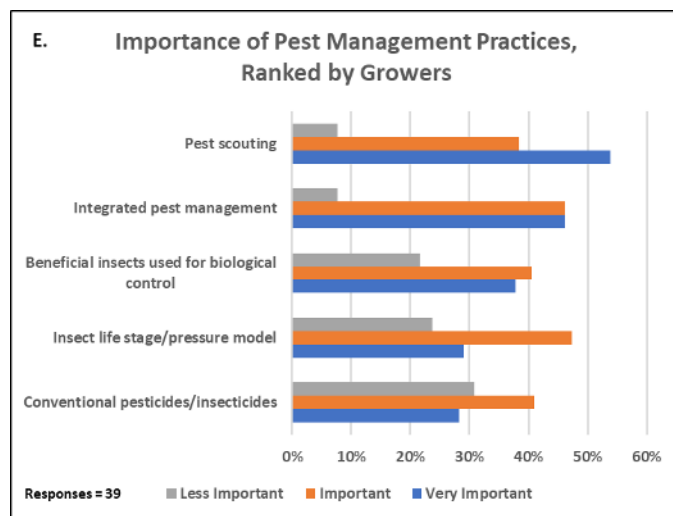
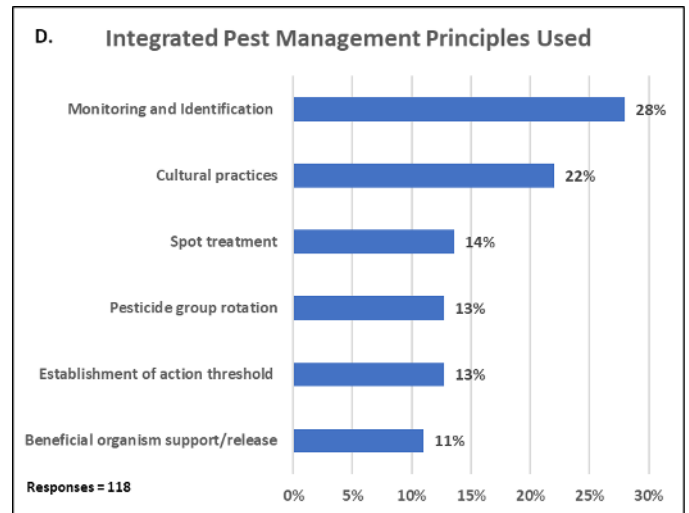
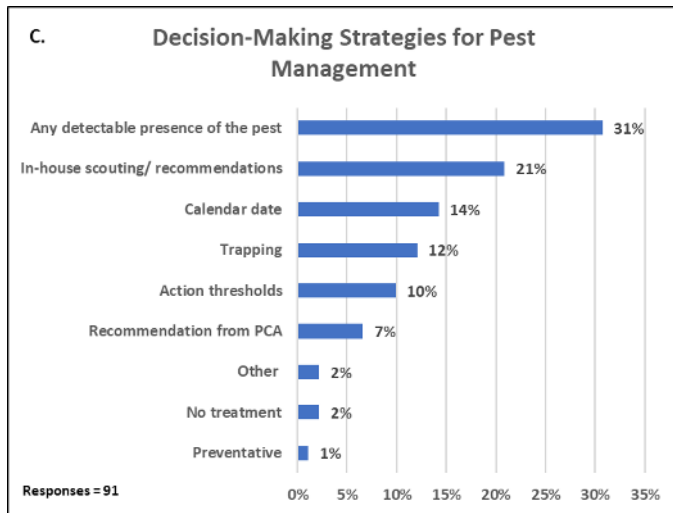
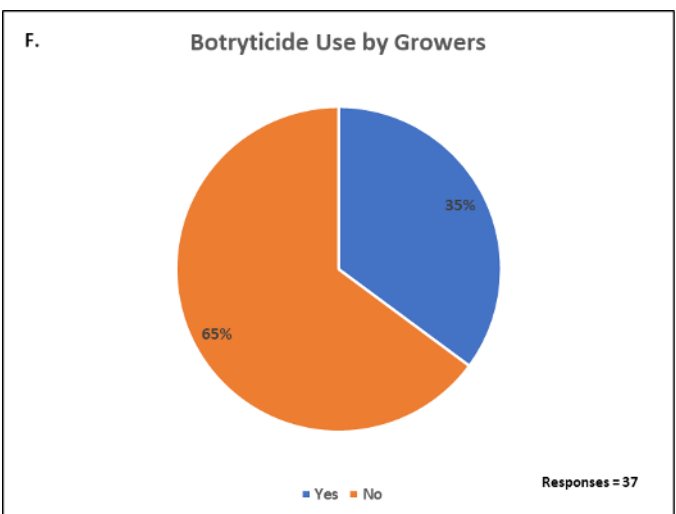
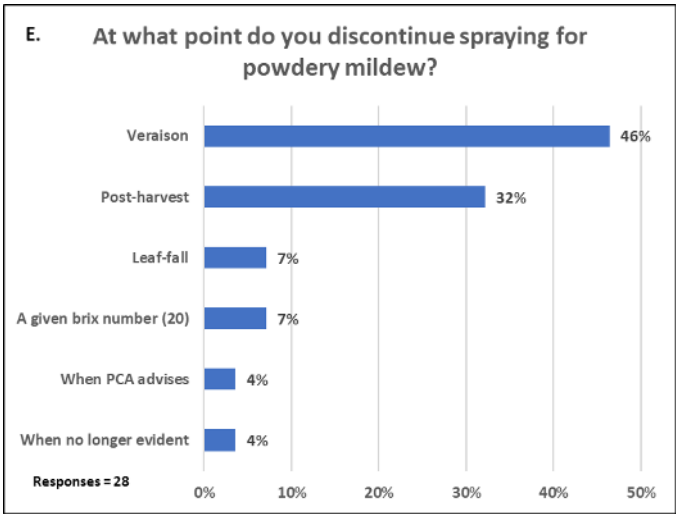
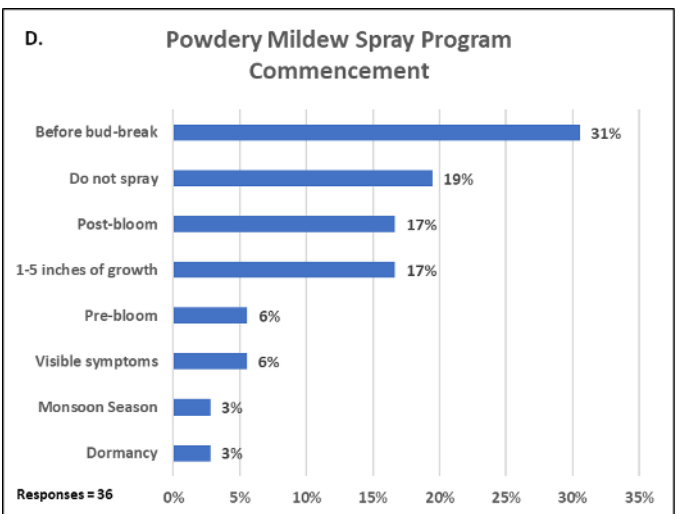
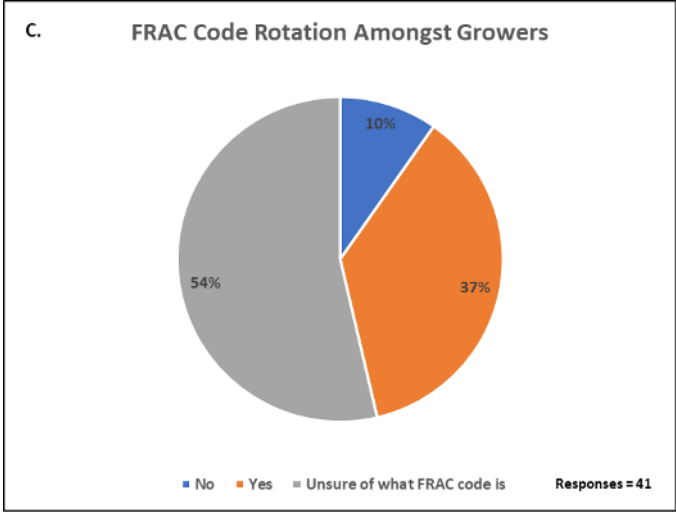
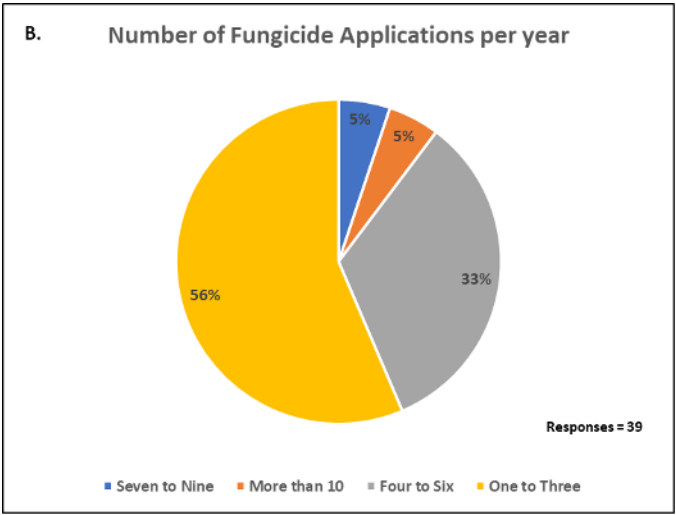
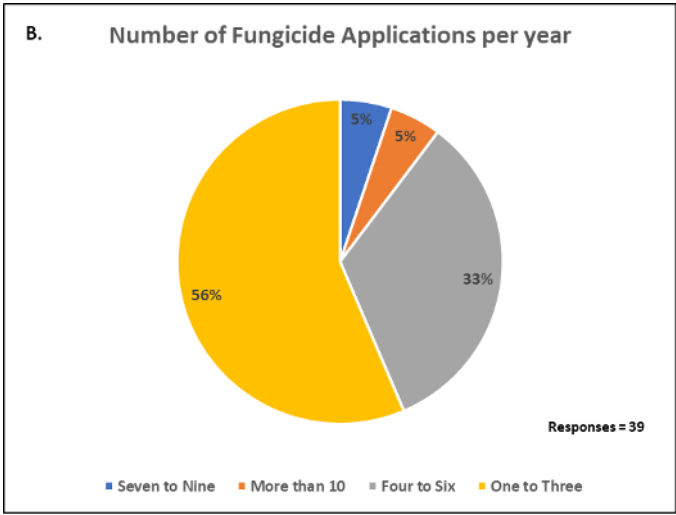


Figure 7: Pest management data

Disease Management

Diseases/ pathogens of greatest concern to the growers of Arizona included *powdery mildew* (18%), *crown gall* (12%), *sour rot* (10%), and *grapevine redblotch virus* (10%) (Figure 8A). Regarding the number of fungicide applications applied per year, the majority (56%) of responses showed that growers applied between one and three per year most commonly (Figure 8B). 64% of respondents either did not practice Fungicide Resistance Action Committee (FRAC) code rotation or *were unsure of what a FRAC code is* (Figure 8C). The majority of responses (31%) indicated that most growers began spraying for powdery mildew disease before *bud-break*, while the second most common answer (19%) was *do not spray* (indicating that no action was taken

to prevent or eradicate powdery mildew), followed by *post-bloom* (17%), and *1-5 inches of growth* (17%) (Figure 8D). The most common times for growers to discontinue spraying for powdery mildew at *veraison* (46%) and *post-harvest* (32%) (Figure 8E). 65% of grower responses indicated that they did not use botryticides for late-season rot control (Figure 8F). The most essential practices for disease control among respondents (rated as “very important”) were *fungicides* (66%) and *cultural practices* (shoot-thinning, leaf removal, and water management) (66%), while *disease-free planting materials* (58%) and *disease vector control* (51%) were also commonly chosen (Figure 8G).



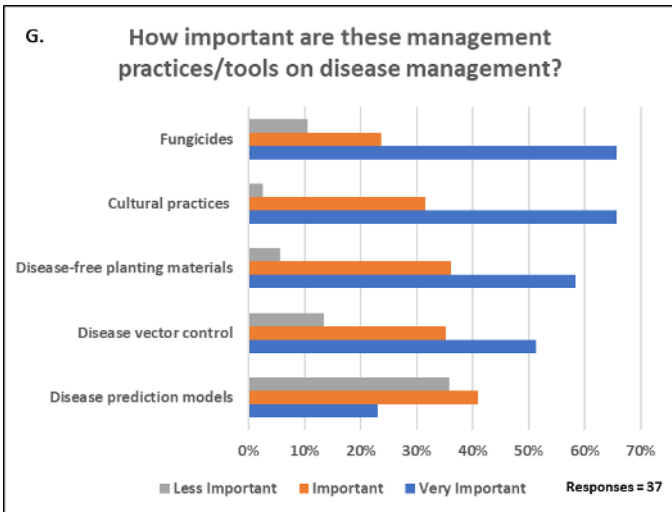
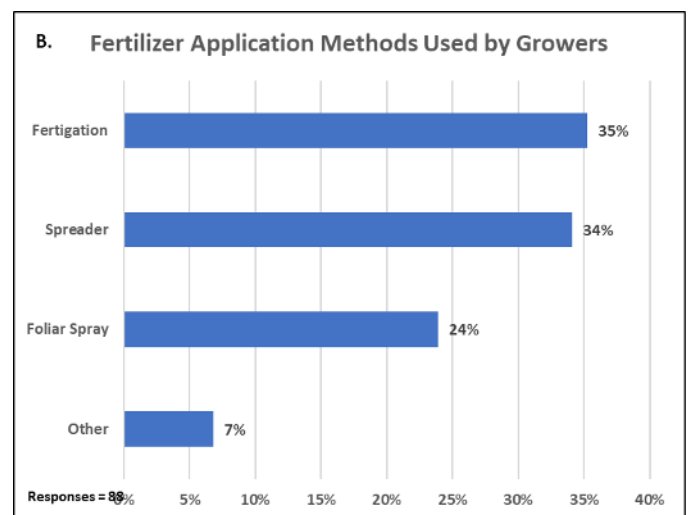
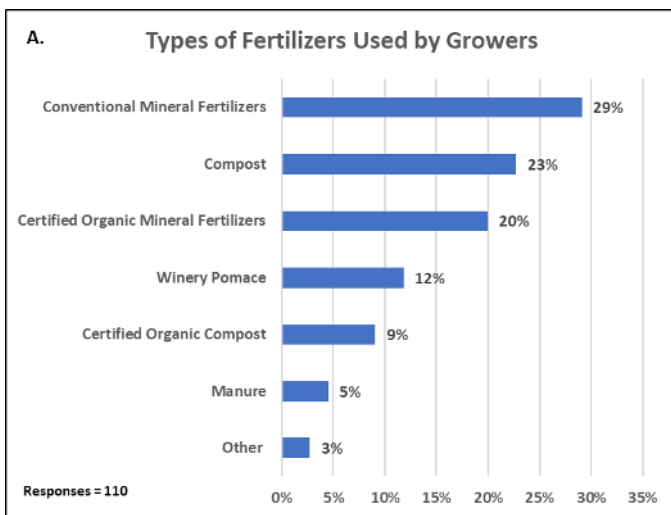


Figure 8: Disease management data

Soil Fertility

100% of growers fertilized or amended their soils in some manner, and the products most commonly used were *conventional mineral fertilizers* (29%), followed by *compost* (23%), and *certified organic mineral fertilizers* (20%), with winery pomace being used by 12% of respondents (Figure 9A). Growers responded that they most commonly used fertigation (35%) as a technique to apply products, with dry product spreaders (34%) receiving almost as many responses and 24% of respondents stating that they used

foliar spray methods (Figure 9B). *Tissue testing* (35%) was the number one answer when growers were asked how they decided how much fertilizer to apply, though almost as many said that they employed *soil testing* (31%), and/or visual cues from the plants (Figure 9C). Regarding the determination of application timing, most growers applied products based on the *time of year* (52%) and *phenology* (45%), though a small percentage applied by *agronomist recommendation* (3%) (Figure 9D).



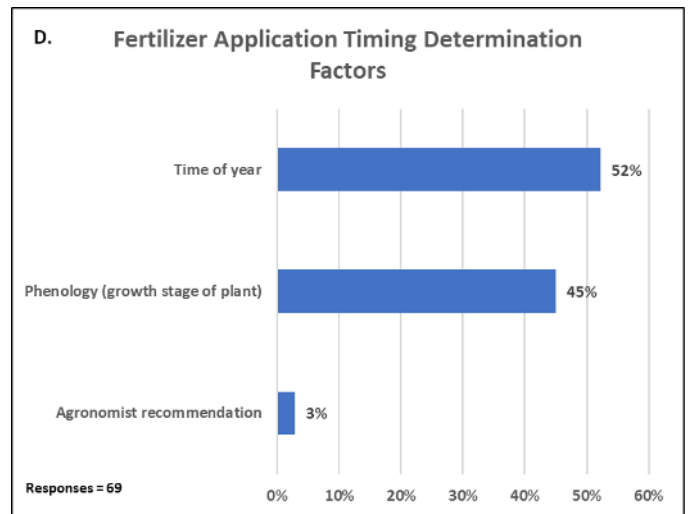
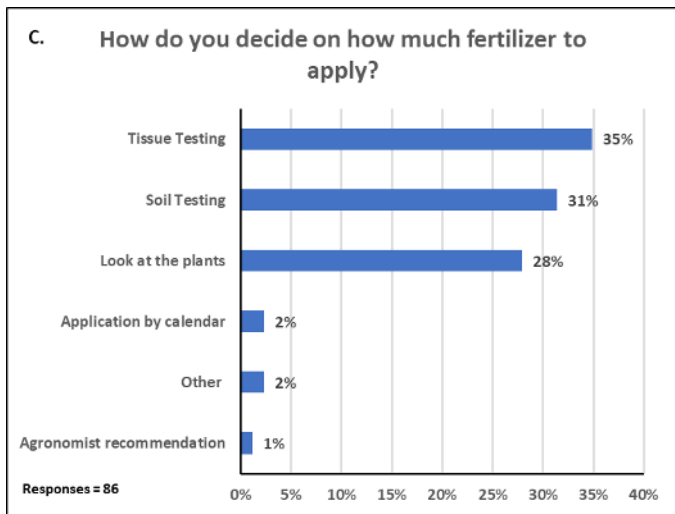


Figure 9: Soil and fertility data

Weather

The *effects of weather* during ripening on harvest fruit composition was found to be the highest priority (79%) for growers of all weather and climate-related topic choices given, with regard to vineyard management (Figure 10).

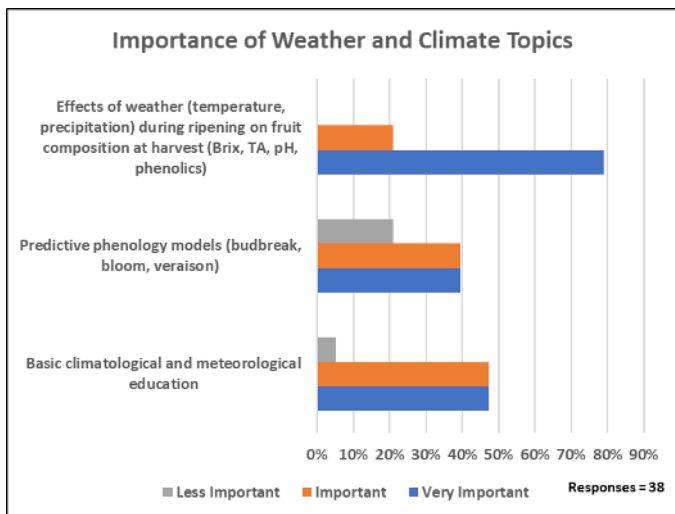


Figure 10: Weather and climate

Weed Management

Although growers stated that *conventional herbicides* and *cultivation* (both 36% of responses) were used with equal regularity on average (Figure 11A), the most important weed management practice for growers was *cultivation* (45%), followed by *conventional herbicides* (30%), *organic*

herbicides (24%) and *alternative technologies* (11%) (Figure 11B). For the “alleyways” or areas between rows of grapes, growers most commonly grew a *native cover crop* (57%) or maintained *bare soil* (30%) (Figure 11C).

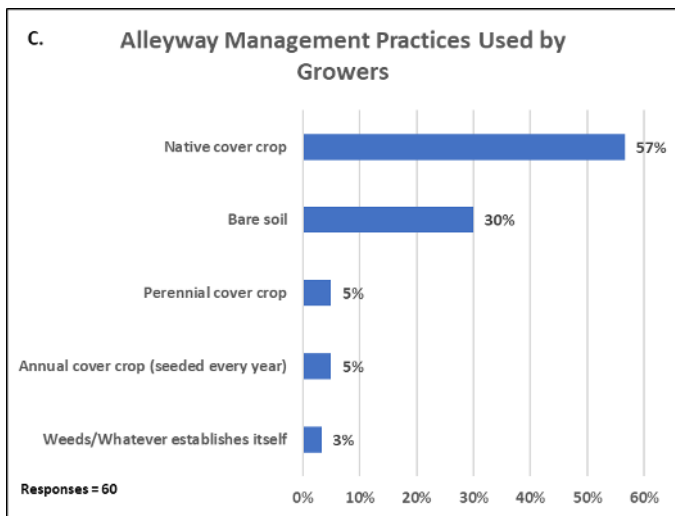
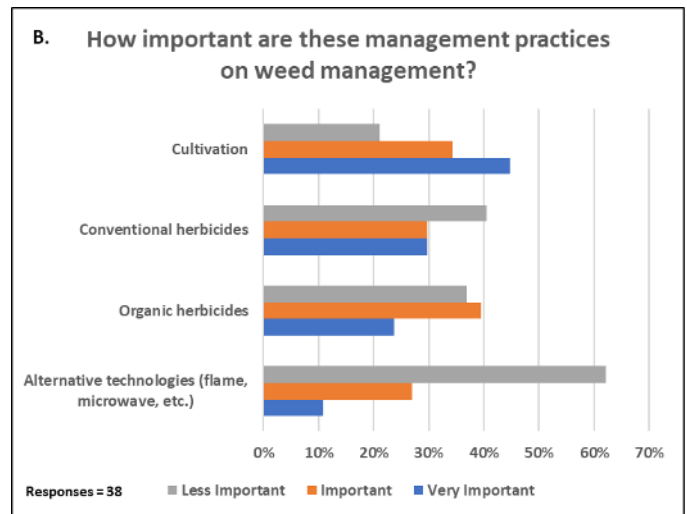
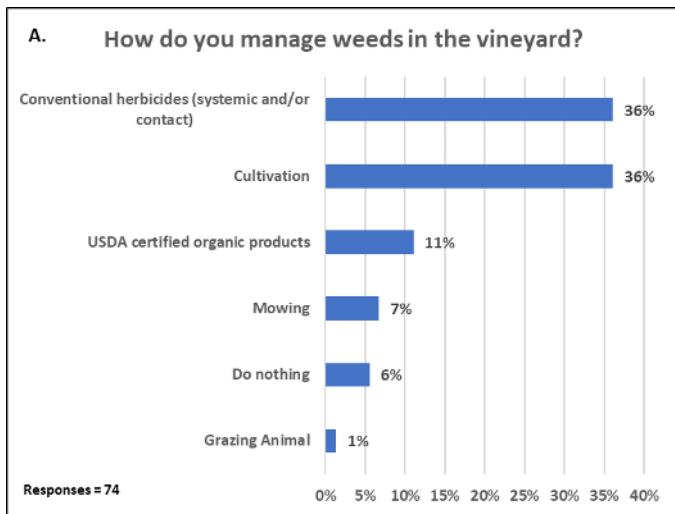


Figure 11: Weed management data

Conclusion

By conducting this needs assessment, The University of Arizona now has a better understanding of the needs and priorities of grape growers throughout the state and can use the resulting data to create impactful programming and scholarly contributions which will be rolled out to meet those needs directly. As respondents listed irrigation, pest and disease management, soil fertility, weather, and weed management as their top priorities, these topics will be the immediate, primary focus of Extension Commercial Viticulture Program, using specific answers to further narrow subject matters. What's more, many of these priorities are interconnected. For example, proper irrigation management is often tied to canopy management, which is a crucial first line of defense within an integrated pest management program. This being said, it was not possible to reach every grower

in the state and Extension work, by nature, is a moving target. As programming is delivered, new issues will arise and the understanding of the needs of growers will become even more apparent. Further, it is likely that more focused needs assessments will be needed in the future, or perhaps another, more extensive iteration in 5 years or so.

References

- Berg, E., 2018. Equal age for age: The growth, death, and rebirth of an Arizona wine industry, 1700-2000. *Journal of Arizona History* Vol. 59, No. 3.
- Bickel, A., Duval, D., Frisvold, G., 2021. Vineyards and wineries in Arizona: an economic contribution analysis. University of Arizona Cooperative Extension Department of Agriculture and Natural Resources Publication.

Appendix: Needs Assessment Survey Questions

Please choose the county that your vineyard is planted in (if you own/work multiple properties, you may choose more than one county.)

- Apache
- Cochise
- Coconino
- Gila
- Graham
- Greenlee
- La Paz
- Maricopa
- Mohave
- Navajo
- Pima
- Pinal
- Santa Cruz
- Yavapai
- Yuma

Are you a first-generation grower?

- Yes
- NO

How long have you been growing grapes?

- 0 to 1 years
- 1.1 to 2 years
- 2.1 to 5 years
- 5.1 to 10 years
- More than 10 years

Water Management

What kind of water source do you use to irrigate?
(Choose all that apply)

- Commercial Well
- Domestic Well
- Irrigation District
- River/Lake
- Other (Specify)

What kind of irrigation system do you use? (Choose all that apply)

- Drip
- Overhead sprinkler

- Under-vine sprinkler
- Flood
- Center Pivot
- Direct Root Zone (below ground emitters)
- Other (Specify)

How do you decide when and how much to irrigate the vines? (Choose all that apply)

- Time of year
- Vine phenology (development stage)
- Soil-moisture probe
- Look at plants (i.e., tendril turgor, shoot lengths, leaf angles, shoot tips)
- Dig and feel soil
- Evapotranspiration
- Other (Specify)

How concerned are you about water availability?

- Very concerned
- Somewhat concerned
- Not concerned at all

What approaches/plans are you utilizing or considering utilizing to address any challenges with water supply for or demand in your vineyard?

Fertility

Do you fertilize or amend your soil?

- Yes
- No

If so, what type of products do you use? (Choose all that apply)

- Conventional Mineral Fertilizers
- Certified Organic Mineral Fertilizers
- Compost
- Certified Organic Compost
- Winery Pomace
- Other (Specify)

How do you apply your fertilizer? (Choose all that apply)

- Spreader
- Fertigation
- Foliar Spray
- Direct root-zone shanking
- Other (Specify)

How do you decide on how much fertilizer to apply? (Choose all that apply)

- Tissue Testing
- Soil Testing
- Look at the plants
- Other (Specify)

How do you determine when to apply fertilizer? (Choose all that apply)

- Phenology (growth stage of plant)
- Time of year
- Other (Specify)

Cultural Practices

What kind of training Systems do you Use? (Choose all that apply)

- Bilateral Cordon
- Unilateral Cordon
- Head (goblet)
- Head (for cane pruning)
- Fan (multiple trunks in a palmate configuration)
- Geneva Double Curtain
- Other (Specify)

What types of pruning methods do you use? (Choose all that apply)

- Spur pruning
- Cane pruning
- Minimal Pruning
- Precision mechanical pruning
- Pre-pruning
- Double pruning
- Other (Specify)

What type of canopy management methods do you use? (Choose all that apply)

- Shoot-thinning/cordon suckering
- Leaf removal
- Summer pruning (hedging)
- Deficit irrigation

- Shoot-tucking
- Moveable catch wires
- Other (Specify)

What practices do you use for the area between rows of grapes? (Choose all that apply)

- Bare soil
- Annual cover crop (seeded every year)
- Perennial cover crop
- Native cover crop
- Other (Specify)

Regarding grafting and propagation, do you: (Choose all that apply)

- Use own-rooted vines?
- Graft in order to change from a less to a more economically favorable vinifera variety?
- Propagate from your own stock to provide planting/grafting material for new blocks?
- Buy certified clean material from a nursery?

Pest Management

What types of pests are you concerned with in your vineyard? (Choose all that apply)

- Mealybugs
- Phylloxera
- Cutworms
- Spider Mites
- Sharpshooters
- Thrips
- Scale
- Fruit Flies
- Parasitic Nematodes
- Other (Specify)

What types of pathogens are you concerned with in your vineyard? (Choose all that apply)

- Powdery Mildew
- Downy Mildew
- Botrytis Bunch Rot
- Sour rot
- Crown Gall (Agrobacterium)
- Leafroll Disease associated viruses
- Redblotch virus
- Phomopsis Cane and Leaf Blight
- Sooty mold
- Cotton (Phymatotrichum) root rot

- Phytopthera crown rot
- Armillaria root rot
- Trunk Disease complex
- Pierce's Disease (*Xylella fastidiosa*)
- Other (Specify)

How many fungicide applications do you typically make per year?

- 1-3
- 4-6
- 7-9
- More than 10

Do you practice the rotation of FRAC codes?

- Yes
- No
- Unsure of what FRAC code is

At what point do you begin spraying for powdery mildew?

- Before bud-break
- 1-5 inches of growth
- Pre-bloom
- Post-bloom
- Other (Specify)

At what point do you discontinue spraying for powdery mildew?

- A given number of days post-bloom (Specify)
- A given fruit size (Specify)
- A given brix number (Specify)
- Veraison
- Post-harvest
- Leaf-fall

Do you use botryticides for late-season rot control?

- Yes
- No

What types of vertebrates pose a major issue in the vineyard? (Choose all that apply)

- Birds
- Deer
- Gophers
- Javelinas
- Other (Specify)

How do you decide when to treat for vineyard pests? (Choose all that apply)

- Calendar date

- Any detectable presence of the pest
- Waiting to treat until economic thresholds have been crossed
- Recommendation from pest control advisor
- In-house scouting and recommendations
- Trapping
- No treatment
- Other (Specify)

Do you use any of the following principles in your pest management program? (Choose all that apply)

- Establishment of action threshold (level of pest pressure at which you act)
- Monitoring and Identification of pests
- Cultural practices that deter pest establishment
- Targeted area of treatment where pest pressure is highest
- Pesticide group (FRAC, IRAC, HRAC number) rotation
- Beneficial organism support/release

How do you manage weeds in the vineyard? (Choose all that apply)

- Conventional herbicides (systemic and/or contact)
- USDA certified organic products
- Cultivation
- Do nothing
- Other (Specify)

Labor/Machines

Is labor an issue of concern for your vineyard operation?

- Yes
- No

Is your labor force...

- All paid
- Volunteer
- A mix of both

How do you pay your labor?

- By the hour
- By contract
- Other (Specify)

Do you use machines/mechanization in your vineyard operation?

- Yes
- No

If so, what type? (Choose all that apply)

- Mechanical pre-pruner
- Electric hand pruners
- Cultivator
- Tow-behind pesticide sprayer
- Tow-behind weed sprayer
- Fertilizer or Compost spreader
- Wire-mover
- PTO-driven mower
- Flail/brush chopper
- Brush sweeps
- Wind Machine
- Other (Specify)

Vineyard and Ownership Questions

(Please only answer the following questions if you are the owner of a vineyard property in Arizona)

Is your operation a family farm?

- Yes
- No

How many acres does your vineyard have in production (planted and currently bearing fruit)?

- 0 to 1 acre
- 1 to 5 acres
- 5 to 10 acres
- 10 to 50 acres
- 50 to 100 acres
- More than 100 acres

How many non-bearing acres does your vineyard consist of (planted, but not currently producing)?

- 0 to 1 acre
- 1 to 5 acres
- 5 to 10 acres
- 10 to 50 acres
- 50 to 100 acres
- More than 100 acres

Do you sell:

- All of your grapes?
- Some of your grapes (keep a percentage for your own winery)?
- None of your grapes (keep all of your grapes for your own winery)?

What percentage of your grapes do you sell to outside wineries? (approximately)

- Less than 10%
- 10-20%
- 20.1-40%
- 40.1-60%
- 60.1-80%
- 80.1-99.9%

What percentage of your grape sales go to counties outside of the county your vineyard is planted in? (approximately)

- Less than 10%
- 10-20%
- 20.1-40%
- 40.1-60%
- 60.1-80%
- 80.1-99.9%

If you sell your fruit, what unit are you paid by?

- Pound/Ton
- Acre
- Other (Specify)

Do you use contracts in your grape sales?

- Yes
- No

How important is University/Extension programming on the following grape production topics?

	Less Important	Important	Very Important
Soil Fertility	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Weed Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Organic Production	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cover Crops	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sustainable Grape Production	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Production Economics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Crop Insurance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vineyard Installation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Weather	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disease Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pest and Insect Management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Safe Pesticide Use Education	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Irrigation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How important are these management practices on soil fertility?

	Less Important	Important	Very Important
Vine nutrition basics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nutrient Recommendations pre- and post-planting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Soil sampling, testing and interpretation of results	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Plant tissue analysis sampling, testing and interpretation of results	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cover-cropping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Using compost or other amendments	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How important are these management practices on weed management?

	Less Important	Important	Very Important
Conventional herbicides	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Organic herbicides	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cultivation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Alternative technologies (flame, microwave, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How important are these management practices/tools on disease management?

	Less Important	Important	Very Important
Cultural practices such as shoot-thinning and leaf removal, water management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fungicides	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A disease prediction model	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Plant pathology models for predicting powdery mildew primary infection periods	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disease-free planting materials	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Disease vector control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How important are these management practices on pest and insect management?

	Less Important	Important	Very Important
Conventional pesticides/insecticides	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Insect life stage/pressure model	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Beneficial insects used for biological control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Integrated pest management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pest scouting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How important are the following weather and climate-related topics to the management of the vineyard?

	Less Important	Important	Very Important
Basic climatological and meteorological education	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Predictive phenology models (budbreak, bloom, veraison)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Effects of weather (temperature, precipitation) during ripening on fruit composition at harvest (Brix, TA, pH, phenolics)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Extension/ Technology Transfer

	Less Important	Important	Very Important
How important are extension/education services to you?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How important is having an area agent for Viticulture in Arizona?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Extension programming on specific aspects of viticulture	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fact sheets/ bulletins on viticultural practices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Conferences and workshops	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vineyard tours	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vineyard visits by extension agents	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Distance education	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Social media	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Podcast	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

How likely would you be to use a web- and map-based site selection tool?

- Unlikely
- Likely
- Very Likely

How important would varietal evaluations regarding the following characteristics be?

	Not at all important	Slightly important	Moderately important
Disease resistance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fruit quality (Brix, TA, pH, phenolics)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Yield	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Phenological timing (budbreak, bloom, ripening)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



AUTHORS

MATTHEW M. HALLDORSON
Yavapai County Director

JEREMY WEISS
AZMet Program Manager

JOSH SHERMAN
County Agriculture Agent, New Mexico State University

VALERIE RAULUK
Founder and CEO, Venture Catalyst, Inc

CONTACT

MATTHEW M. HALLDORSON
mmhalldorson@arizona.edu

This information has been reviewed by University faculty.
extension.arizona.edu/pubs/az2081-2024.pdf

Other titles from Arizona Cooperative Extension can be found at:
extension.arizona.edu/pubs

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Edward C. Martin, Associate Vice President and Director of the Arizona Cooperative Extension System, The University of Arizona. The University of Arizona is an equal opportunity, affirmative action institution. The University does not discriminate on the basis of race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, or genetic information in its programs and activities.