

REDUCING FARMER DEPENDENCE ON FOSSIL FUEL-BASED PESTICIDES AND FERTILIZERS

PLATFORM RECOMMENDATIONS AT-A-GLANCE

- Expand the Pool of SPM Technical Assistance Providers
- Set a Higher Bar for Statewide Increase in Organic Transitions
- Fund Long-Term Research on Organic and Sustainable Pest Management Approaches
- Provide Funding and Multi-Stakeholder Processes to Implement the DPR Roadmap
- Tailor Pest and Fertilizer Regulations by Region, Farm Size, and Crop Diversity
- Increase Fertilizer Mill Fee to Fund R&D on Climate-Resilient Approaches to Soil Fertility

A CLIMATE PLATFORM FOR CALIFORNIA AGRICULTURE

This is one in a series of CalCAN policy briefs that describe approaches to moving California agriculture boldly and quickly toward a carbon-neutral and climate-resilient future. Together, they make up *A Climate Platform for California Agriculture*.

Access the full report at: calclimateag.org/ca-agriculture-climate-platform

AUTHORS: Anna Larson,
Renata Brillinger



INTRODUCTION

Planning for and accelerating the transition away from fossil fuel-based pesticides and fertilizers must be a high priority in the transition to agricultural climate resilience. This transition needs to happen even as climate change leads to new pest, weed, and disease patterns and pressures, and it must be done while safeguarding our food supply and keeping family farmers in business.

Reducing fossil fuel-based agrochemical inputs (referred to in this report as fertilizers and pesticides) has a critical role to play in reducing greenhouse gas (GHG) emissions in the agriculture sector. Approximately 16 percent of California's agricultural GHG emissions come from fertilizers that metabolize to nitrous oxide, a GHG nearly 300 times more potent than carbon dioxide.⁴² It is also important to take into account the energy-intensiveness of producing fertilizers and pesticides from fossil fuels. It is estimated that pesticide manufacturing represents 6 to 16 percent of the energy required to produce crops.⁴³ The production of nitrogen fertilizer accounts for 1.2 percent of global energy demand.⁴⁴

Additionally, the over-application of fertilizers can have a negative impact on soil health⁴⁵ and can significantly reduce soil organic matter and inhibit soil carbon sequestration.⁴⁶ Pesticides also can harm beneficial soil microorganisms and have detrimental impacts on soil ecosystems,

16%

of California's agricultural GHG emissions come from fertilizers

6-16%

of the energy required to produce crops comes from pesticide manufacturing

1.2%

of global energy demand comes from the production of nitrogen fertilizer

⁴² Legislative Analyst's Office. (2021). [Assessing California's climate policies—agriculture](#).

⁴³ Audsley, E., et al. (2009). [Estimation of the greenhouse gas emissions from agricultural pesticide manufacture and use](#).

⁴⁴ Ahlgren, S., et al. (2008). [Ammonium nitrate fertiliser production based on biomass—environmental effects from a life cycle perspective](#). *Bioresources Technology*, 99(17).

⁴⁵ Ozlu, E., & Kumar, S. (2018). [Response of soil organic carbon, pH, electrical conductivity, and water stable aggregates to long-term annual manure and inorganic fertilizer](#). *Soil Science Society of America Journal*, 82(5). 1243–51.

⁴⁶ Khan, S. A., et al. (2007). [The myth of nitrogen fertilization for soil carbon sequestration](#). *Journal of Environmental Quality*, 36(6). 1821–32.

which decreases the amount of carbon the soil can store.^{47,48} Conversely, it has been shown that organic farms have higher stable soil organic matter compared to conventional systems;⁴⁹ and practices such as compost, cover cropping, crop rotations, and increasing biodiversity to create habitat for natural pest predators can enhance soil carbon sequestration.

Not only do over-applying fertilizers and using toxic pesticides contribute to climate change, but there are also numerous well-documented environmental and human health hazards, including leaching of nitrates into groundwater, which contaminates drinking water.⁵⁰ These harms are often concentrated in agricultural regions that are home to low-income communities of color, resulting in exposure to some of the worst air and water quality in the country.

FINDINGS

Site-Specific Pest and Fertility Management Are Essential

A climate-resilient approach to farm management views farms as ecosystems and seeks to promote biodiversity, soil health, and plant health as part of one integrated system. These management approaches often include practices such as cover cropping, composting, creating habitat for birds and predatory beneficial insects, minimized disturbance to the soil, and integration of livestock into cropping systems. These practices can support a healthy farm ecosystem, increasing plant resilience and creating an environment less conducive to pests and weeds. The best management approaches depend on local farm factors such as crop type, soil composition, and climate, which vary widely across the state.

Risk Aversion, Cost, Product Availability, and Regulations Drive Fertilizer Use

Farmer decision-making regarding fertilizer use is influenced by a suite of factors that include perceived or real yield impacts, risk aversion, up-front costs, product availability, and regulatory requirements. Farmers sometimes use fertilizer applications as a safety net to ensure high productivity, resulting in over-application. A report by the Central Coast Water Board found that most farms reported their fertilizer use exceeded the application rate recommended by UC Cooperative Extension, many by two to three times.⁵¹ Furthermore, they found that most farmers do not account for the nitrogen already in irrigation water—which can be substantial—when determining how much fertilizer to use. However, farmers become more receptive to using alternatives when fertilizer prices spike, particularly the alternatives that can be reliably sourced and have fewer price fluctuations.

Food safety regulations can be a barrier to adopting alternative fertility management strategies such as compost and livestock integration and can discourage ways to increase biodiversity with hedgerows and other conservation plantings that create wildlife habitat. A study of growers in the Central Coast found that food safety regulations “frequently characterized biodiversity as a liability rather than an asset, particularly in the wake of more stringent food safety audits” and discouraged or prohibited farmers from using compost and hedgerows.⁵² Almond farmers have similarly reported food safety regulations severely limiting the window of time in winter and spring when they can bring in sheep to graze their orchard floors.

⁴⁷ Seghers, D., et al. (2003). [Effect of long-term herbicide applications on the bacterial community structure and function in an agricultural soil](#). *FEMS Microbiology Ecology*, 46(2). 139–46.

⁴⁸ Gunstone, T., et al. (2021). [Pesticides and soil invertebrates: A hazard assessment](#). *Front. Environ. Sci.*, 9.

⁴⁹ Paustian, K., et al., (2016). [Climate-smart soils](#). *Nature*, 532. 49–57

⁵⁰ For more on this subject: [Pesticides and Climate Change: A Vicious Cycle](#).

⁵¹ From a 2015 presentation to the Fertilizer Research and Education Program technical advisory committee by Chris Rose, Irrigated Lands Regulatory Program of the Central Coast Water Board.

⁵² Esquivel, K.E., et al. (2021). [The “sweet spot” in the middle: Why do mid-scale farms adopt diversification practices at higher rates?](#) *Front. Sustain. Food Syst.*, 5.



Regulatory efforts to reduce and track fertilizer over-application and pollution are needed, but they must be adapted to meet the needs of small-scale, diversified, organic, and/or socially disadvantaged farmers. The Irrigated Lands Regulatory Program (ILRP) is intended to prevent nitrate leaching from fertilizers into surface water and groundwater by educating producers and requiring them to produce nutrient management plans and reports. However, for farmers with diverse crop systems, the reporting can be unduly complex and time-consuming. Also, there is insufficient technical assistance available for diversified, small-scale, and organic farmers and for socially disadvantaged farmers who may have language and technology barriers. Finally, the regulations are not well-suited to organic farmers or others who use biological alternatives that cause much less nitrate leaching than conventional fertilizers.

In recent years, the Fertilizer Research and Education Program (FREP) at the California Department of Food and Agriculture (CDFA) has been funded with a fee on fertilizers, and it can play a valuable role in reducing farmer reliance on fertilizers. Encouragingly, in the last several years it has broadened its original narrow focus on funding research on nitrogen fertilizer use efficiency to also funding technical assistance and including soil health as one eligible funding area. With new expertise on the FREP technical advisory committee, more could be done to deliver needed resources for farmers ready to transition to alternative nutrient management systems.

Farmers Need Support to Reduce or Eliminate Agrochemical Use

Three important alternatives to fossil fuel-based fertilizers are compost, cover crops (plants such as clovers, legumes, and ryegrass that provide soil nutrients), and integrated crop and livestock systems. The [Enhancing Soil Health & Biodiversity for On-Farm Climate Resilience](#) section of this report summarizes the many co-benefits of these practices for farmers and the environment.

Transitioning to alternative sources of fertility involves risks for conventional producers who may have relied on fertilizers for the past six or seven decades. These barriers can include the need to make infrastructure investments; little access to information and advice on alternative approaches; and small profit margins that leave little room for experimentation and learning. Additionally, while organic forms of fertility tend to provide benefits such as less nitrate leaching and nitrous oxide emissions, they can be harder for farmers to manage because the nutrients are released slowly and sometimes at unpredictable rates, introducing risk of yield drops. Finding reliable supplies of cover crop seed can be challenging—one interviewee recalled a recent heat wave in Oregon that wiped out an entire variety of cover crop seed, leaving only one supplier who was unable to meet the demand. It can also be a challenge to meet the demand for high-quality and affordable compost, whether it is produced from manure or urban waste, that doesn't have to be transported long distances.

Farmers stressed that if regulations remove tools, there also needs to be support to transition to alternatives. Many of our interviewees pointed to the clear need for demonstration projects and technical assistance to support growers in changing their management approaches and mitigating the financial risk or potential short-term economic losses associated with transitioning. Examples include the Biologically Integrated Farming Systems Program⁵³ and the new Pollinator Habitat Program.⁵⁴

Organic agriculture is an effective and reliable strategy to eliminate agrochemical use while receiving a price premium, but many producers face barriers to transitioning. Farmers need technical assistance to learn new management approaches and navigate organic regulatory requirements, and some growers need financial assistance to help de-risk the three-year transition process.

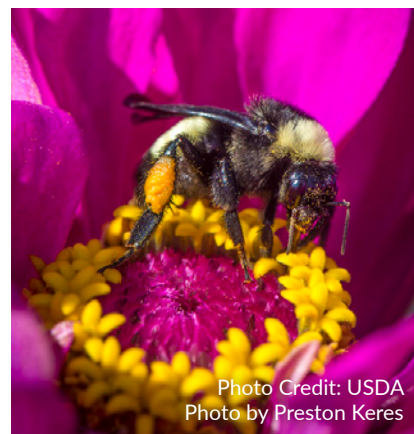


Photo Credit: USDA
Photo by Preston Keres

⁵³ Funded by a grant from CDFA, the [Biologically Integrated Farming Systems Program](#) is run by the University of California Agriculture and Natural Resources' Sustainable Agriculture Research and Education Program.

⁵⁴ CDFA's [Pollinator Habitat Program](#) awarded its first \$15 million in grants in 2022.





Organic agriculture is the only federally backed certification standard, and it does not allow growers to use synthetic pesticides or fertilizers on organic acreage. Rather, organic producers approach pest, disease, and weed management by looking at the farm as an agro-ecosystem. Many of the approaches used in organic and climate-resilient food production are techniques developed by indigenous farmers and farmers of color over long periods of time in relationship with land.⁵⁵ Likewise, most California farmworkers come from agrarian backgrounds and have extensive knowledge rooted in their relationship with land that can provide key insights into growing food without reliance on agrochemicals.

While organic agriculture encompasses a diverse set of approaches to farming, on average organic farms sequester more carbon and are associated with better soil health than conventional farms.^{56,57} California has outlined a goal in its 2022 Scoping Plan Update to certify 20 percent of California's acreage organic by 2045.

California's Sustainable Pest Management Roadmap Shows Promise

In January 2023, informed by two years of in-depth multi-stakeholder consultation and dialogue, the California Department of Pesticide Regulation (DPR), CDFA, and CalEPA released *Accelerating Sustainable Pest Management: A Roadmap for California*, which outlines many elements needed for a transition away from high-risk pesticides toward adoption of safer, more sustainable pest control practices.⁵⁸ The *Roadmap* sets a 2050 goal of eliminating the use of "priority pesticides"⁵⁹ by transitioning to sustainable pest management (SPM) practices. It calls on the state to, by 2025, develop a plan, funding mechanisms, and programs to prioritize pesticides for reduction and to transition away from the use of high-risk insecticides, fungicides, and herbicides.

Several interviewees noted that the DPR-led *Roadmap* is an important coalescing of key agriculture stakeholders around a common vision of sustainable pest management. This planning process brought together growers, commodity groups, agency staff, environmental justice advocates, and technical assistance providers to lay out an ambitious vision grounded in the need to transition from fossil fuel-based pesticides. Importantly, the *Roadmap* takes a systems-based view to sustainable pest management that considers community impacts, equity, broader environmental impacts such as soil health and climate impacts, and a broader consideration of economic benefits and impacts.⁶⁰ Resources will be needed to implement the *Roadmap* in order for DPR to continue coordinating state-level leadership.

⁵⁵ Carlisle, L. (2022). [Healing Grounds](#).

⁵⁶ Rodale Institute. [Farming systems trial](#).

⁵⁷ Merrigan, K., et al. (2022) [Grow organic: The climate, health, and economic case for expanding organic agriculture](#). NRDC.

⁵⁸ As defined in the [DPR Roadmap](#): "Sustainable Pest Management (SPM) is a holistic, whole-system approach applicable in agricultural and other managed ecosystems and urban and rural communities that builds on the concept of integrated pest management (IPM) to include the wider context of the three sustainability pillars: human health and social equity; and, environmental protections; economic vitality."

⁵⁹ The criteria for classifying pesticides as "Priority Pesticides" includes, but is not limited to, hazard and risk classifications, availability of effective alternative products or practices, and special consideration of pest management situations that potentially cause severe or widespread adverse impacts. The identification of these Priority Pesticides will be conducted by DPR under advisement of the multi-stakeholder Sustainable Pest Management Priorities Advisory Committee.

⁶⁰ California Department of Pesticide Regulation. [Accelerating sustainable pest management: A roadmap for California](#), p. 6.



RECOMMENDATIONS

Expand the Pool of SPM Technical Assistance Providers

Adopting new management approaches requires learning new farming techniques. One critical way to mitigate the risk for farmers in making the transition to climate resilience is to increase the availability of technical assistance providers trained in SPM and alternative nutrient management. A high priority when implementing the DPR *Roadmap* should be to establish a new Pest Control Advisor (PCA) credential for sustainable pest management and require all PCAs to receive baseline training in SPM.⁶¹ Since many PCAs derive their income in part from sales of agrochemical products, the state should consider subsidizing independent PCAs. Technical assistance providers with language and cultural literacy need to be recruited and trained to ensure that state resources are accessible to all farmers, particularly to farmers of color and underserved farmers. Resources are needed to provide technical assistance and access to land for farmworkers seeking to start farm operations, such as the services provided by the Agriculture and Land-Based Training Association.

Set a Higher Bar for Statewide Increase in Organic Transitions

Transitioning to organic production, a federally backed and enforced label, is the most clearly defined and verifiable strategy to farm without fossil fuel-based inputs. The state has set a goal of reaching 20 percent organic acreage by 2045, which is not sufficiently ambitious considering the high and increasing demand for organic products and the number of farmers seeking to transition to organic who face financial and knowledge barriers. This target also undervalues the effectiveness of organic as a strategy for sustainable pest management. With sufficient technical assistance (TA) and financial assistance from both state and federal programs⁶² to support farmers transitioning to organic, California can reach 40 percent 2045.⁶³

Fund Long-Term Research on Organic and Sustainable Pest Management Approaches

As was identified in the DPR *Roadmap*,⁶⁴ more research is needed into alternative pest management techniques and tools such as insect mating disruption and automated traps, but also climate-resilient approaches that manage the farm as an ecosystem. Over the past several decades, funding for biological control research has declined dramatically, and the state has very few researchers that focus on organic farming methods. To support research for alternatives, we recommend the following:

- Funding UC Cooperative Extension to hire five career track, permanent positions for organic specialists to serve across the state
- Increasing support for research and demonstration projects, such as the Alliance Grants Program⁶⁵ and Biologically Integrated Farming Systems (BIFS),⁶⁶ that support farmers' transition away from synthetic pesticides and fertilizers
- Funding participatory research that involves organic and diversified farmers, farmers of color, and indigenous and Tribal producers in positions of leadership

⁶¹ Ibid. p. 46-47

⁶² USDA launched a new [Organic Transition Initiative](#) in 2022 with \$300 million in funding.

⁶³ This target was included in recommendations made by CalCAN and a coalition of advocates to the California Natural Resources Agency in response to its call for public comment on target setting as required by AB 1757. See this [CalCAN blog](#) for more details.

⁶⁴ California Department of Pesticide Regulation. [Accelerating sustainable pest management: A roadmap for California](#). p. 27, 42.

⁶⁵ See more on the Alliance Grants Program [here](#).

⁶⁶ See more on the BIFS program [here](#).



Provide Funding and Multi-Stakeholder Processes to Implement the DPR Roadmap

To address the challenges discussed above regarding DPR's funding sources, we recommend that the state consider other funding sources to support the agency. One option is to increase the pesticide mill fee, which could include higher fees for more hazardous pesticides. The legislature funded a study released in 2022 that examined this possibility and recommended rate options.⁶⁷

We also recommend that DPR institutionalize the multi-stakeholder working group that guided the *Roadmap* process to guide its implementation.

Tailor Pest and Fertilizer Regulations by Region, Farm Size, and Crop Diversity

The Irrigated Lands Regulatory Program (ILRP) is a powerful tool for reducing nitrate leaching. To ensure that the program meets the needs of diversified, small-scale farmers using alternative fertility approaches, the State Water Resources Control Board should look to the Central Coast's regionally tailored approach. The Central Coast accounts for the use of non-legume cover crops during the winter, as they scavenge nitrogen and prevent it from leaching into groundwater.⁶⁸ Regional tailoring to local conditions and crops should be made in coordination with partner agencies like CDFA and UC Agriculture and Natural Resources (UCANR) and with grower consultation. In addition, more technical assistance is needed to support diversified, small-scale, organic, and socially disadvantaged farmers with ILRP compliance.

In May 2023, CDFA kicked off a two-year public process to evaluate food safety and water quality regulatory reporting requirements as part of an effort to improve administrative processes.⁶⁹ This process should prioritize addressing barriers to healthy soils practices like compost use, cover cropping, and hedgerows.

Increase Fertilizer Mill Fee to Fund R&D on Climate-Resilient Approaches to Soil Fertility

A refrain during our interviews was that, in order to achieve climate resilience, it will be critical for farmers to have effective, affordable, and available alternatives to fossil fuel-based fertilizers. UCANR should add more extension research positions to refine our scientific understanding of biological alternatives to fertilizers. FREP can contribute to this effort by expanding their resources for research and technical assistance on compost, cover crops, and other soil-building nutrient management strategies. An increase in the fertilizer mill fee (currently \$0.001 per dollar of fertilizer sales) could be dedicated to this purpose.



Farmer Al Courchesne, of Frog Hollow Farm stands next to his compost pile.

⁶⁷ Department of Pesticide Regulation. (2023). [Mill assessment study: Preliminary recommendations and implementation plan](#).

⁶⁸ Technical background available in a [video produced by Dr. Eric Brennan](#) from the USDA Agricultural Research Service explaining this model approved under Ag Order 4.0 for the Central Coast Regional Water Quality Control Board.

⁶⁹ CDFA. (2023, May 2). [CDFA announces new study to explore opportunities to streamline regulatory processes for agriculture](#) [Press release].

