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Critical Issue Report: Occupational Pesticide Exposure



Organic Agriculture: Reducing occupational pesticide exposure in farmers and farmworkers

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Executive Summary

Farmers and farmworkers are a fundamental part of the global food system. Yet, the sustained use of agricultural chemicals puts this population at serious risk for a wide range of adverse health effects—a consequence of agriculture that is largely overlooked.

A wide range of regulatory pesticide management regimes exists worldwide and can be highly variable both in rigor and enforcement. However, even under the best regulations, there is still potential for harm. This timely report investigates the impacts of pesticide exposure on farmer and farmworker health, and demonstrates how the implementation of organic practices can help minimize those exposures.



There is a growing awareness of how agricultural chemicals affect our health and the health of our environment. Consumers want to learn more as they strive to make the best choices for themselves and their families. Consumers often cite reduced pesticide exposure and environmental stewardship as the top reasons they choose organic products, yet organic systems also provide substantial benefits for farmworkers and agricultural communities by prohibiting most toxic synthetic pesticides.

This study looks at how adult farmers and farmworkers are exposed to pesticides, the negative health consequences of those exposures, and the organic production practices and processes used by organic agriculture to protect farmers and farmworkers. It also provides a clear overview of pest management practices that can be implemented in any farming system to reduce the need for pesticides to fight pests and diseases.

The Organic Center has synthesized over 120 research studies from around the world to understand the health impacts of occupational exposure to toxic synthetic pesticides on farmers and farmworkers, and elucidate how organic farming methods and the regulations that govern USDA certified organic farming systems directly benefit this community.

The health and safety of those who produce our food should be a top concern for all of us, and consumers can take action to support healthy farming communities by choosing food grown organically. By shifting to more sustainable food production systems that rely on balanced ecosystems as a first line of defense against pests, we can ensure sustainable food security and healthy agricultural communities into the future.



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INTRODUCTION

Sustaining human and environmental health are the core principles at the heart of the organic movement, and are manifest in the regulatory framework of the U.S. organic program. As a result, organic systems not only provide numerous environmental benefits but also societal benefits by contributing to the health of farmers and farmworkers. Organic agriculture bans the use of most synthetic pesticides in the production of certified food and fiber, thus reducing occupational exposure to more toxic, synthetic chemicals.

Pesticide usage in the United States totals over 1.1 billion pounds annually with more than 90% of those pesticides utilized in the agricultural sector.¹ Pesticides are substances that are meant to kill or repel pests including but not limited to insects, weeds, fungi, rodents, mollusks such as snails and slugs, and disease-causing pathogens. Pesticides can be classified by their mode of action—how they kill an organism or chemical class. However, most commonly they are classified by the organisms they are meant to kill or harm. Herbicides target plant weeds, insecticides target insects, fungicides target fungi, and rodenticides target rodents.

Almost 1,400 pesticides with over 900 active ingredients are currently registered with the U.S. Environmental Protection Agency (EPA) and approved for use in the United States.² Pesticides can help farmers increase their yield and crop quality while reducing labor. However, increasing reliance on pesticides for food and fiber production has also led to serious unintended consequences.

By definition, pesticides are toxic to living organisms, so it is not surprising that they can also be toxic to the environment

and humans. While the adverse effects of pesticides on non-target organisms such as beneficial insect predators,³ song birds,⁴⁻⁵ pollinators,⁶⁻⁷ and native plants⁸ are well documented in the scientific literature, the unintended effects of pesticides on humans are perhaps the most concerning. Farmers and farmworkers are at the greatest risk for pesticide exposure and associated adverse health impacts. Not only are they often exposed to pesticides at higher doses and with greater frequency than the general public, they are also at risk for exposure to more toxic, restricted-use pesticides that are not available for use by the general public.

A large and growing body of research documents the health hazards associated with occupational exposure to pesticides commonly used on conventional farms. Health impacts include acute poisoning due to high dose exposure leading to immediate health effects as well as long-term health impacts such as cancer.

Pesticide use is regulated at some level in most countries. However, the strictness and level at which those regulations are enforced can vary widely among and even within countries. For example, in the United States, the Environmental Protection Agency is responsible for federal regulations on agricultural pesticide use. However, within the U.S., the state of California has advanced some of the strictest pesticide regulations in the world, even surpassing those laid forth by the EPA. Laws such as the Agricultural Worker Protection Standard (WPS)⁹ have also been implemented in the U.S. in an attempt to reduce occupational exposures to pesticides on farms by mandating pesticide trainings, regulating pesticide application protocols, and requiring that personal protective equipment is available. Still, even under the best regulations, significant risk remains, and studies have shown that even when farmers are well informed of the risks associated with pesticide exposure, it does not necessarily translate into safer handling practices.¹⁰⁻¹¹

Organic production, on the other hand, provides a safeguard for farmers and farmworkers from the adverse health effects of toxic pesticides. U.S. Department of Agriculture (USDA) certified organic agriculture prohibits the use of most toxic synthetic pesticides and is the only agricultural system in the U.S. that uses certification and inspection to verify that prohibited substances are not used. In the following section, we take an in-depth look at how adult farmers and farmworkers are exposed to pesticides; the negative health consequences of those exposures; the practices and processes implemented within organic agriculture to ensure that farmers and farmworkers are protected from the negative effects of toxic pesticide exposure; and an overview of pest management strategies that can be implemented in any farming system to reduce the need for pesticides to combat pests and pathogens.

UNINTENDED CONSEQUENCES

Occupational Pesticide Exposure

EPA estimates that between 1,800 and 3,000 preventable pesticide exposures occur among agricultural workers and pesticide handlers each year.⁹ In 2015, California's Pesticide Illness Surveillance Program identified 1,187 reported illnesses that were possibly associated with pesticide exposure.¹² However, these estimates are likely too low for a variety of reasons. First, acute pesticide poisonings are the types of exposures most likely to be reported, meaning that most exposure estimates do not account for low-level, chronic exposure that many farmers and farmworkers experience. Second, almost half of the nation's two million farmworkers are migrants who often have limited access to health care or face language barriers that hinder effective communication with their health care providers.¹³ Finally, undocumented farmworkers may avoid seeking health care altogether even in the face of illness.¹³ These factors have confounded attempts to accurately determine the true extent to which adult agricultural workers are exposed to and negatively affected by pesticide exposure.

Occupational exposure to pesticides can occur in a number of different ways. Workers involved in the preparation, transportation, loading, and application of pesticides are at the highest risk for pesticide exposures that can occur from splashing, spills, or leakage, or from dust generated by pesticides in solid form. Incorrect use of application equipment, failure to utilize appropriate personal protective equipment, or failure to employ proper handling and sanitation practices are also leading causes of agricultural pesticide exposure.^{14–15} Occupational pesticide exposure can occur even when farm personnel are not directly involved in pesticide preparation and application. For instance, field workers may be exposed to pesticides via drift when winds carry pesticides from a neighboring field or farm; they may be inadvertently exposed by direct spray or to pesticide residues that persist in the soil and on crops from previous treatments.¹⁴

Exposure Routes

Pesticide exposure occurs through ingestion, inhalation or skin absorption, with inhalation and skin absorption being the most common exposure routes for farmers and farmworkers during day-to-day handling.¹⁴ Absorption through the skin commonly occurs via splashes or spills, spray that lands on skin, transfer from vegetation to skin and transfer to skin through the settling of pesticide vapor. The severity of exposure depends on the duration of contact, the part of the body that the pesticide comes in contact with, and the chemical properties of the pesticide—which ultimately determine the ease in which it can be absorbed through the skin.



Prenatal Exposure

Prenatal exposure refers to secondary exposure to a substance when it passes from a pregnant mother's bloodstream, through the placenta, and into the developing fetus. Prenatal pesticide exposure, as early as the first trimester of pregnancy, can have adverse health effects on the mother and the developing fetus later on in life.^{124–126} Furthermore, while all pesticides are reviewed for safety by the U.S. Environmental Protection Agency, the agency does not rely on studies that consider vulnerable populations such as pregnant women and/or their developing fetuses. One long-term study, known as the The Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS) Study conducted by scientists at the Center for Environmental Research and Children's Health (CERCH) at the University of California, Berkeley, began in 1999. This study examines the effect of prenatal exposure to agricultural pesticides on children's growth, neurodevelopment and overall health in Salinas Valley, California. Results from this study and others support the assertion that children born from pregnant female farmworkers occupationally exposed to certain agricultural pesticides, are at risk for experiencing adverse health effects in childhood.^{125–129}

Pesticides can be inhaled when farmers and farmworkers are exposed to dust during mixing or application in dry form,¹⁷ fine aerosol application of pesticides in liquid form¹⁶ or vapors from highly volatile pesticides such as some soil fumigants.¹⁷ Inhalation of pesticides can be particularly dangerous when exposure occurs in confined areas with limited ventilation, such as greenhouses, when the pesticide is being applied in high concentrations, or when the chemical vapor lacks color and odor, which can lead to workers being unknowingly exposed.^{17,14}

Acute Toxicity

Acute toxicity refers to the adverse health effects that occur from a single exposure to a hazardous substance or multiple exposures that occur over a very short time. Symptoms vary from skin and eye irritation to vomiting or respiratory distress. Acute exposures make up the majority of reported illnesses caused by pesticide poisoning on the farm, and can occur if proper protective gear such as gloves, respirators, or eye protection are not utilized or through unintended exposure via drift or direct spray. One example of acute pesticide exposure comes from The Centers for Disease Control (CDC), which reported the poisoning of farmworkers in the state of Washington after accidental exposure to drifting pesticides.¹⁸ Twenty people were working in a cherry orchard when they were exposed to the pesticides pyridaben, novaluron and triflumizole sprayed in a nearby pear orchard. Within minutes of the exposure, the workers began to experience symptoms including headaches, nausea, respiratory irritation and eye irritation. While acute poisoning reports are the most commonly reported cases of pesticide toxicity, they do not take

into account negative health effects that may not appear until years down the line or the effects of chronic or low-level exposure to pesticides over time.

Long-Term Health Effects

Unlike acute pesticide poisonings that are easily diagnosable, the long-term health effects of pesticide exposure are harder to recognize. Studies that evaluate previous or chronic low-level pesticide exposures and later health effects in humans are called cohort studies. Cohort studies are long-term studies that collect data on a group, or cohort, of healthy people who share similarities (such as occupation) but vary with respect to a particular risk factor (such as pesticide exposure). The cohort provides detailed information about their experiences and behaviors as are relevant to the study, and then subjects in the cohort are followed for a duration of time over which their health is evaluated. In this way, researchers are able to look for statistically significant associations between the risk factor in question and the development of certain diseases. An example of one such cohort study is the Agricultural Health Study (AHS).¹⁹

The AHS is a prospective cohort study that seeks to understand how occupational, lifestyle and genetic factors affect the health of farming populations. The study is a collaborative effort involving the National Cancer Institute, the National Institute of Environmental Health Sciences, EPA, and the National Institute for Occupational Safety and Health that followed 89,000 private and commercial applicators and their spouses from Iowa and North Carolina from 1993–2010. During that time, study participants shared baseline

Organophosphate Pesticides

Organophosphate (OP) pesticides are one of the most widely used classes of synthetic insecticides in agriculture. Chlorpyrifos is an example of one OP pesticide commonly used in agriculture across the United States although many believe the science supports a complete ban of its use. OP pesticides work by damaging an enzyme that is essential for controlling nerve signals in animals. Thus, while it is effective at killing insect pests, exposure can also adversely affect human health. There is a large and growing body of compelling scientific literature linking negative health outcomes in farmers and farmworkers to both short- and long-term OP pesticide exposure. Negative health effects include impaired neurobehavioral function, increased risk for cardiovascular and respiratory disease, and cancer. Moreover, prenatal exposure is associated with adverse birth outcomes and the development of childhood neurodevelopmental disorders.



information related to demographics, pesticide use history, current farming practices, health status and dietary practices.

A significant portion of the research from this study has focused on the link between cancer in applicators, spouses, and children; reproductive health; respiratory health; neurological symptoms and disease; diabetes; thyroid disease; rheumatoid arthritis and other autoimmune diseases. Thus, using long-term data from a large population of farmers and farmworkers in the United States, researchers are able to better understand how occupational pesticide use and exposure on farms are associated with the emergence of negative health effects years later.¹⁹

In addition to the AHS, numerous cohort and other epidemiological studies from around the world have investigated and continue to investigate the link between occupational pesticide exposure and health outcomes. Understanding the long-term effects of pesticide exposure is complex and much is unknown. However, a growing body of scientific literature now links occupational pesticide exposure to a wide range of human health disorders including many types of cancer,²⁰⁻⁶⁰ neurodegenerative diseases,⁶¹⁻⁶⁷ respiratory diseases and symptoms,⁶⁸⁻⁷⁶ reproductive problems in both men and women,⁷⁷⁻⁸⁸ and mental health disorders.⁸⁹⁻⁹⁴

Reducing Exposure

Farms can take a number of strategies for reducing farmer and farmworker exposure to pesticides. Activities such as notifying field workers and nearby farms prior to spraying, improved safety training and access to protective gear are important steps to take to reduce pesticide exposures. Furthermore, when applying any pesticide, even those that are non-toxic, farm operators and pesticide applicators should always ensure that they are adhering to labor laws and strictly following label recommendations. However, even if best management practices for pesticide use are followed, restricting pesticide use altogether is the only sure way to eliminate exposure risk.

Organic farming protects farmers and farmworkers by doing exactly that. Prohibiting most toxic, synthetic pesticides from the field greatly reduces the risk of exposure. Furthermore, organic farmers utilize preventive practices prior to utilizing organic approved pesticides—using them only as a last resort. These restrictions have forced organic growers to explore alternative means to successfully control agricultural pests, pathogens, and weeds. These “organic” techniques often benefit the environment, and have far fewer human health repercussions. Thus, their adoption can benefit any farming system looking to reduce pesticide use through the implementation of sustainable management practices.



Pesticide Watch List

In the past, we have underestimated the health risks of many commonly used pest control chemicals. Here we highlight pesticides that are very common in agricultural production yet very little research has investigated the potential human health risks associated with chronic exposure.



Pyrethroids

Pyrethroids are a class of synthetic insecticides commonly used in agricultural production. In the United States, at least 18 different pyrethroid insecticides are registered for use and globally they account for more than 17% of agricultural chemical sales.^{104, 105} Farmers and farmworkers can be exposed to pyrethroids through inhalation, ingestion and skin absorption.¹⁰⁶ While the health effects of acute accidental exposure are well established and include nausea, vomiting, respiratory irritation, eye irritation and skin irritation,

information regarding long-term, low-dose exposure is still limited.^{106, 107} Several recent epidemiological studies have raised concerns about potentially adverse effects on heart health, sperm quality and cognitive development in children through prenatal exposure. However, it will take more research to clarify the possible risks associated with chronic exposure to pyrethroid insecticides.^{108–110}

Neonicotinoids

Neonicotinoids are the most widely used class of insecticides in the United States and the world. They include imidacloprid, thiamethoxam, clothianidin, acetamiprid, thiacloprid, dinotefuran and nitenpyram. Neonicotinoids are a relatively new class of pesticides. Since their original introduction in the mid 1990s, their use has increased dramatically largely due to the availability of treated seeds that are coated with pesticides as a prophylactic protection against pests.¹¹¹ It is estimated that seed for more than 90% of corn and almost 50% of soybeans grown in the United States are treated with neonicotinoids. Neonicotinoid seed treatments are also commonly used on grain, fruit and vegetable crops.^{112–114} Neonicotinoids are also applied to leaves in established crops via foliar sprays. Nearly four million pounds of neonicotinoid insecticides are applied annually in the United States.¹¹¹



Several studies have demonstrated that these pesticides are also persistent in the environment. They have been found in dust, aquifers, streams and rivers, non-crop plants and marketplace fruits and vegetables.^{112–113, 115–120} While neonicotinoids are known for their negative impact on bee populations and aquatic insects, some recent laboratory studies have also shown that they can have adverse effects on mammals as well.^{121–123} To date, a small number of studies have suggested that exposure to neonicotinoids may impact human health but more work is needed to understand the human health risks associated with long-term and low-dose exposure.¹¹⁴

Glyphosate

Glyphosate is the most commonly used herbicide in the world. While used in a multitude of herbicidal products, it is most commonly known as the active ingredient in Monsanto's Roundup™. Glyphosate is applied widely on genetically modified (GM) crops designed to tolerate the herbicide. As the use of GM crops increases globally, so has the use of glyphosate. Two high profile reviews on glyphosate's health risks came to conflicting conclusions. An independent review by the World Health Organization's International Agency for Research on Cancer (IARC) found that glyphosate is a "probable human carcinogen." A separate review by the European Food Safety Agency (EFSA) found that it was "unlikely" to pose a carcinogenic hazard to humans. It will take more research to clarify the risks of chronic exposure to glyphosate in farmers and farmworkers.

ORGANIC FARMING TO SAFEGUARD FARMWORKER HEALTH

Organic farming reduces farmer and farmworker exposure to most toxic synthetic pesticides. USDA defines organic agriculture as a “production system that is managed to respond to site-specific conditions by integrating cultural, biological and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity” (CFR205.2). USDA’s National Organic Program regulations explicitly require organic producers to manage their farms in a manner that fosters biodiversity and improves natural resources. They also require organic farmers to implement rigorous preventive systems to reduce the need for using even organic-approved materials to combat pests. These preventive systems require the use of non-toxic, integrated pest, weed, and disease prevention plans prior to considering organically approved material application. While certified organic farmers are required by law to meet these requirements, any farmer can draw on the strategies utilized by organic farmers to reduce their use of chemical inputs.

A Proactive Approach to Pest Management

Organic farmers utilize a variety of chemical-free techniques to control pests, pathogens and weeds on their farms—using pesticides only as a last resort. As part of the process to obtain and maintain USDA organic certification, organic farmers must develop an organic system plan (OSP) for their farm that must be approved by a third-party certifier. Each farm’s OSP must detail the “what,” “why,” “how,” and “when” for all practices implemented on the farm. For example, the OSP must describe the pests of concern, how they will be monitored, and the integrative practices to be implemented on the farm to control pests such as crop rotation and soil health strategies. The OSP must also list all substances that may be used for pest control if integrative practices are unsuccessful, and when and how they will be used. Each OSP must be approved by a third-party certifier and verified during an on-site inspection annually to maintain organic certification. If an organic farmer applies a pest control substance that is not listed in their OSP, even if it is approved for use in organic, they may be at risk of losing their certification.

Combating Pests Without Pesticides

Organic farmers utilize farming practices that protect the environment and promote ecosystem services. In return, the farm benefits from enhanced ecosystem services, including improved pest control via beneficial insects and healthier soils that reduce the need for costly inputs. Numerous studies have demonstrated that organic farming promotes biodiversity and increases biological control of pests by supporting beneficial insect predators that prey on insect pests and consume weeds.



For instance, one study assessed 30 fields growing triticale, a wheat-rye hybrid.⁹⁵ Fifteen of the fields were organic and 15 were conventional. Researchers quantified aphids and their predators in each of the 30 fields. They found that the abundance of cereal aphids was five times lower in organic fields compared to the conventional fields, and beneficial predator abundances were three times higher. Predator-prey ratios were twenty times higher in the organic fields.

These results indicate a significantly higher potential for biological pest control in organic fields. Further, insecticide treatment in conventional fields reduced aphid densities briefly after application, but then aphid abundances increased to exceed pre-treatment levels.

Together these data indicate that in this system organic farming increases predators that enhance natural pest control and that insecticide treatment delivered short-term benefits that soon disappeared because it negatively impacted beneficial insect predators throughout the season, reducing natural bio-control of the aphid populations. The larger message here is that ecological balance is often the key for effectively managing pest populations in organic systems.

Organic farmers rely on a number of techniques that promote ecological balance on the farm to control pests, pathogens and weeds without the use of chemicals. A few of these common management practices include the use of crop rotation, intercropping, the use of buffers and hedgerows, and building soil health.

Crop Rotation

Crop rotation is the practice of planting a different crop in the same location each season to maintain soil fertility and control pest and pathogen populations.⁹⁶⁻⁹⁷ Crop pests and pathogens typically prefer to eat or infect a subset of closely related plants. For instance, the cabbage looper attacks cabbage, but also broccoli, kale, and cauliflower. Potato beetles are a major pest in potato fields, but they will



also eat closely related crop plants including tomatoes and eggplants. Planting the same crop or closely related crops in the same area season after season provides reliable food and habitat for crop pests, allowing them to establish and grow their population to create big problems for farmers.

When diverse crop rotations are implemented with unrelated crops planted in succession from season to season, pest and pathogen populations that specialize on a particular crop or group of closely related crops will naturally decline without their preferred host or food source.⁹⁸ Furthermore, on a landscape scale, higher crop diversity from field to field can disrupt pest dispersal among preferred crops.⁹⁸ While it is a common practice in conventional agriculture to plant the same crop in the same place year after year and combat the resulting pest problems with insecticides, implementing diverse and extended crop rotations allow organic farmers to keep crop-specific pest and pathogen populations under control naturally.

Intercropping

Intercropping describes the use of planting more than one crop together to utilize their attractive or repellent properties for pest control. For instance, many plants have evolved to produce chemicals as a natural defense against pests. By growing crops that produce volatiles that are naturally repellent to insect pests—such as marigolds or basil—along with other crops, farmers can deter pest populations. For example, one study found that intercropping Chinese chive plants with tomatoes significantly delayed and suppressed the tomato bacterial wilt pathogen, *Pseudomonas solanacearum*.⁹⁹

Intercropping also makes host plants less visible to pests¹⁰⁰ One study found that when cabbage was intercropped with red clover, the diamond back moth, a cabbage specialist, laid fewer eggs on the cabbage.¹⁰¹ Alternatively, a method of intercropping known as trap cropping entails growing crops that are attractive to pests near the primary crop. These companion crops essentially are sacrificed to lure the pest away from other crops, and often are destroyed along with the pests.

Buffers and Hedgerows

Hedgerows and buffer strips are trees, bushes, grasses, and other perennial or annual plants that surround farm fields or border natural resources such as streams. While they provide a variety of benefits to farmers, they can play a key role in increasing natural pest control on farms by providing food and habitat for the natural enemies of crop pests. In a review of the scientific literature, one study tested the hypothesis that natural pest control is enhanced in landscapes with non-crop habitats as compared to simple large-scale agricultural landscapes.¹⁰² Researchers found that in almost 75% of the studies that they reviewed, beneficial pest predator populations were higher and pest pressure lower in the complex landscapes versus simple landscapes.

Augmented pest-predator presence was associated with the presence of non-woody plants such as fallows and field margins with non-crop plants or hedgerows (80% of the studies reviewed). Similarly, wooded habitats such as forest patches or riparian buffers with trees also had positive effects on pest predators (71% of the studies reviewed). These results demonstrate that habitat diversity is important for enhancing populations of natural pest enemies on and around farms.

Soil Health

Because organic farmers are prohibited from utilizing synthetic fertilizers, they must manage their land in a way that promotes healthy soils. In addition to providing nutrients to crops, healthy soils can protect plants against pests and pathogens in a number of ways. For instance, plants grown in healthy soils, with adequate access to nutrients, sun and water, will have a strong immune system and will have adequate energy to devote to pest and pathogen defense mechanisms. Soils high in biodiversity also protect plants from pests and pathogens. For example, beneficial bacteria and other microorganisms found in healthy soils often compete for resources with soil pests and pathogens, creating an environment where it is difficult for invading plant diseases to colonize and grow.

One study assessed the physical, chemical and biological properties of three sets of organic and conventional soils collected from the fields. Researchers planted flax plants in the soils and inoculated them with the flax wilt pathogen. All soils then were disturbed by adding grass and clover. The results showed not only that the organic soils had more resilient soil microbes than conventional soils, but also that the wilt pathogen was suppressed, reducing the severity disease symptoms observed in the flax plants grown in the organic soils compared to those grown in conventional soils. These results demonstrate that the resilient soil microbial communities commonly found in organic soils are important for pathogen suppression.¹⁰³



Step-by-Step Guide to Verification by Certifiers in USDA Organic Crop Production

STEP 1: Organic operators must create an Organic System Plan that includes a pest and disease management plan describing how they will first prevent and manage pests using cultural, biological, and natural materials. Organic approved pest control substances included in the plan are only for when the preventive measures are not sufficient to control the pest or disease.

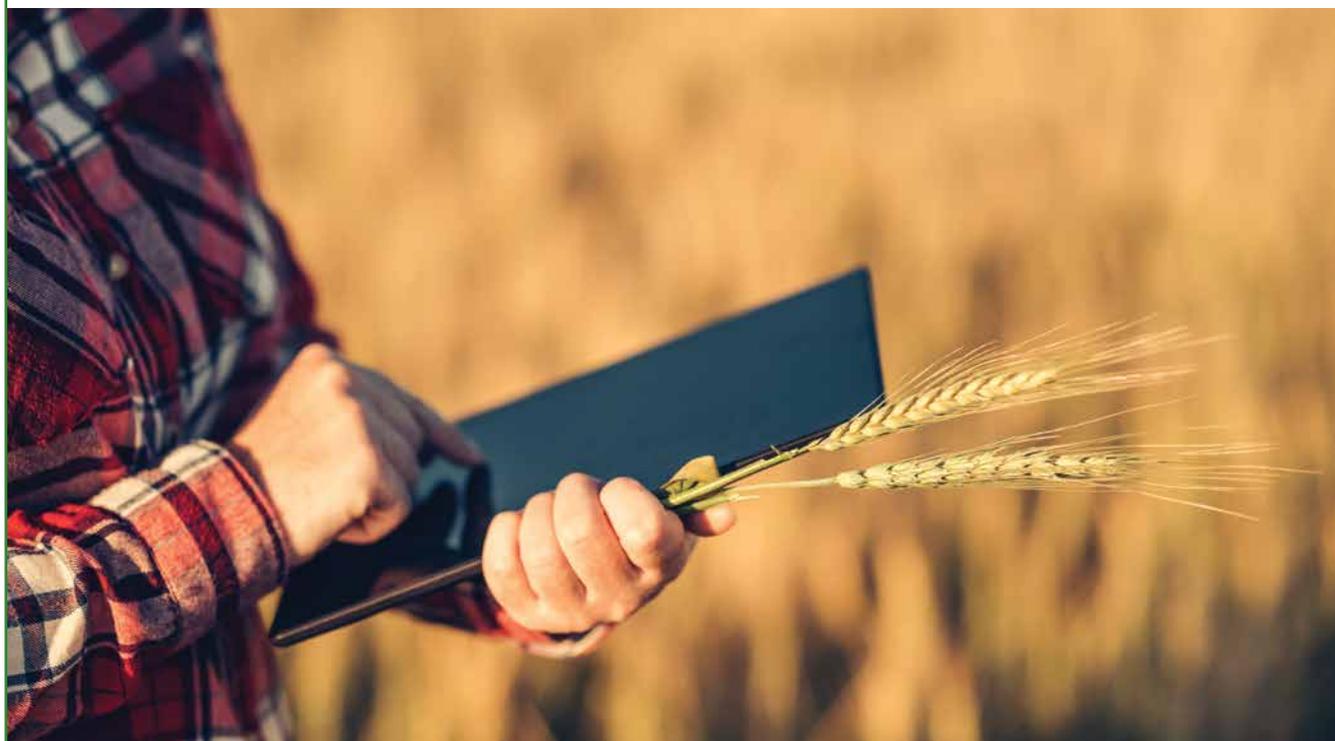
STEP 2: Organic Operators must maintain a record-keeping system where they will record the use of any organic approved pest control substance and maintain supporting information to demonstrate that they have complied with applicable restrictions on using the material.

STEP 3: The certifier reviews the Organic System Plan and verifies compliance of the pest and disease management plan. The certifier confirms and reviews the formulation of brand-name input material to ensure no prohibited materials are included.

STEP 4: The certifier conducts an initial on-site inspection of the operation to verify compliance of the Organic System Plan. The certifier reviews the results of the on-site inspection and may grant certification if they deem the operation in compliance with the organic regulations.

REPEAT STEPS 1–4: Each year thereafter, the operator must submit an updated Organic System Plan to the certifier for review, and have an on-site inspection for the certifier to verify continued compliance with the organic regulations.

****Operators are also subject to unannounced inspections and pesticide residue testing as required by the certifier. Noncompliant uses of input materials may lead to suspension or revocation of organic certification.**



Organic Approved Pesticides as a Last Resort

In spite of the preventive measures taken by organic farmers, sometimes pest and pathogen populations can still become a problem. In the event that preventive practices are ineffective, organic farmers can use a limited number of pesticides under restricted conditions and as a last resort.

While there are approximately 900 synthetic pesticides approved for use in conventional farming, the National Organic Program only allows about 25 synthetic materials that pose little risk to human health or the environment in organic production. Organic farmers are also allowed to use most naturally derived substances. However, just because a substance originates in nature does not necessarily mean that it is safe. Thus, natural substances reviewed by the NOSB and found sufficiently harmful to humans and the environment also are prohibited from use in organic farming. All synthetic substances approved for use in organic production and all natural substances prohibited from use in organic production are on the National List of Allowed and

Prohibited Substances, which is a component of the organic standards (CFR205.600—CFR205.606).

Examples of synthetic materials allowed for use in organic farming include hydrogen peroxide, soaps and Vitamin D₃. Natural substances prohibited from use in organic farming on the National List include strychnine, arsenic, lead, and nicotine.

Furthermore, when pesticides must be used, organic farmers are encouraged to apply them in a manner that results in the lowest potential exposure risk possible. This can include methods such as pest insect baiting, to lure pests away from crops instead of applying a pest control product directly to the crops, or spot treatments where treatment is strictly consigned to the area on the farm where an infestation or outbreak is actively occurring. As with any farm operation, farmers and farmworkers must adhere to all local and federal labor laws and must apply pest control products according to the label specifications.

Copper Sulfate Pesticides in Organic Crop Production

About copper sulfate

Copper sulfate is a compound used in agriculture as a plant pesticide to control bacterial and fungal diseases, such as mildews, blights and scabs. Copper fungicides are synthetically manufactured and contain the pentahydrate form of copper sulfate. They are sold commercially as granules, powder, or crystals with bright blue color.

Restricted uses in organic crop production

Copper sulfate is permitted as a pesticide in organic crop production only in certain specific and restricted circumstances.

- **For plant disease control.** Must be used in a manner that minimizes accumulation of copper in the soil. *Ref: 7 CFR 205.601(i)(1)*
- **In aquatic rice systems** as an algicide and tadpole shrimp control. One application per field during any 24-month period. Application rates are limited to those that do not increase baseline soil test values for copper over a timeframe agreed upon by the producer and accredited certifying agent. *Ref: 7 CFR 205.601(a)(3) & (e)(3)*

Before using any approved synthetic pest control materials such as copper sulfate, organic operators are required to have preventive measures in place, which may include mechanical methods and cultural practices. Copper sulfate may be used only if these preventive practices prove insufficient to prevent or control the target pest or disease *Ref: 7 CFR 205.206(e)*

Organic operators are also required by the NOP regulations to maintain or improve the natural resources of their operation, including soil and water quality. Therefore, copper sulfate may only be used in a manner that does not contribute to the contamination of crops, soil, or water by heavy metals or any other prohibited substance. *Ref: 205.200*

National Organic Standards Board

The National Organic Standards Board (NOSB) advises USDA on which inputs should be allowed or prohibited in organic farming, and ensures that they meet high standards for protecting human and environmental health using specific criteria specified in the Organic Foods Production Act. NOSB consists of volunteers appointed by the Secretary of Agriculture and is made up of four farmers, two handlers/processors, one retailer, one scientist, three consumer/public-interest advocates, three environmentalists, and a certifying agent.

NOSB evaluates a number of criteria, including the impact on human and environmental health, prior to recommending the addition or removal a substance from the National List. Furthermore, every substance on the List must be reviewed every five years to ensure that they continue to meet the criteria set forth in the Organic Food Production Act.

The process for adding or removing substances to the National List allows the public and stakeholders to engage directly with NOSB to provide input. The typical process is as follows. First, an individual or organization submits a formal petition to add, remove, or modify the listing of a specific substance. One of the NOSB subcommittees reviews the petition and may commission the development of a technical report that compiles scientific information about the substance and identifies any environmental or human health concerns. Based on this review, the subcommittee develops and publishes a proposal for the substance followed by a call for public comments. The full NOSB meets twice per year in a public forum to discuss the issues and vote on their final recommendations. During these meetings, the Board considers the public comments prior to its final vote on whether to remove, add, or modify a substance on the list. Once the NOSB has developed its final recommendation, it submits it to USDA's National Organic Program for consideration. While USDA can reject a recommendation to add a substance to the National List, it cannot add synthetic substances to the list that NOSB has not recommended.

Through this unique process, the National Organic Program ensures that substances approved for use in organic production are continually monitored to ensure their safety, and provides a course of action to prohibit substances if they are found to pose a significant risk to human and environmental health.



Specific criteria that the National Organic Standards Board uses to evaluate substances on the National List

According to §6518(m) of the Organic Foods Production Act, the NOSB shall consider:

1. "the potential of such substances for detrimental chemical interactions with other materials used in organic farming systems;
2. the toxicity and mode of action of the substance and of its breakdown products or any contaminants, and their persistence and areas of concentration in the environment;
3. the probability of environmental contamination during manufacture, use, misuse or disposal of such substance;
4. the effect of the substance on human health;
5. the effects of the substance on biological and chemical interactions in the agroecosystem, including the physiological effects of the substance on soil organisms (including the salt index and solubility of the soil), crops and livestock;
6. the alternatives to using the substance in terms of practices or other available materials; and its compatibility with a system of sustainable agriculture."

Work Cited

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