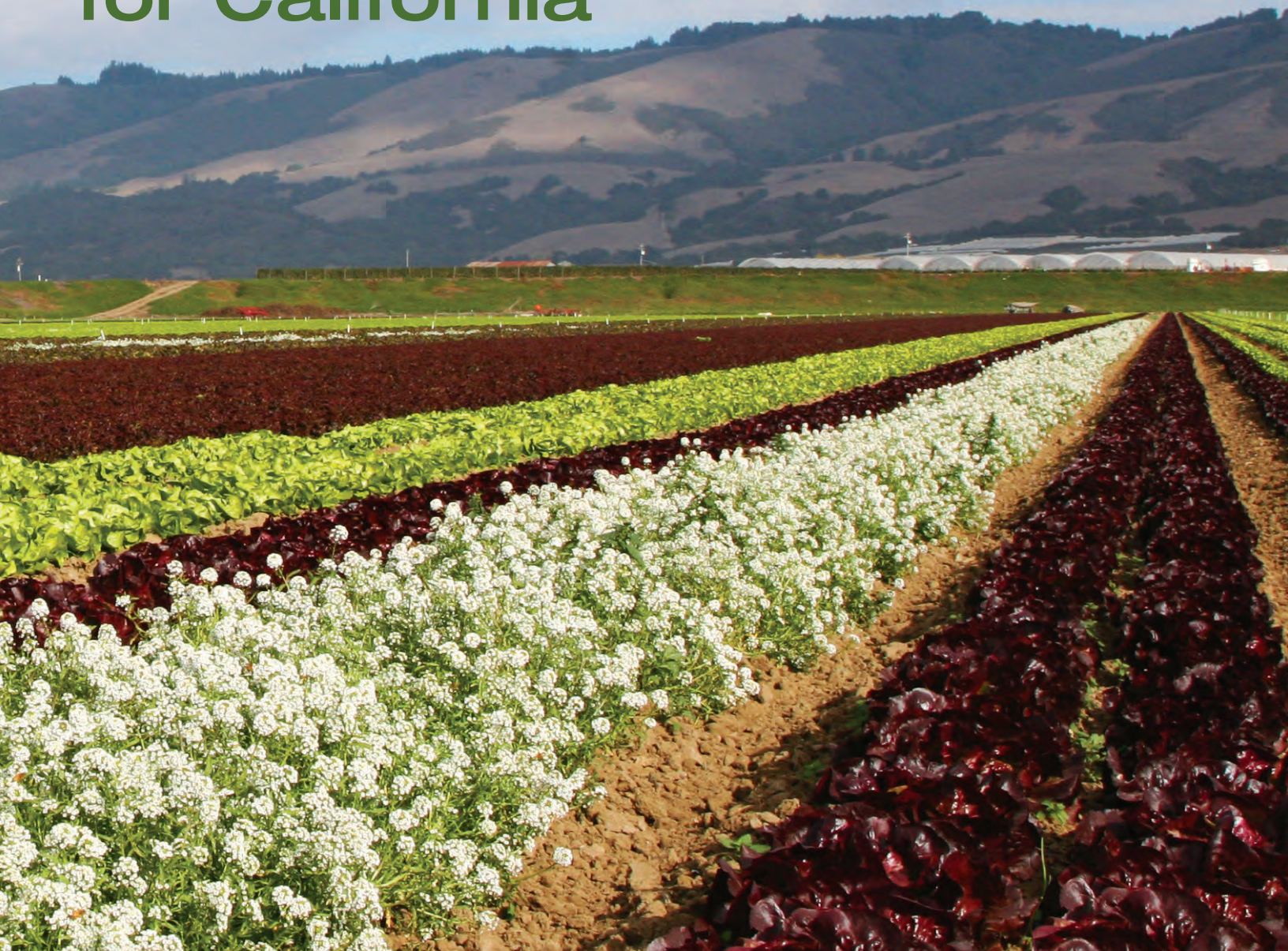


ORGANIC AGRICULTURE Research Priorities for California



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April 2017

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TOP OFRF RECOMMENDATIONS FOR CALIFORNIA

Based on feedback from survey respondents regarding high priority research needs in California, OFRF recommends expanded research funding and attention to the areas of:

- Irrigation and water management for coping with both drought and flooding
- Soil health
- Weed management
- Disease management
- Insect management

This report describes the most pressing challenges for organic producers in California as well as recommendations for future investment in organic agricultural research. These recommendations are based on the results of OFRF's 2015 survey of and listening sessions with organic farmers and ranchers from California. The 2015 Organic Farmer Survey was conducted online and completed by over 170 organic producers. Their responses directly inform our top recommendations for organic research.

OFRF also recommends prioritizing the following areas:

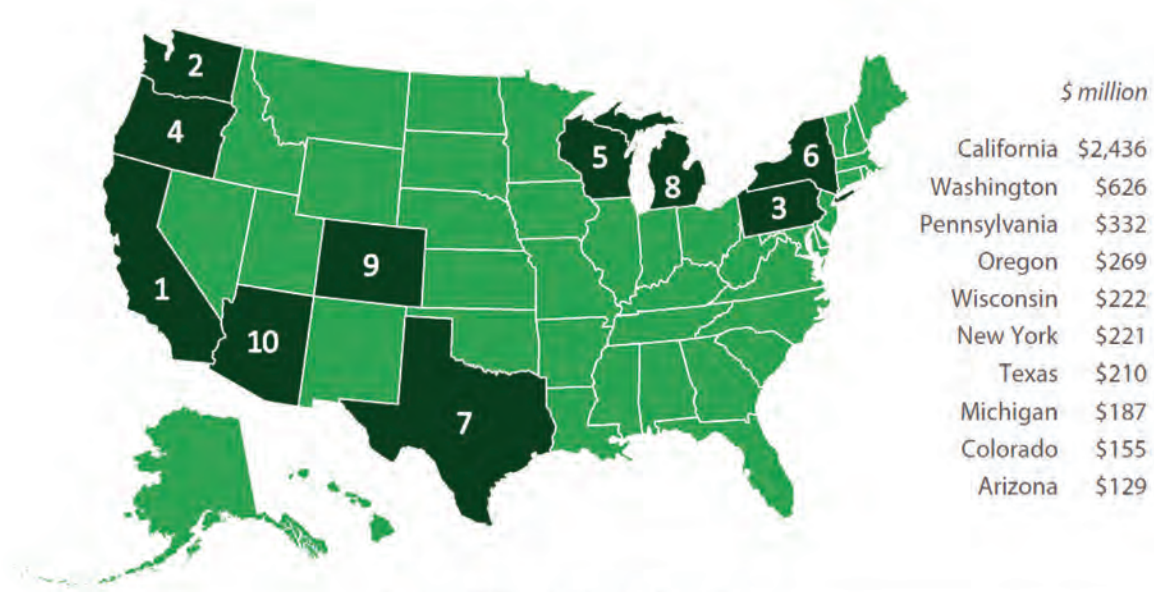
- Research and training for new and transitioning organic farmers on organic production practices, especially related to soil health.
- Research on livestock health, especially parasite control and organic animal nutrition.
- Development and selection of public livestock and poultry breeds for organic systems.
- Social science research on the marketing, policy, and economic barriers to successful organic production and barriers to transition, including issues of access to labor and equitable treatment of workers.

This report details the research priority areas and includes a discussion of the survey results leading to the development of OFRF's recommendations.

INTRODUCTION

Organic farming in California leads the way in sustainable food production in the US. For organic farming to expand, it is essential to provide research solutions to organic farmers' most pressing challenges. This report focuses on the needs of California's organic farmers in order to support the prioritization of funding for organic farming research. The information presented is part of the results from our national farmer survey and the OFRF report, *2016 National Organic Research Agenda*.

California has the largest number of organic farms: 2,805 in 2014, as well as the highest value in organic sales, \$2.2 billion (Figure 1). OFRF distributed a nationwide survey to organic farmers asking about their research needs; 173 California organic farmers completed the survey and 71 farmers partially completed the survey. This report is based on those survey responses as well as feedback from listening sessions. California Certified Organic Farmers (CCOF) conducted sessions from July-September, 2015 in Novato, San Luis Obispo, and San Juan Bautista, California. OFRF conducted sessions at the Ecological Farming Conference in Monterey in 2014 and 2015.



Source: USDA NASS 2015 Certified Organic Survey



Find out more at www.nass.usda.gov

Figure 1. States with the highest organic sales in 2015 (USDA, 2016).

ORGANIC AGRICULTURE SURVEY RESULTS

California farmers who participated in the survey ranged from beginning farmers with one year of organic farming experience to farmers who have been farming organically for more than 50 years. The size of the farms ranged from less than a tenth of an acre to over 10,000 acres. Fifty percent of the farmers surveyed transitioned to organic farming from conventional farming practices, and 45% began farming using organic practices. While 99% of the survey respondents had at least part of their land certified organic, many farmers also had uncertified acres under organic production, acres in transition to organic production, and acres under conventional production. CCOF was the certifier for 90% of the survey respondents in California.

TOP RESEARCH PRIORITIES IN CALIFORNIA

For California, the highest priority for research was listed as irrigation and drought management, which was rated as a high priority by 69.4% of respondents. Other top research priorities in order of importance include: a) soil health, biology, quality, and nutrient cycling; b) fertility management; c) weed management; d) disease management; e) insect management, and f) nutritional quality and health benefits of organic food (Figure 2).

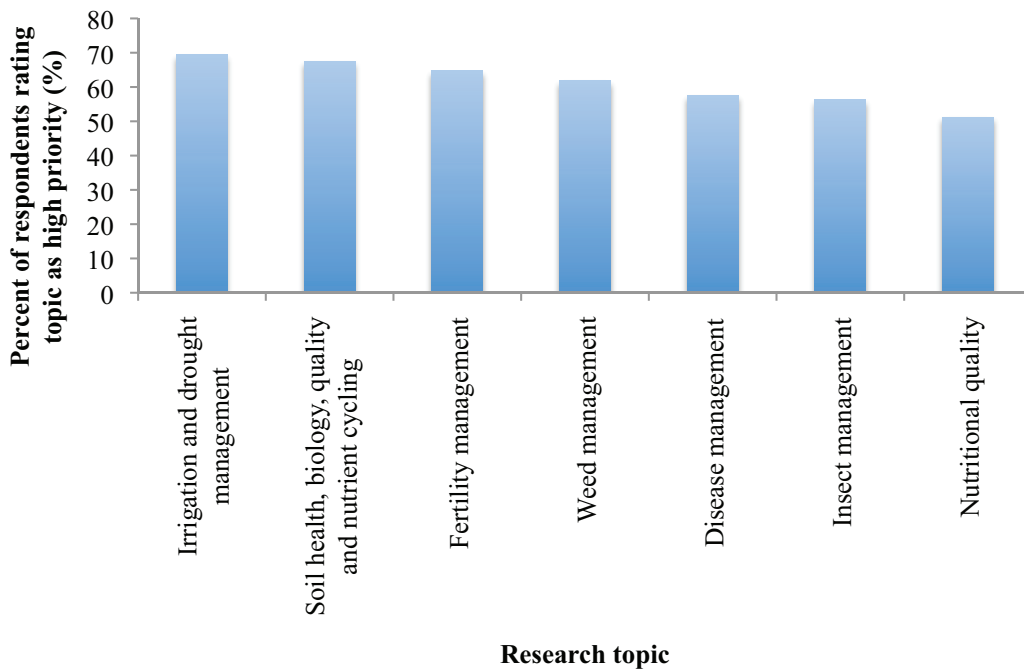
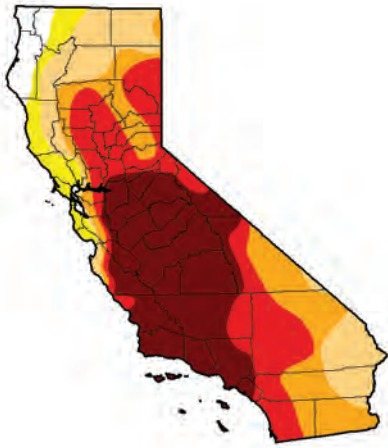


Figure 2. Top seven research priority areas identified in the OFRF survey of organic farmers in California.

Participants raised broad-scale research questions, such as the difference between organic and conventional production in terms of the impacts on water quality, biodiversity, and ecosystem health.

Water and Drought Management



As of January 2016, the majority of California was in extreme drought and 40% of the state was experiencing exceptional drought, the highest intensity of drought (Figure 3; Svoboda, 2016). This survey was distributed during the summer of 2015, one of the warmest years on record in California (NOAA, 2016). The topic of drought and how farmers can manage water to ensure the survival of their operations is of critical importance, and this was reflected in the survey with research on drought management the top priority for survey respondents (Figure 4).

Figure 3. Areas in brown represent exceptional drought and areas in red represent extreme drought in April 2016 (Svoboda, 2016).

Surveyed farmers expressed both the need for research to help with drought management as well as general concern regarding the drought.

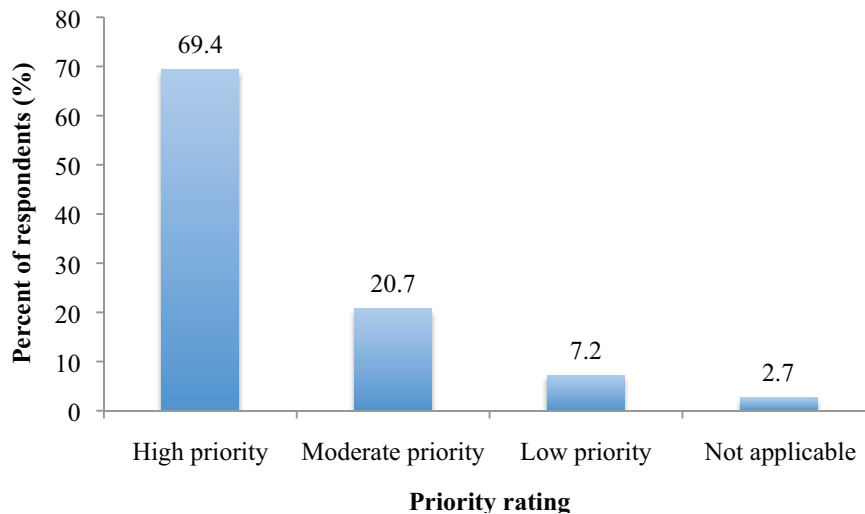


Figure 4. Priority rating of research on the drought by CA organic farmers in 2015.

Many growers listed the impact of the drought as their biggest production challenge. One producer stated they no longer grow grain because of the California drought. One survey respondent stated, “Weather, particularly drought issues are our most pressing concern. However, three years ago we were faced with the issues associated with drowning rain and lack of sunshine. We seem to be swinging between extremes annually. This June our weather was a 1 in 400-year drought.” Survey respondents reported the need for research on:

- Tracking water quantity, increasing soil water retention, water storage grant funding, and design for drought resistance.
- Coping with high salinity soils due to drought.
- Absorption and soil moisture maintenance.
- The impact of drought on pasture management (both soil and grass health).
- Increasing compost to reduce water use.
- The correct timing and type of irrigation (drip versus sprinkler) to reduce water use.
- Drought and pasture management.
- The effects of drought on soil and grass health.

The 2017 winter brought heavy rainfall and replenishment of the Sierra snowpack, leaving only a small number of California counties in an emergency drought situation (Executive Order B-40-17, 2017). The heavy rain from the 2017 winter caused its own challenges of flooding and water logging of agricultural fields. Research on how organic farmers in California can best cope with weather patterns of both intense drought and heavy seasonal precipitation is an important priority area.

Soil Health, Biology, and Nutrient Cycling

Research on soil health was identified as a high priority by 67.4% of survey respondents (Figure 5). Main research areas identified in the survey included:

- The use of probiotics for improving soil health.
- How to maintain and enhance soil biology while using standard tillage.
- How to maintain and enhance soil biology while using minimal tillage.
- How to bring health to soils that were degraded by conventional agriculture.
- The role of tillage in the ability of soil to sequester carbon.
- The role livestock can play in restoring degraded soil landscapes.

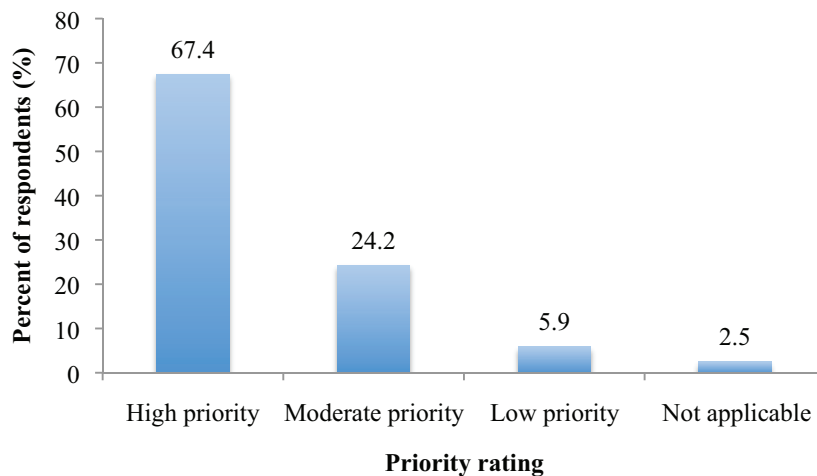


Figure 5. Priority rating of research on the soil health by California organic farmers in 2015.

In addition to survey data, listening sessions identified several areas for additional research related to soil health. Growers were interested in a range of nutrient, ecological, and biological issues. Topics of interest identified in the listening sessions (that were not previously mentioned in the survey results) include: the comparison of organic and conventional erosion rates, coping with salt build up in soil, the potential of biochar for improving soil health, and finding an alternative to rice bran for anaerobic soil disinfestation. The topic of climate change, specifically related to carbon sequestration, was listed as an important area of research. Many farmers expressed interest in learning about best cultural and land management practices to sequester carbon in the soil (Figure 6).

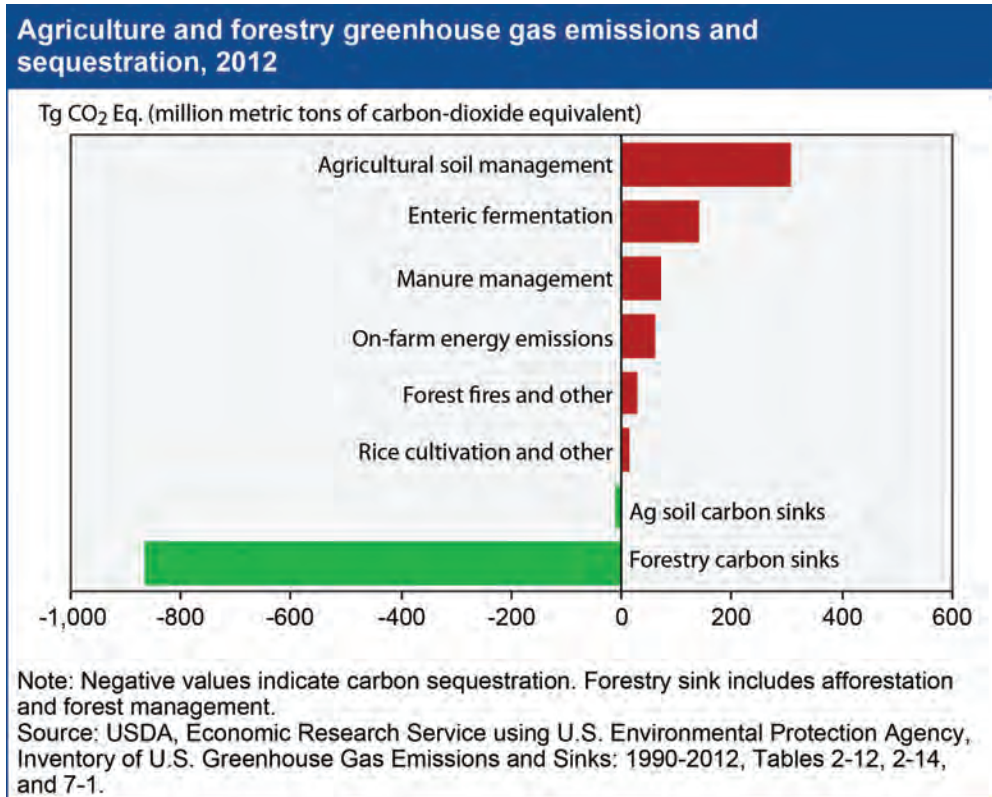


Figure 6. USDA chart demonstrating that current agricultural soil management leads to the release of carbon, whereas agricultural soil can also serve as a carbon sink.

Fertility Management

Research on fertility management was identified as a high priority by 64.8% of respondents (Figure 7). Survey respondents reported the need for research related to crop rotations and the impact on soil fertility, the use of microbes to improve soil fertility, best practices to build lasting fertility, and soil amendment requirements for enhanced fertility.

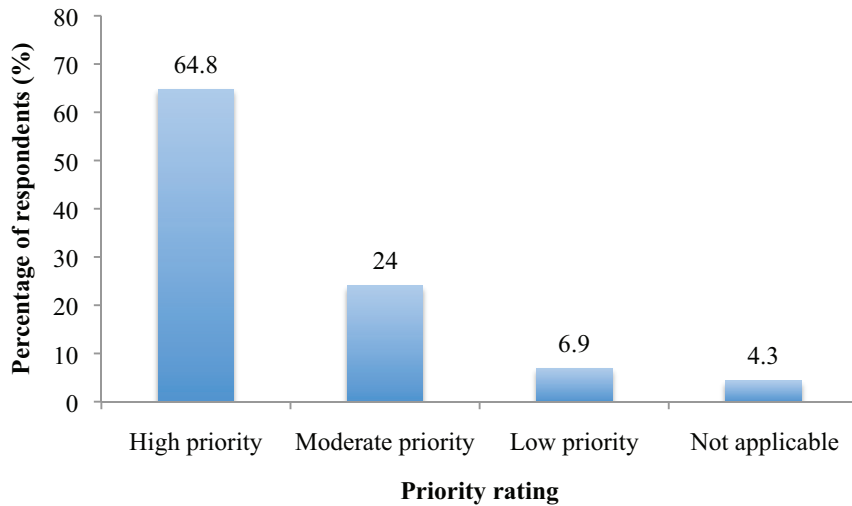


Figure 7. Priority rating of research on the soil fertility management by California organic farmers in 2015.

Weed Management

Weed research was a high priority for 61.8% of respondents (Figure 8). Farmers expressed the need for new organic weeding techniques that are both economically feasible and environmentally protective of the soil. Farmers expressed the need for weed control options that have fewer air quality impacts than flame weeding. They also expressed interest in different kinds of mechanical weeders, especially for orchard crops, and the possible future use of certified organic herbicides.

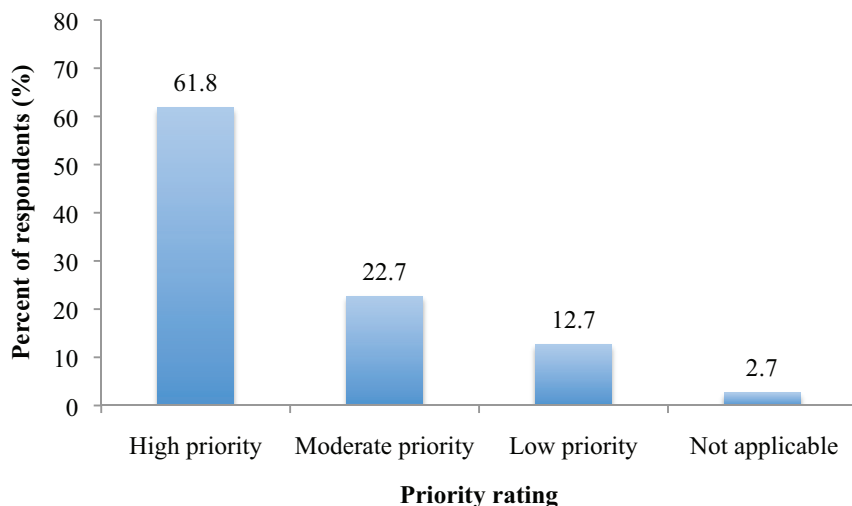


Figure 8. Priority rating of research on weed management by California organic farmers in 2015.

Farmers that responded to the survey or participated in the listening sessions identified several problematic weeds in California, including invasive perennial weeds, puncturevine (*Tribulus terrestris* L., Figure 9) and Johnsongrass (*Sorghum halepense*, Figure 10).



Figure 9. Image of puncturevine (Patrick J. Alexander, hosted by the USDA-NRCS PLANTS Database).



Figure 10. Image of Johnsongrass (Photo: Charles T. Bryson, USDA Agricultural Research Service).

There was substantial interest in the role crop and livestock rotation management could play in weed control. Survey respondents reported the need for research on:

- Using animals to manage weeds, disease and pests, and the effect animals might have on these types of management.
- Rotation and tillage strategies to decrease annual weed pressure.
- Weed tillage to benefit the soil and reduce the cost of weed control.

Disease Management

Research on disease management was identified as a high priority by 57.7% of respondents (Figure 11). Several diseases were identified as a concern for California organic growers, including fusarium wilt (*Fusarium oxysporum*), charcoal rot (*Macrophomina phaseolina*), curly top virus, downy mildew (example: *Peronospora farinosa*), powdery mildew (example: *Podosphaera xanthii*), Pierce's disease (*Xylella fastidiosa*), verticillium wilt (*Verticillium spp.*), phytophthora (*Phytophthora spp.*).

Specific disease issues noted in the survey include:

- Soil disease and nematode control.
- Plant breeding for disease resistance.
- Disease resistance rootstocks for avocado, citrus, and grapes.
- Disease control research for tomatoes, grapes, and kiwis.

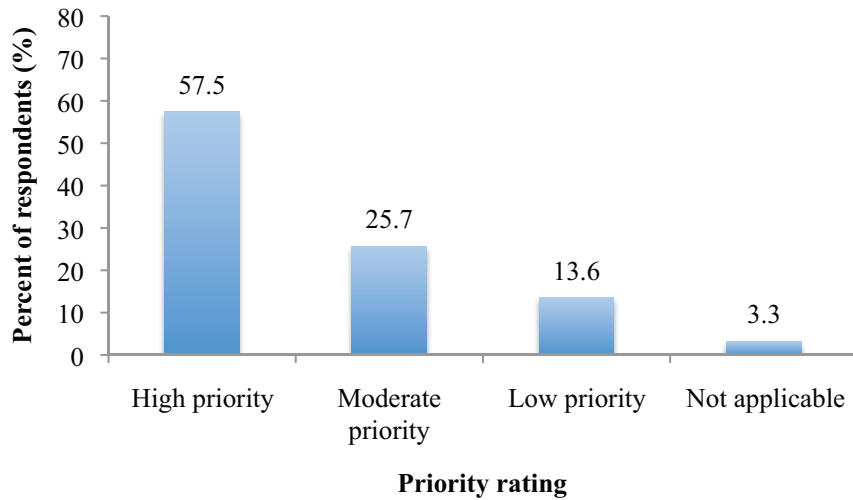


Figure 11. Priority rating of research on the disease management by California organic farmers in 2015.

Insect and Pest Management

Research on insect management was identified as a high priority by 56.3% of respondents (Figure 12). Specific insect pests identified in the survey include bagrada bug (*Bagrada hilaris*, Figure 13), vine mealybug (*Planococcus ficus*), lygus bug (*Lygus Hesperus*), and alfalfa weevil (*Hypera postica*). In addition to insect pests, respondents reported problems with symphylans (*Scutigera immaculata*), voles, gophers, moles, and birds.

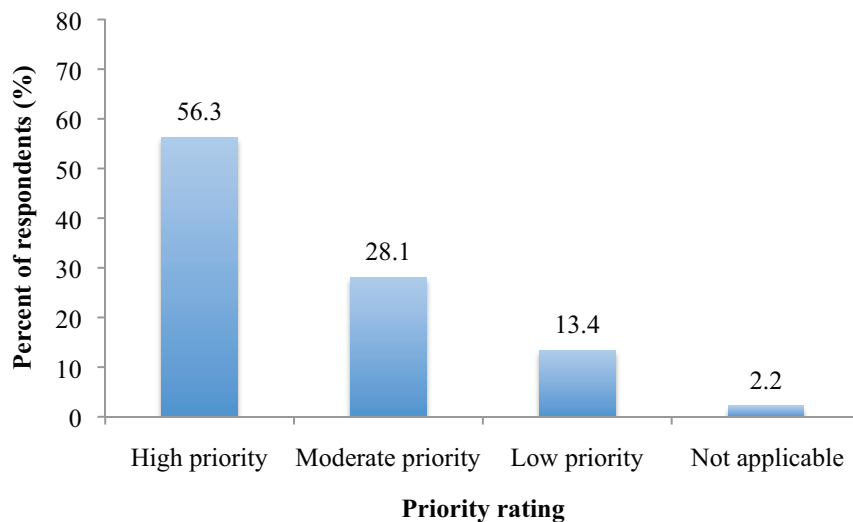


Figure 12. Priority rating of research on insect management by California organic farmers in 2015.

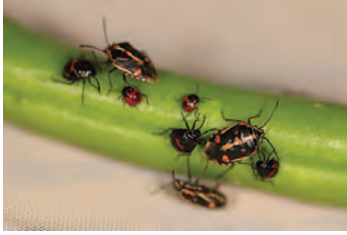


Figure 13. *Bagrada bug* (Photo from UC Statewide IPM Program).

Growers asked for research on the following insect research topic areas:

- Citrus and wine grape insect control.
- Natural enemy introduction.
- Influence of changing climate on insect pests.
- Crop management to encourage beneficial insects.
- The use of organic insecticides.

New invasive insect pests in California include:

The Asian citrus psyllid (*Diaphorina citri*) - Since 2008, the Asian citrus psyllid has been present in California, and there is concern that it will spread to other Western region states and throughout the US. The Asian citrus psyllid can ultimately kill citrus trees by infecting them with toxic bacteria.

Polyphagous shot hole borer (*Euwallacea sp.*) – This is a type of ambrosia beetle that has been prevalent in Southern California since 2010. It attacks over 200 tree species and can cause severe damage by infecting them with *Fusarium* fungus.

Bagrada bug - The bagrada bug was found in June 2008 in southern California, and it has now become a major problem throughout southern California and southern Arizona. Bagrada bug is a pest of crop plants in the Brassicaceae (*Cruciferae*), which includes important foods like cabbage, kale, turnip, cauliflower, mustard, broccoli, and radish.

Animal Agriculture

California is a major producer of organic animals and animal products. For example, in 2015 California sold \$254,337,800 in organic cow milk (USDA, 2016). OFRF survey respondents noted several areas related to animal health and production for additional research. Topics of importance include integrating animal grazing into permanent crops and how to do this while maintaining food safety standards.

A major challenge expressed in the survey and during listening sessions is the dearth of slaughter facilities available in many parts of California. This has been a major issue for growers in California as the number of slaughterhouses has dramatically declined in the state, predominantly affecting the businesses of small to medium sized growers. Farmers wanted to know about the potential for small/mobile processing units as well as the community and environmental impact of animal processing facilities. Producers were interested in the overall environmental impact of grass-fed meat, including data on the relationship between grazing and carbon sequestration.

RESEARCH, EXTENSION, AND EDUCATIONAL RECOMMENDATIONS

Results from OFRFs survey and listening sessions provide a basis for making recommendations for future research to support the production, marketing, environmental, and societal needs of organic agriculture practitioners. These recommendations for research specific to the needs of organic producers in California include:

- Providing beginning and transitioning farmers and ranchers the tools, knowledge, and on-going mentoring to be successful organic producers.
- Prioritizing water management in drought conditions in California. Research on water efficiency technologies and innovations for drought management are of high priority for organic farming.
- Continuing long-term research on soil health focused on nutrient and water management.
- Prioritizing research on organic production practices that can increase carbon sequestration. Current research shows that organic soils with higher soil organic matter can increase the sequestration of carbon in the soils.
- Prioritizing research on weed control for weed pests specific to California and the Western Region. Weed control continues to be an area where research can promote more sustainable weed control practices, especially for resistance and invasive weeds. Efficacy of organic products will also benefit the farmers as they select efficient and cost-effective products. Different tillage practices (including reduced and no-till) and plant and animal rotations are of particular interest.
- Managing disease and pest problems is of high importance. Invest in research for disease and pest problems of high importance in California. In addition to general research on specific insect controls, continued efforts in breeding seeds for varieties specific to organic production will increase productivity and economic viability of organic producers.
- Researching challenges involved with animal agriculture in the California. California is a major producer of milk products and organic livestock and poultry. To increase the availability of these products to the market place, significant increases in research and extension efforts need to be provided for all aspects of animal production, especially information for rotational and grass fed animals.

CONCLUSION

This report demonstrates the importance of monitoring the needs of organic farmers in California. OFRF is committed to communicating the research needs of organic farmers to the policy and research communities. We encourage research that has farmer needs at the core of the research questions.

Greater federal and state funding will be necessary to achieve the growth of organic and conventional agriculture sectors and the associated environmental and social benefits. We encourage policy makers and researchers to use the findings in this report to work towards funding and conducting research projects that will solve the challenges faced by organic farmers. Increased funding for research on critical issues related to water management, soil health and fertility, weed control, managing diseases, and controlling insect pests will provide organic farmers and ranchers in California the knowledge and tools to enhance their production and marketing. Greater extension and outreach to the organic sector will benefit organic farming will benefit from information and guidance that supports the most environmentally and economically sustainable agricultural production systems.

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ACKNOWLEDGEMENTS

Thank you to the following people for their contributions to this report: Brise Tencer, Vicki Lowell, Jane Sooby, Meagan Donovan, and Jessica Becket Parr.

Thank you to the following organizations whose financial support made this project possible: Cascadian Farm, Organic Valley, Driscoll's, Lundberg Family Farms, Foundation of Sustainability and Innovation, UNFI Foundation.



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