



Needs Assessment for Commercial Horticulture and Small Acreage in North Central Arizona

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Summary

Understanding the needs of stakeholders is crucial for extension and outreach programs, especially in developing new programs. From January to April 2020, a needs assessment was conducted in Yavapai and Coconino Counties for the newly created Commercial Horticulture and Small Acreage (CHSA) program. The information from the needs assessment is important to extension agents, farmers (existing and potential future farmers), researchers, policymakers, and private organizations interested in CHSA farming in the region. This needs assessment helped to identify the stakeholders in north central Arizona for the CHSA program and has established the needed connections for fruitful collaboration. The growers are passionate about sustainable agriculture practices and operations that have low synthetic chemical inputs. Most of the growers have a ready market for their products by selling at the farmer's market, to restaurants, and community supported agriculture (CSA). The growers see engaging with researchers and industry in research and extension activities as very important and indicated their willingness to initiate on-farm research. Stakeholder responses identified workshops, farm tours, farm visits by an agent, and farmers' school with short courses, distance/online programs, telephone calls, and sharing fact sheets as the most preferred format for educational program delivery.

Introduction

Yavapai and Coconino Counties are in north central Arizona, with elevations ranging from 1,900 feet in the Sonoran Desert areas near Phoenix to over 12,500 on Mount Humphries near Flagstaff. Currently, small farms are mostly located in the greater Flagstaff and Navajo Reservation areas of Coconino County and the Verde Valley, Chino Valley, Paulden, Dewey, Cordes Junction, and Prescott areas of Yavapai County. The counties have rich cultural diversity, including the Native American tribal communities that have resided here and grown food crops for thousands of years. The population in the two counties increased in recent years with diverse economic activities, including estate development and tourism. There is a

growing demand for locally grown food. However, most of the food consumed in the area is transported great distances from farms outside the region. This led to the creation of a faculty position by the University of Arizona Cooperative Extension with research and extension responsibilities focusing on commercial horticulture and small acreage. This position aims to promote local production of fruits, grains, and vegetables in the area through structured, non-formal education programs with science-based research information. This requires understanding the needs and interests of local producers and stakeholders and the level of readiness to collaborate with extension faculty. This needs assessment will assist in the development of programs that meet the needs of stakeholders at an appropriate level of collaboration to promote the adoption of innovative practices and to increase local food production in Northern Arizona.

Materials and Methods

The survey was conducted from January to April 2020 in Yavapai and Coconino Counties in Arizona using an online format (Qualtrics) and printed copies. The survey questions (Appendix) were reviewed and approved by the Institutional Review Board (IRB) of the University of Arizona before sending them out. Farmers included in this survey were crop producers and growers whose activities were commercial, meaning they fully or partially make their family income from it. In total, 80 surveys were sent out and 30 responses were received.

Result

Demographic Information of Participants in this Needs Assessment

Summary of demographic

Thirty (30) growers in northern Arizona participated in the survey but not all responded to all the questions.

- Twenty-eight (28) growers responded to county location question with 68% of the growers in Yavapai and 32% in Coconino (Fig. 1a).

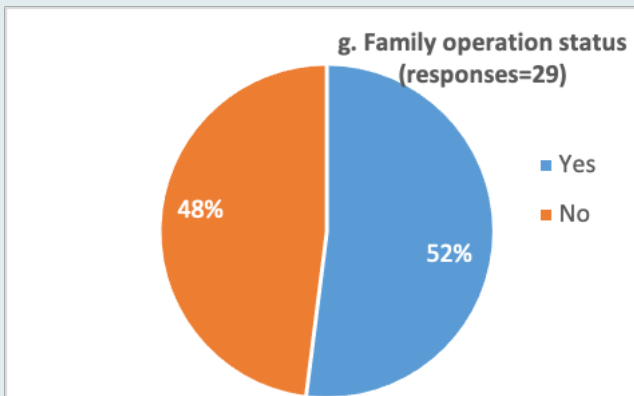
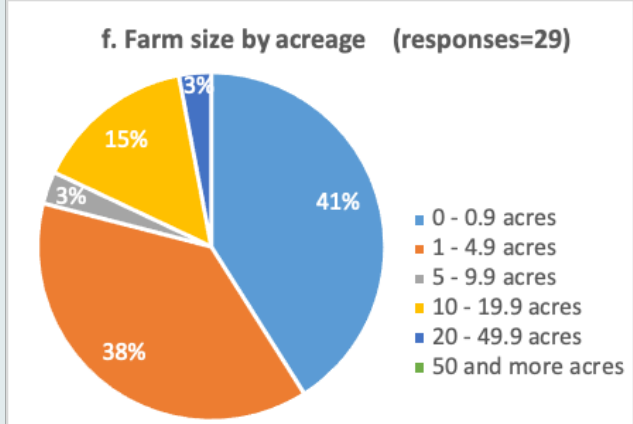
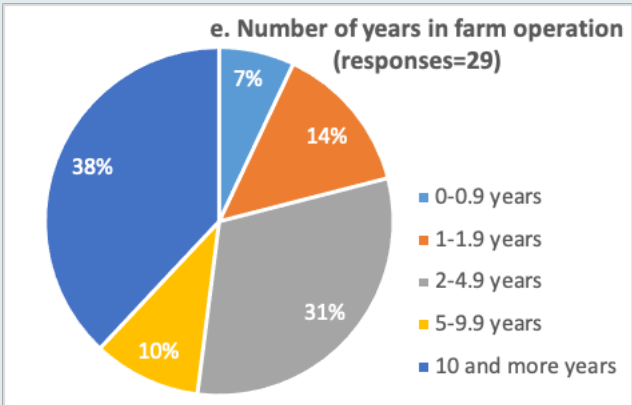
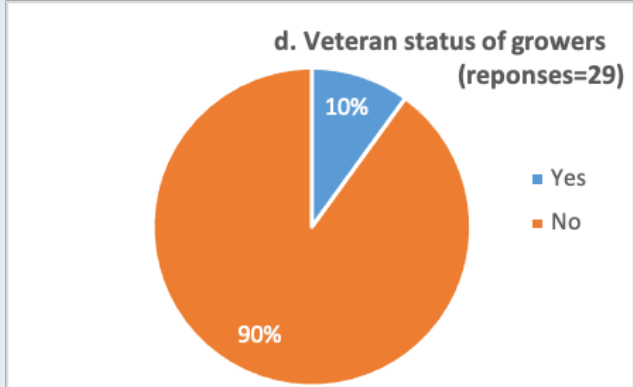
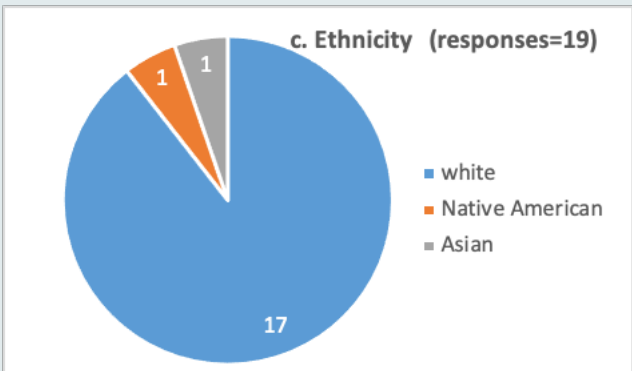
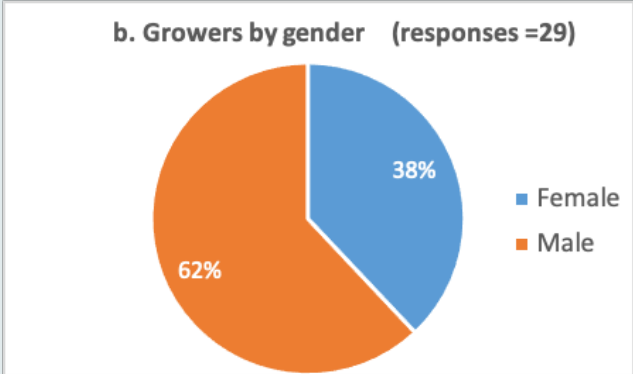
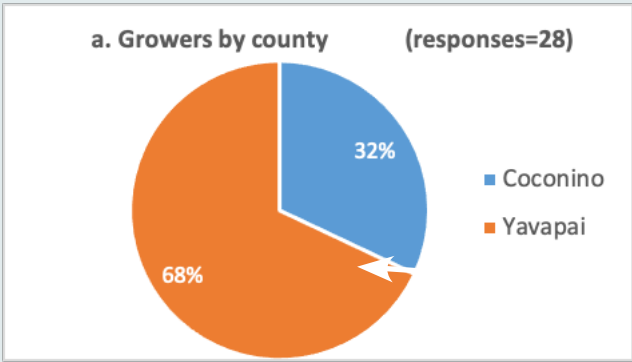


Figure 1: Demographic information of north central Arizona commercial horticulture and small acreage growers

- Twenty-nine (29) growers responded to the gender question with 62% male and 38% in female growers (Fig. 1b).
- Only 19 growers participated in the ethnicity question with 17 White, 1 Asian and 1 Native American (Fig. 1c).
- Twenty-nine (29) growers responded to the veteran status question with 10% veterans and 90% non-veteran growers (Fig. 1d).
- Twenty-nine (29) growers responded to the number of years in operations. Most of the growers are first generation farms with 52% (less than 5 years in operation), 38% (more than 10 years in operation), and 10% (5-9.9 years in operation) (Fig. 1e).

Market Information

Summary of market

Thirty (30) growers in northern Arizona participated in the survey but not all responded to all the questions.

- Out of the 29 growers who participated in the survey, 79% have available markets for their products while 21% did not (Fig. 2a).

- Out of the 29 growers who participated in the survey, 68% used the sales as supplemental income while the remaining 38% depended on the farm sales as their main family income (Fig. 2b).
- 82% of growers made less than \$25,000 as their annual income, 11% (\$26,000 to 50,000), and 7% (\$200,000 and more) (Fig. 2d).
- The most common markets for growers are the farmer’s market, CSA, and restaurants (Fig. 2c).

Production Systems and Types of Crops

Summary of production systems

Thirty (30) growers participated in the survey but not all responded to all the questions.

- For the production systems, 23% had their farms only in open fields, 13% greenhouses or hoop houses, and 57% operated in both open fields and greenhouses or hoop houses with 7% indicating other systems (Fig. 3a).
- 52% of the crops grown are horticulture crops (vegetables and fruits), 3% grew field crops, and landscape and ornamentals horticulture while 32% produced two or more of the crop groups (Fig. 3b).

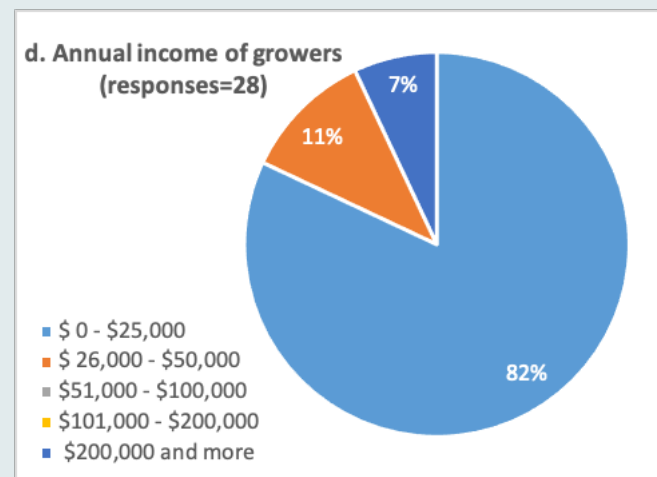
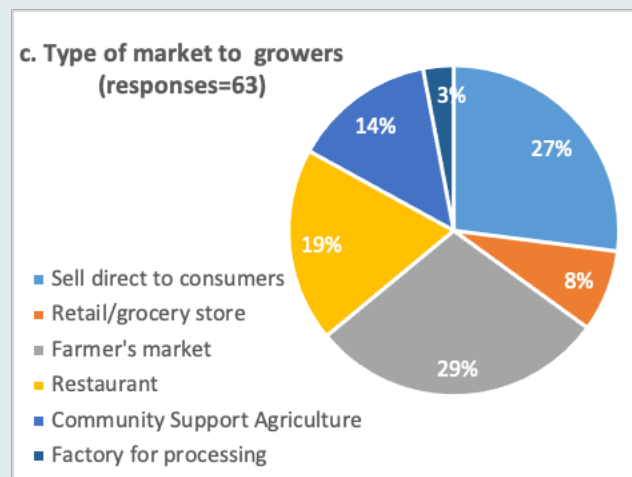
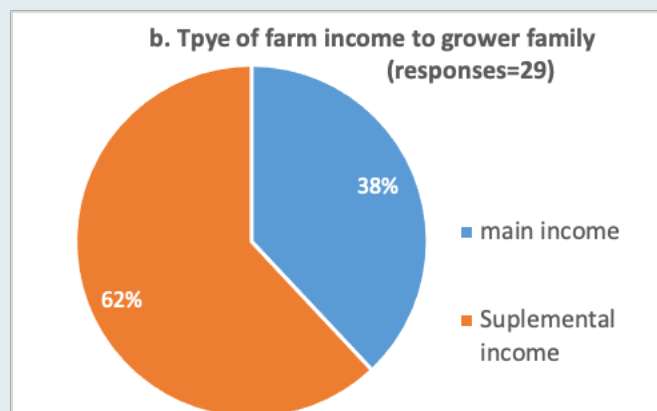
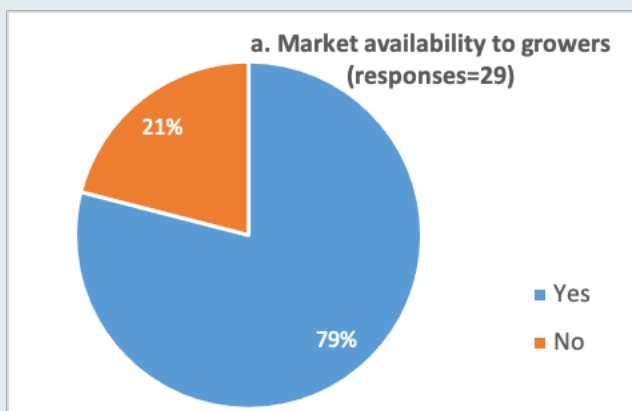


Figure 2: Availability of markets, market type, and type of income source to growers in north central Arizona.

- None of the growers are USDA organic certified, about 20% are self-defined organic growers, 10% conventional growers and about 70% defined themselves as sustainable producers (Fig. 3c).
- 54% of growers used drip irrigation, 21% sprinklers, 11% open flood and 2% each used sub-surface drip and pivot sprinklers while 8% of the growers used other irrigation systems such as hand watering or hydroponics (Fig. 4b).

Water Sources and Irrigation Systems

Summary of water sources and irrigation systems

- 50% relied on well water for irrigation, 27% on rainwater, which included rain harvesting (Fig. 4a).

Current Land Use and Cultural Practices

Summary of land use and cultural practices

- Common land use practices include no-till, reduced tillage, crop rotation, and the use of cover crops (Fig. 5a).

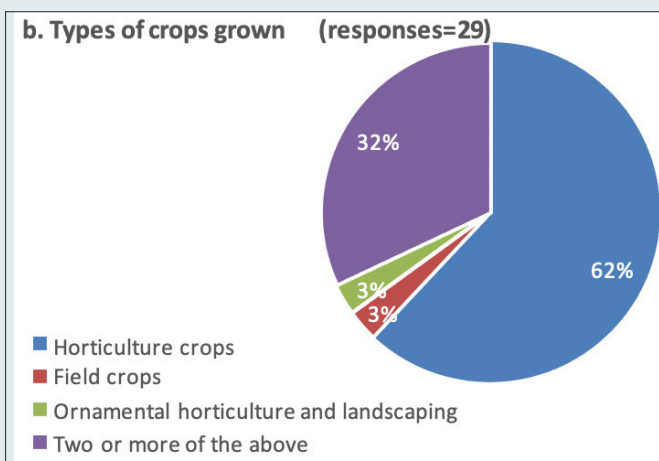
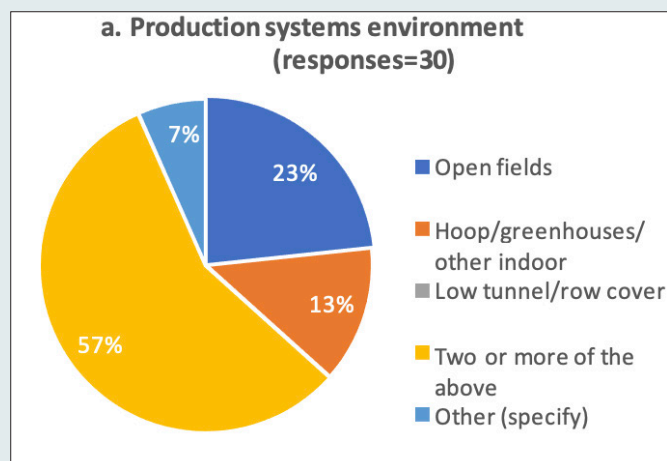


Figure 3: Production environments and types of crops grown in north central Arizona

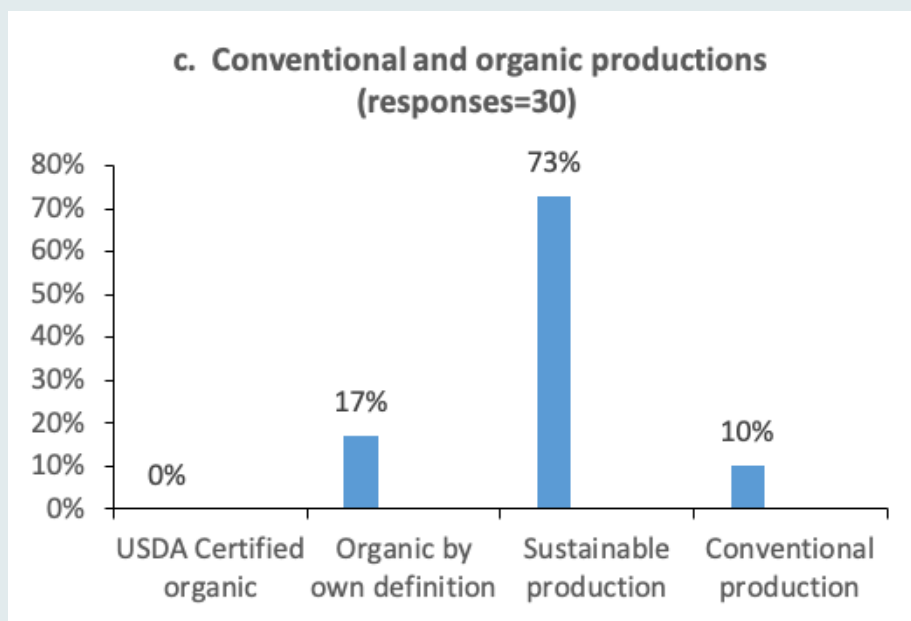


Figure 3c: Conventional and organic production systems (n=30). (sustainable production includes resource use efficiencies and recycling; conventional includes the use of synthetic fertilizers and synthetic herbicides)

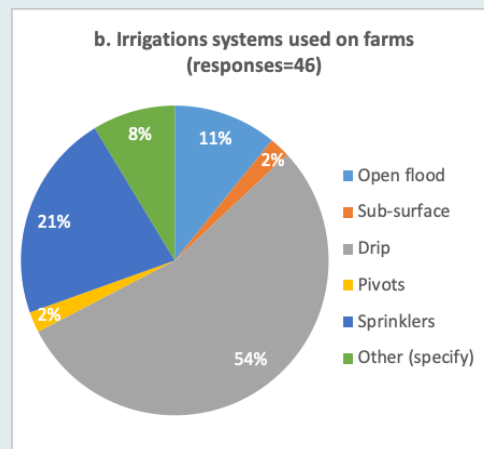
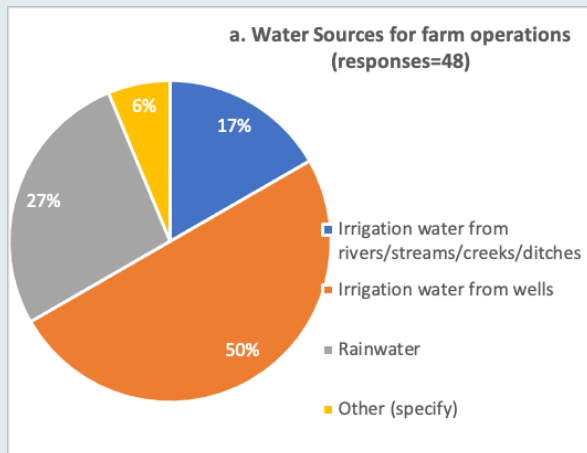


Figure 4: Water sources and irrigation systems used among north central Arizona growers (Others water sources include city and reclaimed water while other irrigation systems includes hand watering and hydroponics. The north central number of responses in each case, is higher than the actual number of participants for the survey because the farmers could make multiple choices.

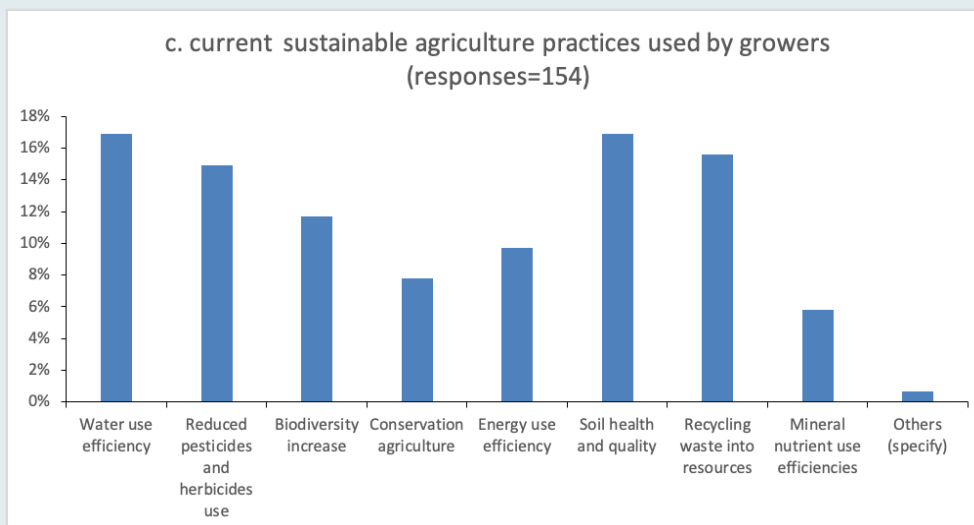
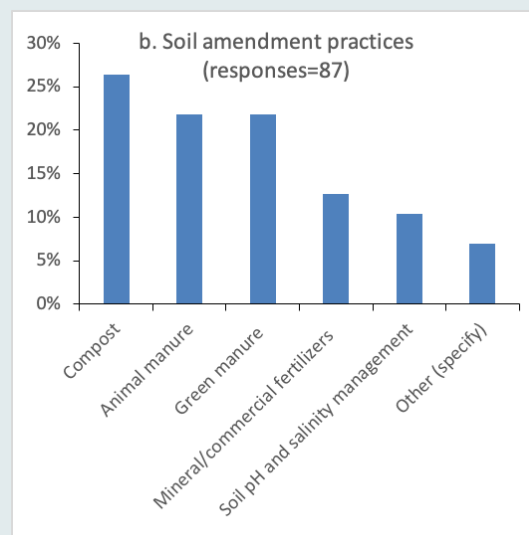
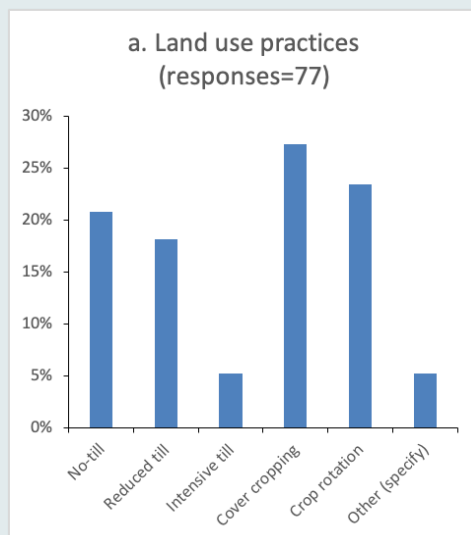


Figure 5: Land use, soil amendment, and sustainable practices (other soil amendment practices includes humic acids, worm castings, and soil microbial inoculations). The number of responses in each case, is higher than the actual number of participants in the survey because the farmers could make multiple choices.

- Compost, animal, and green manure were the most common soil amendment practices while less used of synthetic mineral fertilizers (Fig. 5b).
- Common sustainable practices include water use efficiencies, reduced pesticide and herbicide applications, soil health practices, and recycling waste products (Fig. 5c).
- Growers adopted more biological and cultural control practices for weed, pest and disease management and only used chemicals that are allowed in organic production systems (Fig. 6).
- Rodents are the most common wildlife issue the growers contend with, followed by large mammals and birds, respectively (Fig. 7).

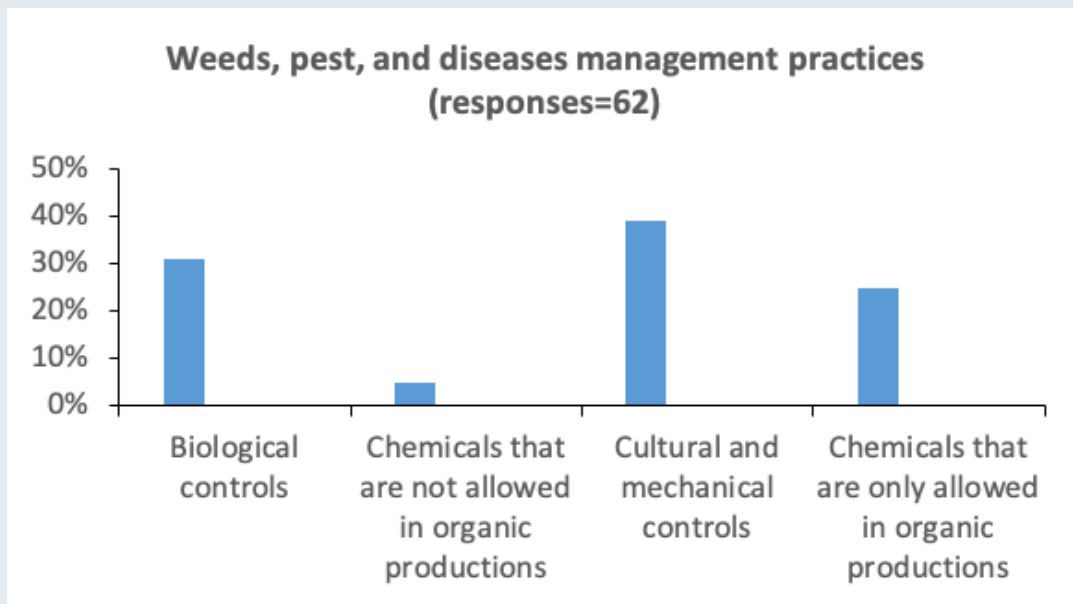


Figure 6: Weed, pest and disease management practices among growers in north central Arizona. The number of responses in each case, is higher than the actual number of participants in the survey because the farmers could make multiple choices.

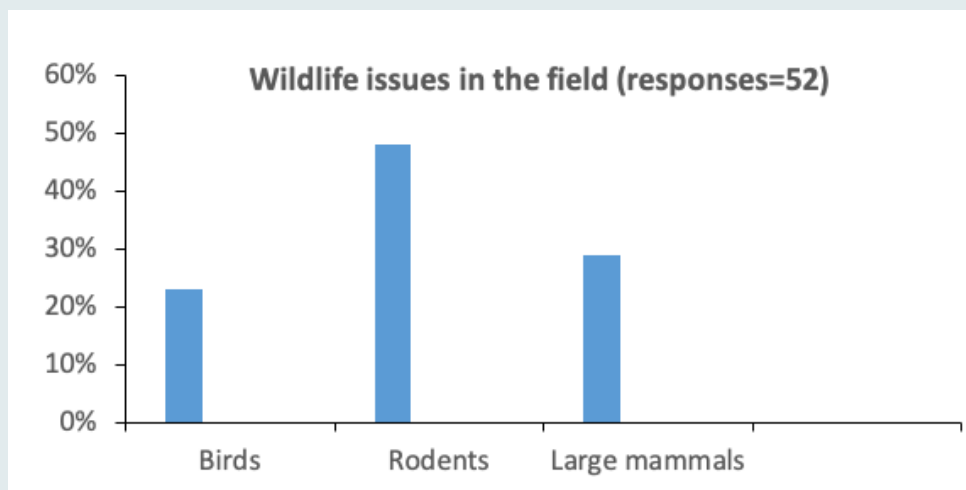


Figure 7: What wildlife issues for northern Arizona growers. The number of responses in each case, is higher than the actual number of participants in the survey because the farmers could make multiple choices.

Post-production and Market Information

Summary of post-production and marketing information

This section gives a brief overview of the growers' interest in post-harvest activities such as market branding and value addition.

The most important topic for the growers was the promotion of their produce locally under the brand name “buy local and eat local”. They also wanted assistance for value addition to their products, postharvest technology, and food safety (Fig. 8).

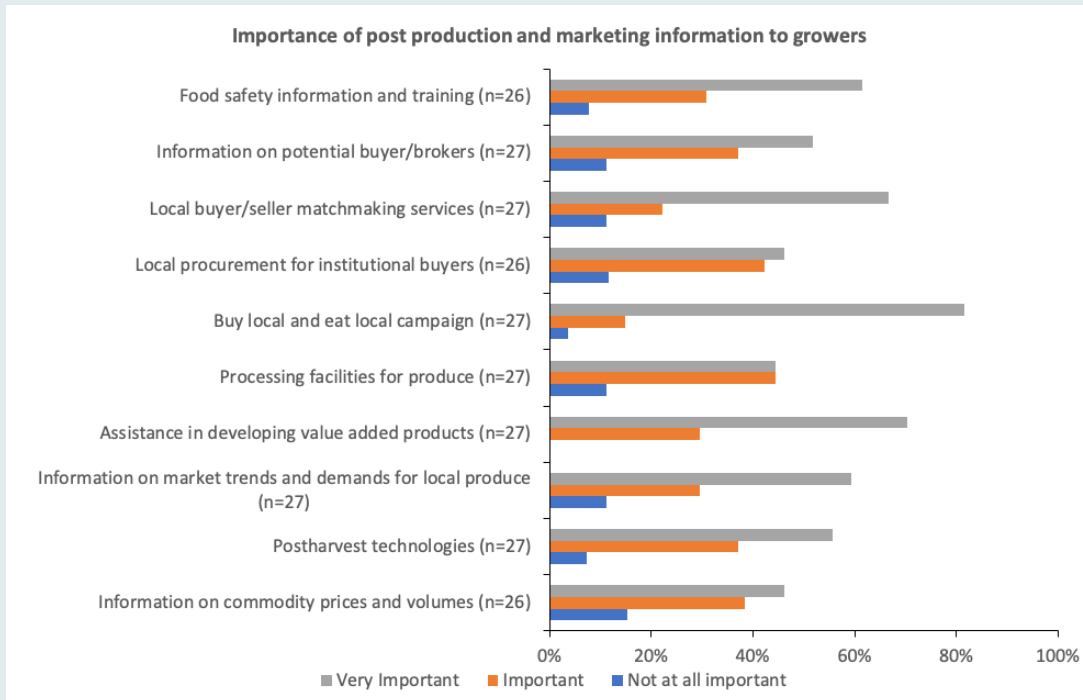


Figure 8: Importance of food safety, post-production, and marketing information to north central Arizona grower

Research and Extension Interests of Growers

Summary of research and extension interest of growers

This section provided an overview of topics for research and extension programs growers are most interested in.

Soil health, soil fertility, crop pest and insect management, and sustainable agriculture practices were the most important research and extension topics for growers with over 80% selecting ‘very important’ (Fig. 9). This was closely followed by weed and disease management, irrigation and efficient water use, food safety, and conservation agriculture with 70-80% selecting ‘very important’ (Fig. 9).

The least important research and extension areas for the growers were agroforestry, conventional agriculture, and certified organic production with 20-35% responding ‘not important’ (Fig. 9).

On specific soil management practices, growers were most interested in research and extension programs that focus on soil biology and health and the use of manure and compost with 70-85% responding ‘very important’. There was some interest in other management practices such as soil pH, erosion, the use of mineral fertilizers, and soil inoculants (Fig. 10).

For weed control, growers were more interested in research and extension programs focusing on cultural control and biological methods, and the use of organic herbicides. Some growers indicated they are interested in the use of conventional herbicides (Fig. 11a).

Interest in research and extension programs for pest and disease control management followed a similar pattern as weed control with more interest in cultural, biological, and integrated approaches while over 50% saw the use of conventional and synthetic chemicals as not important to them (Fig. 11 b & c).

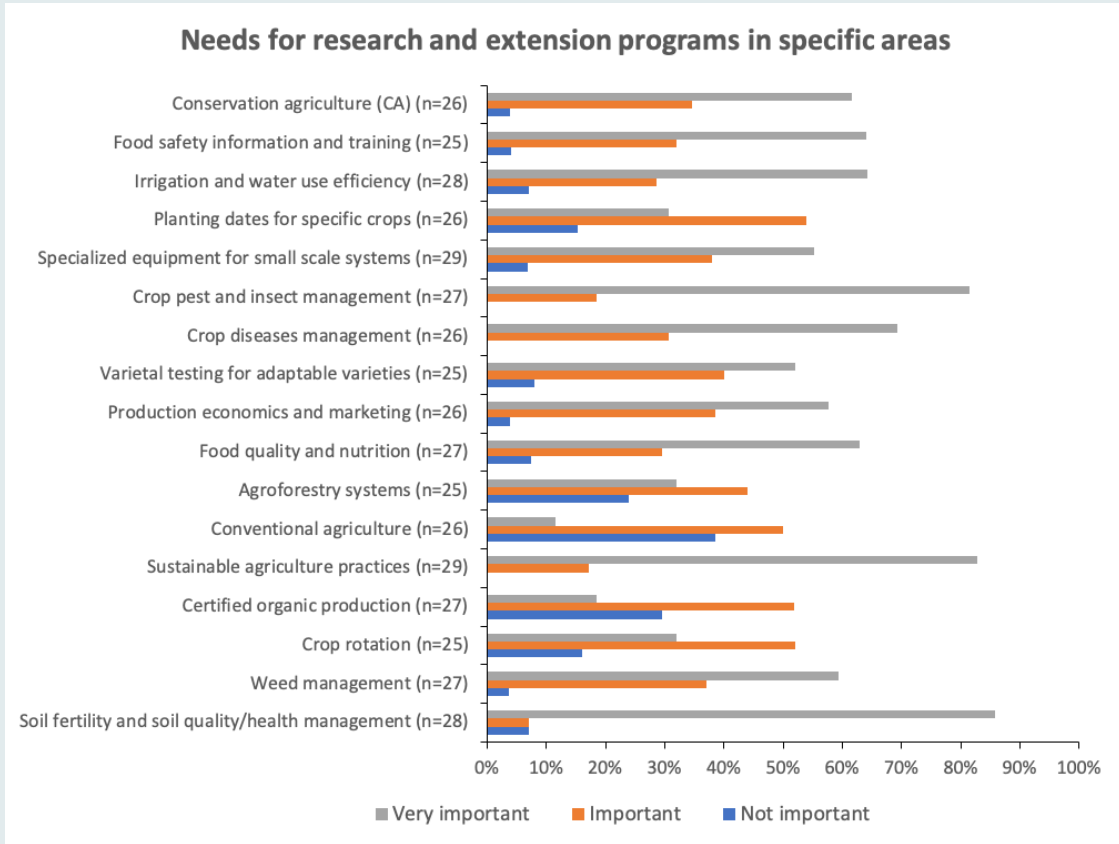


Figure 9: Research and extension production topics of interest to growers in northern Arizona

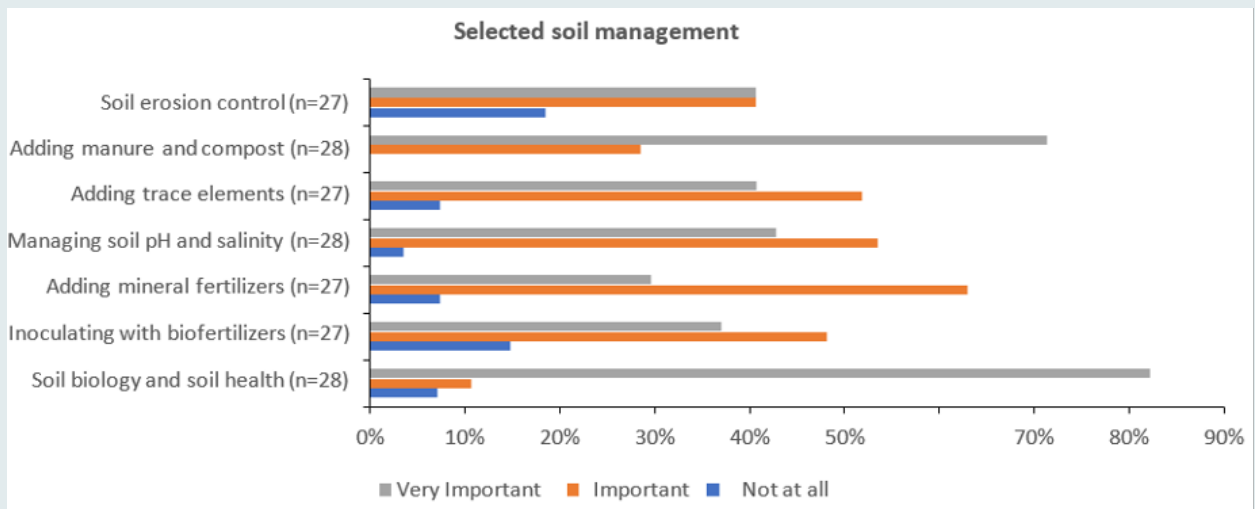


Figure 10: Importance of selected soil management practices to northern Arizona growers

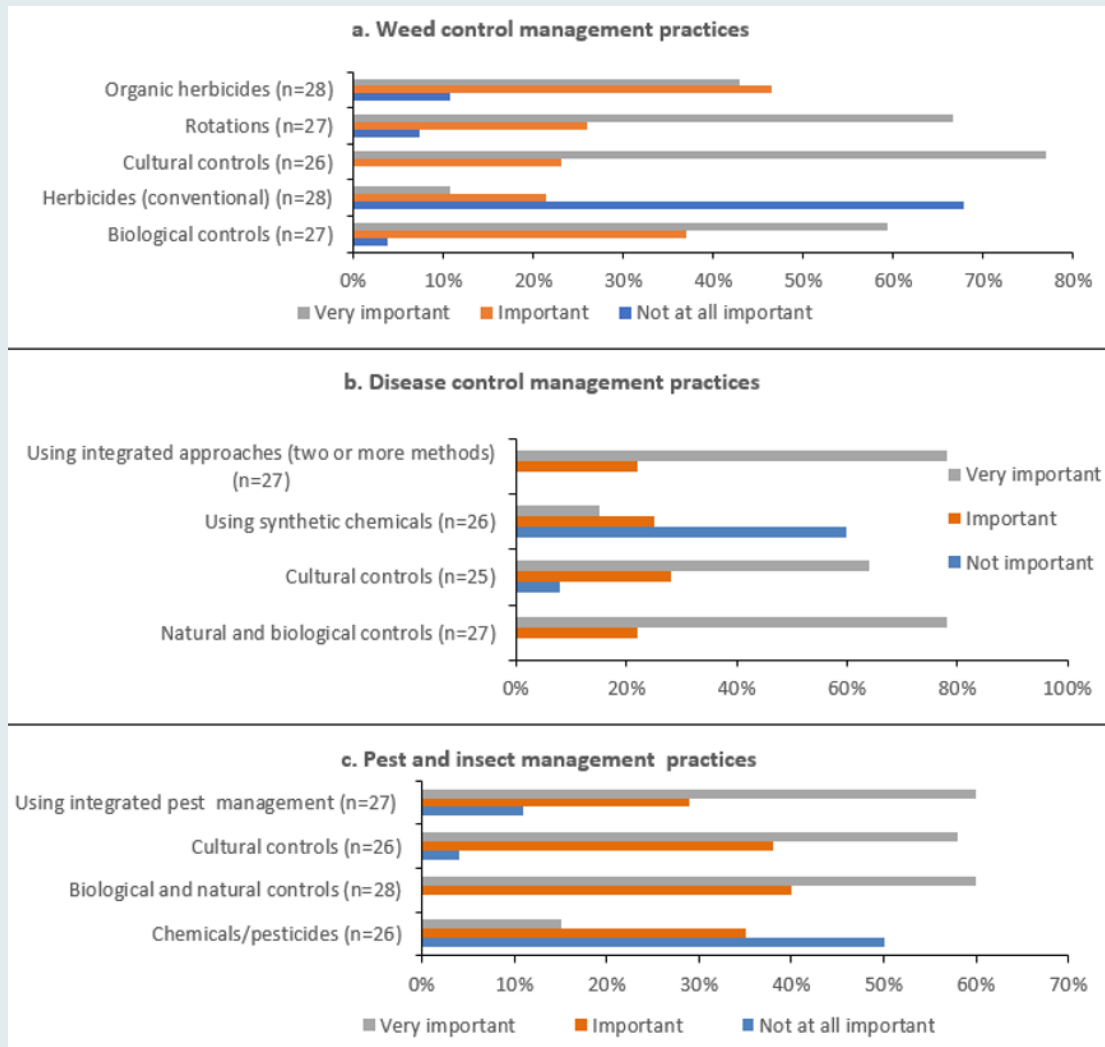


Figure 11: Importance of selected weeds, insects, and diseases management practices to north central Arizona grower

The growers were very interested in sustainable practices and learning more through research and education programs (Fig. 12).

Growers level of involvement in research collaborations

Summary of grower's preference for research location and level of engagement

This section sought to understand grower's preference for research locations and the level at which they want to be engaged in research.

The level of interest for research on the farmer's field and at the regional research station was the same and was selected as

'very important' (Fig. 13a). Regarding the level of engagement, the growers wanted a high level of involvement in research activities and saw serving as project advisory committee members, collaborating with researchers and industry, and initiating their own research as 'very important' (Fig. 13b).

Growers preferred format for extension programs

Summary of preferred extension outreach format

This section examined the interest of growers in extension activities and the preferred format of program delivery.

Generally, growers considered extension programs to be 'very important' (54%) to them with preferred formats to be

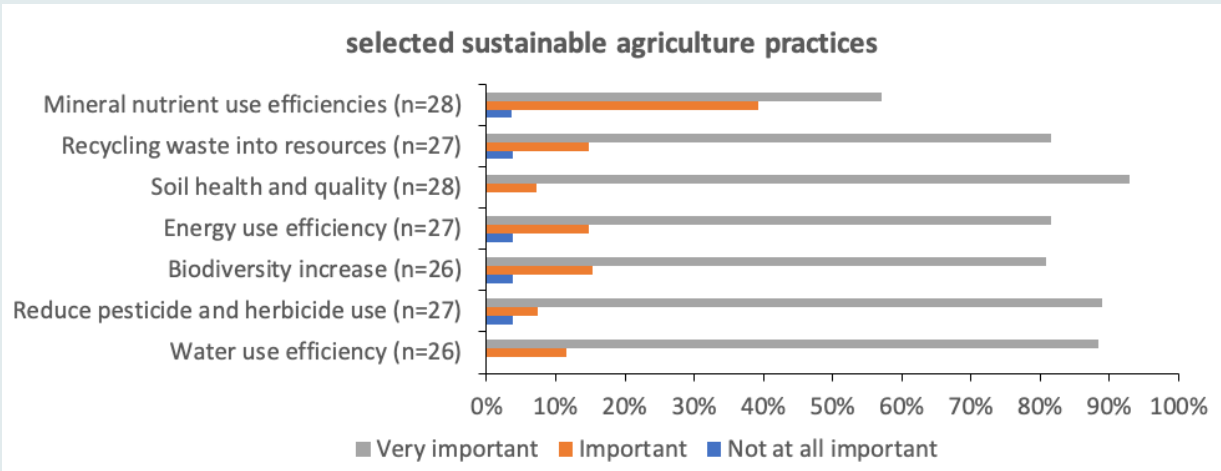


Figure 12: How important these sustainable agriculture practices are to north central Arizona growers

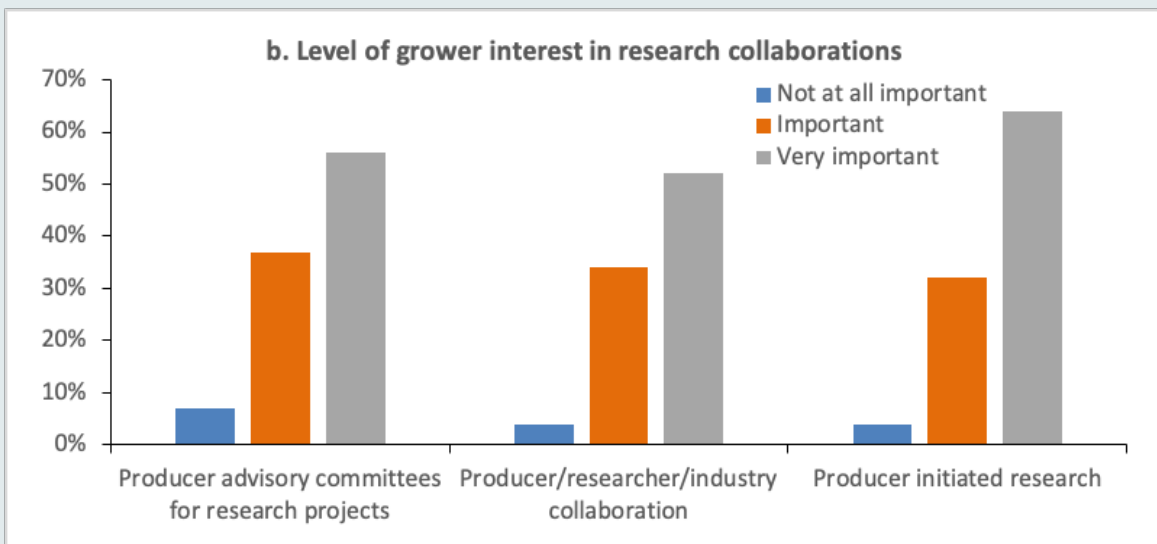
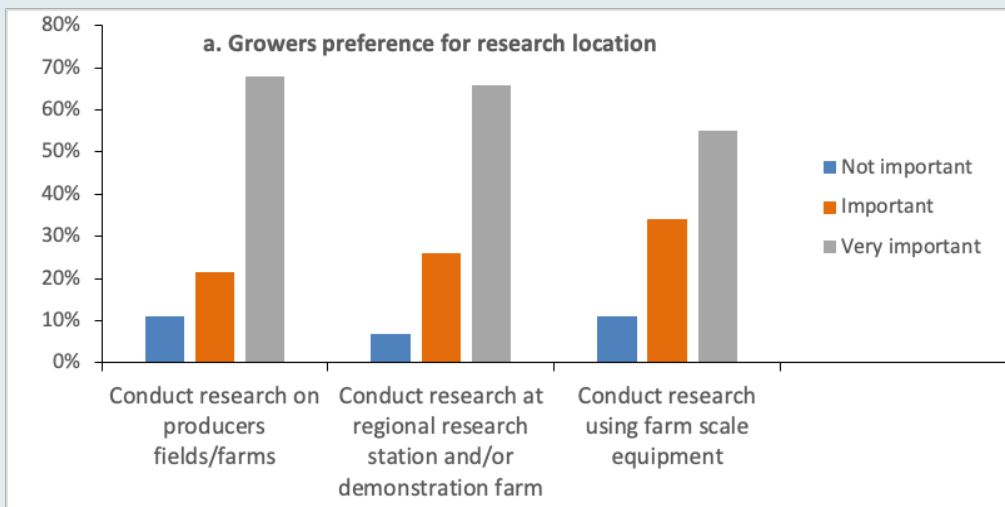


Figure 13: Growers preference for research location and interest in research involvement

workshops, farm tours, farm visits by agent, and farmers' school with short courses. Other important formats are distance/online programs, telephone calls, and sharing fact sheets (Table 1).

Popularity of Cooperative Extension activities to growers

Summary of popularity of Cooperative Extension Activities to growers in Northern Arizona

The knowledge about Cooperative Extension and the newly hired agent is popular among growers with limited knowledge about the Cracchiolo DK Ranch Experiment

Station. Ninety-seven percent (97%) of the growers identified the newly hired agent and the DK Ranch as 'important' to 'very important' to them (Fig. 14).

Conclusion

The needs assessment helped to identify stakeholder needs and interests in north central Arizona for the University of Arizona commercial horticulture and small acreage program and established connections for fruitful collaboration. It also provided basic data to support future proposal development and collaborations with farmers, extension agents, policymakers, and private organizations

Table1: Preferred format for extension and educational information delivery and outreach?

	Not at all important	Important	Very important	n
How crucial are extension and education services to you?	0%	46%	54%	28
Extension programs on specific aspects of cop production	7%	50%	43%	28
Fact sheets on commercial horticulture practices	11%	46%	43%	28
Workshops at the regional level	8%	23%	69%	26
Farm mentorship programs	7%	48%	44%	27
Farm tours/trips and events	4%	46%	50%	28
Telephone calls	18%	50%	32%	28
Conferences	15%	42%	42%	26
Farm visits by extension agent	7%	26%	67%	27
Distance/online education for commercial horticulture	7%	67%	26%	27
Farmers school with short courses at the regional level	15%	27%	58%	26
University degree courses on commercial horticulture and small acreage	23%	42%	35%	26
Sharing fact sheets and information on social media	8%	52%	40%	25
Sharing information through journal publications and extension bulleting	19%	48%	33%	27

interested in CHSA industry in the region. The growers were very passionate about sustainable agriculture practices and operations that have low synthetic chemical inputs. Also, growers saw engaging with researchers and industry in research and extension activities as very important. They identified workshops, farm tours, farm visits by an agent, and farmers' school with short courses,

distance/online programs, telephone calls, and sharing fact sheets as the most preferred format for educational program delivery. However, the COVID-19 pandemic could have affected reported figures on marketing and preferred formats of information delivery, which may require additional data to assess future situations on the ground.

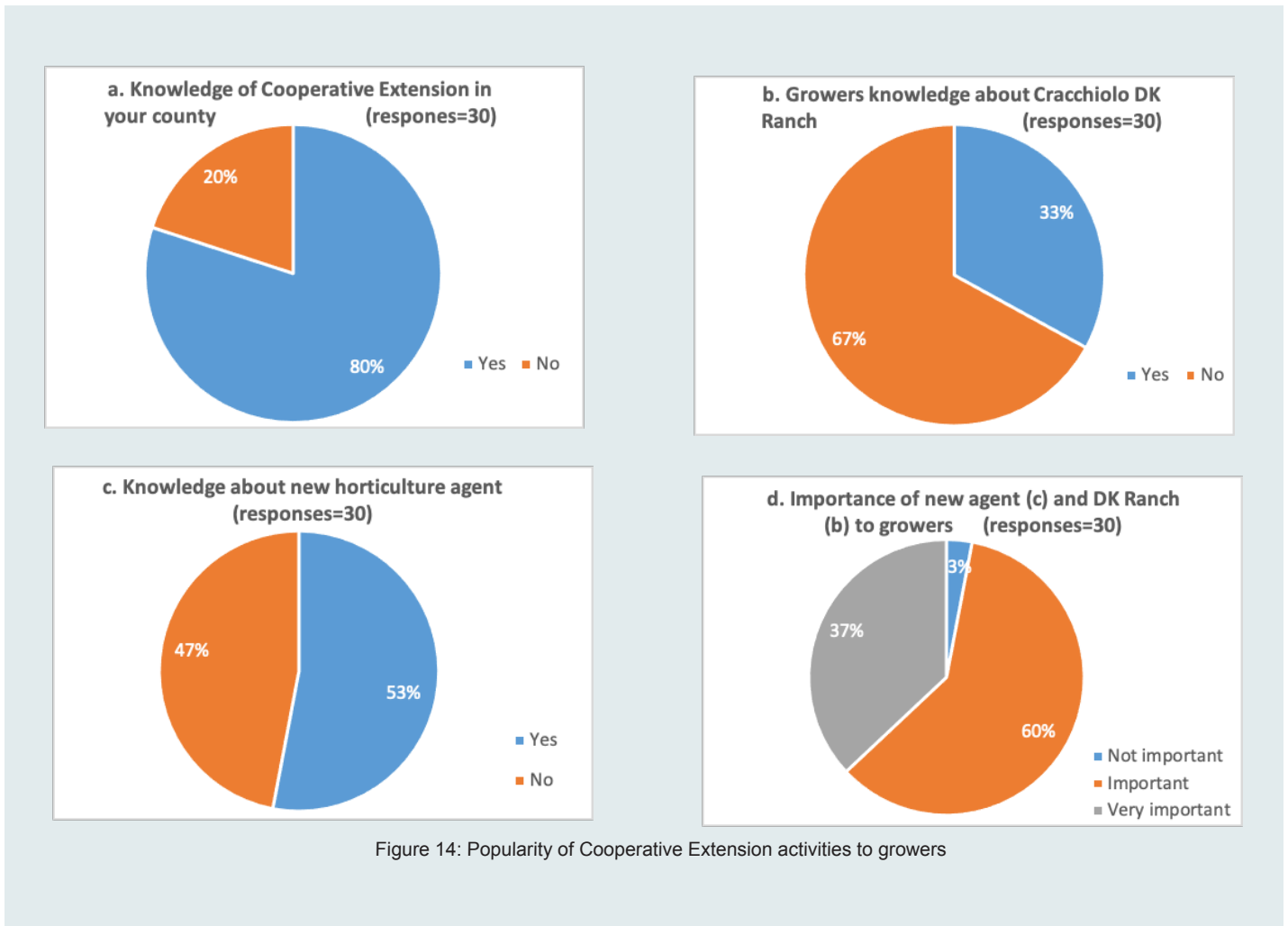


Figure 14: Popularity of Cooperative Extension activities to growers

Appendix -Survey Questions

Please respond to all questions if applicable or provide additional information.

Section A: About Cooperative Extension

- A1. Do you know about the University of Arizona Cooperative Extension in your county? (Circle the best option)
Yes No
- A2. Are you aware the University of Arizona received 42 acres of land at Cracchiolo DK Ranch as a donation from Steel Foundation for research and extension programming for Northern Arizona? (Circle the best option) Yes No
- A3. Are you aware the University of Arizona Cooperative Extension has employed an area agent for Commercial Horticulture and small acreage for the region? (Circle the best option) Yes No
- A4. How important in the information in A2 and A3 to you? (1=less important, 3=very important) 1 2 3

Section B: Production systems and on-farm practices

- B1. What is your Production systems environment? (Circle the best option)
- a. Open fields
 - b. Hoop/greenhouses/other indoor
 - c. Low tunnel/row cover
 - d. Two or more of the above
 - e. Others (specify.....)
- B2. What kind of production are you involved in? (Circle the best option)
- a. USDA Certified organic production
 - b. Organic production by own definition
 - c. Sustainable production (using practices that reduces negative impact on the environment)
 - d. Conventional production (this includes mineral/commercial fertilizers, pesticides and herbicides)
- B3. What kind of water do you depend on for your production? (Circle all that applies)
- a. Irrigation water from rivers/stream/creeks/ditches
 - b. Irrigation water from wells
 - c. Rainwater
 - d. Others (specify.....)
- B4. If you depend on a river/stream/creek/ditch, and want to share, please give the name in the box below (write in the space below if applicable)
- B5. What type of irrigation system do you use in your operation? (Circle all that applies)
- a. Open flood
 - b. Sub-surface
 - c. Drip
 - d. Pivots
 - e. Sprinklers
 - f. Others (specify.....)

B6. What land use practices do you implement on your field? (Circle all that applies)

- a. No-till
- b. Reduced till
- c. Intensive till
- d. Cover cropping
- e. Crop rotation
- f. Others (specify.....)

B7. What kind of soil amendments do you use? (Circle all that applies)

- a. Compost
- b. Animal manure
- c. Green manure (growing catch/cover crops and incorporating them into the soil before planting the main crop)
- d. Mineral/commercial fertilizers (this includes soil conditioners and lime)
- e. Soil pH and salinity management
- f. Others (specify.....)

B8. What practices do you carry out on your field to manage weed, pest, insect and disease? (Circle all that applies)

- a. Biological controls (using organisms to control harmful organisms that may damage our crops)
- b. Chemicals that are not allowed in organic productions
- c. Cultural controls (seeding rates, varieties, cropping management)
- d. Chemicals that are only allowed in organic productions
- e. Others (specify.....)

B9. What sustainable agriculture practices do you carry out on your farm?

- a. Water use efficiency
- b. Reduced pesticides and herbicides use
- c. Biodiversity increase
- d. Conservation agriculture
- e. Energy use efficiency
- f. Soil health and quality
- g. Recycling waste into resources (manure, composting, catch crops)
- h. Mineral nutrient use efficiencies
- i. Others (List.....)

B10. What wildlife is a major issue on your field? (Circle all that applies)

- a. Birds
- b. Rodents
- c. Large mammals
- d. Others.....

B11. How do you sway wildlife such as birds, rodents and large mammals from your farm?

List them

Section B: Production systems and on-farm practices

Grade your need for research and extension programs in these areas. (Check all row, 3 = very important while 1= less important)

C1. General information on production	Less important	Important	Very important
	1	2	3
Soil fertility and soil quality/health management			
Weed management			
Crop rotation			
Certified organic production			
Sustainable agriculture practices			
Conventional agriculture			
Agroforestry systems			
Food quality and nutrition			
Production economics and marketing			
Varietal testing for adaptable varieties			
Crop diseases management			
Crop pest and insect management			
Specialized equipment for small scale systems			
Planting dates for specific crops			
Irrigation and water use efficiency			
Food safety information and training (preventing food contamination and poisoning from field production to marketing)			
Conservation agriculture (CA)			

C2. How important are these management practices on soil fertility, quality and health to you?	Less important	Important	Very important
	1	2	3
Soil Biology-management to improve soil health (conservation agriculture, cover crops, crop rotation)			
Inoculating with biofertilizers			
Adding mineral fertilizers			
Managing soil pH and salinity			
Adding trace elements			
Adding manure and compost			
Soil erosion control			

C3. How important are these weed management practices to you?	Less important	Important	Very important
	1	2	3
Biological controls (natural and introduced diseases and predators of weeds)			
Herbicides (Round up and selective herbicides)			
Cultural controls (seeding rates, varieties, cropping management)			
Rotations (green manures, crop order)			
Organic herbicides			
What specific weeds are a problem in your fields? (.....)			

C4. How important are these crop disease management practices to you?	Less important	Important	Very important
	1	2	3
Promoting natural and biological controls (using beneficial bacteria)			
Cultural controls (crop rotations, intercrops, crop management)			
Using synthetic chemicals			
Using integrated approaches (combining two or more methods above)			

C5. How important are these crop pest and insect management practices to you?	Less important	Important	Very important
	1	2	3
Chemicals/pesticides			
Biological controls (e.g. releasing insect diseases or predators)			
Cultural controls (crop rotations, intercrops, crop management)			
Using integrated pest management (combining chemicals, biological and cultural approach)			

C6. How important are these sustainable agriculture practices to you?	Less important	Important	Very important
	1	2	3
Water use efficiency			
Reduce pesticides and herbicides use			
Biodiversity increase			
Carbon sequestering			
Energy use efficiency			
Soil health and quality			
Recycling waste into resources (manure, composting, catch crops)			
Mineral nutrient use efficiencies			

SECTION D: Research Management (this is how and where research should be conducted and the level of involvement)

	Less important	Important	Very important
	1	2	3
Conduct research on producers fields/farms			
Conduct research at regional research station and/or demonstration farms			
Conduct research using farm scale equipment			
What level of producer involvement is important to you?			
Producer advisory committees for research projects			
Producer / researcher/ industry collaboration			
Producer initiated research			

SECTION E: Post Production Needs (Please grade the importance of the following post-production processes and marketing information are to you as a grower)

	Less important	Important	Very important
	1	2	5
Information on commodity prices and volumes			
Postharvest technologies			
Information on market trends and demands for local produce			
Assistance in developing value added products			
Processing facilities for produce			
Buy local and eat local campaign			
Local procurement for institutional buyers			
Local buyer/seller matchmaking services			
Information on potential buyers/brokers			
Food safety information and training			

SECTION F: Extension/Technology Transfer (How do you prefer research and innovation information to reach you?)

	Less important	Important	Very important
	1	2	3
How crucial are extension and education services to you?			
Extension programs on specific aspect of crop production			
Fact sheets on commercial Horticulture practices			
Workshops at the regional level			
Farm mentorship programs			
Farm tours/ trips and events			
Telephone calls			
Conferences			
Farm visits by extension agent			
Distance education programs for commercial Horticulture			
Farmers school with short courses at regional level			
University degree courses on commercial horticulture and small acreage			
Sharing factsheets and information on social media			
Sharing information through journal publications and extension bulleting			

SECTION G: Grower Demographics

G1. Please circle the best option of or fill in the blank spaces below

County (Yavapai Coconino) Town/community.....

Gender (Male Female) Ethnicity..... Veteran (Yes No)

G2. Is your operation a family farm? (Circle the best option) Yes No

G3. How long have you been in operation?

a. 0-1 year

- b. 1-2 years
- c. 2-5years
- d. 5-10years
- e. More than 10 years

G4. How many acres do you have under production? (Circle the best option)

- a. 0-0.9
- b. 1-4.9
- c. 5-9.9
- d. 10-19.9
- e. 20-49.9
- f. More than 50

G5. How many acres do you envision having in the next 5-10 years? (Specify.....)

Section H: Products and market

H1. What crops do you grow now? (Circle the best option)

- a. Horticultural crops (fruits, nuts, vegetables, herbs and species)
- b. Field crops (cereals oilseed, pulses and forage)
- c. Ornamental horticulture/landscaping
- d. Two or more (specify.....)

H2. What crops do you want to grow in future? (Circle all that applies)

- e. Horticultural crops (fruits, nuts, vegetables, herbs and species)
- f. Field crops (cereals oilseed, pulses and forage)
- g. Ornamental horticulture/landscaping
- h. Others (specify.....)

H3. Do you have already a market for your produce? (Circle the best option) Yes No

H4. Where do you sell your produce?

- a. Direct to consumers
- b. Retail/supermarket/grocery store
- c. Farmer's market
- d. Restaurants
- e. Community support Agriculture (CSA)
- f. Export
- g. Factory for processing

H5. Is the farm you main source of household income?

- a. Yes-main source of income
- b. No-supplemental income

H6. How much do you make from the farm operation per year?

- a. \$ 0-25,000
- b. \$ 26-50,000
- c. \$51-100,000
- d. \$101-200,000
- e. More than \$ 20,000



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