Chapter 12

The Importance of Pesticide-Free Products From Agricultural Fields to Our Tables and Solution Partners in Pesticide-Free Production

Gokhan Onder Erguven[1]

Alper Guven[2]

Abstract

This study highlights the importance of pesticide-free agricultural production for human health, environmental sustainability, and economic efficiency. Various alternative methods are explored for this purpose, including the use of organic or green manure, compost, crop rotation with controlled biological pests, and polyculture. These techniques aim to increase soil fertility, biodiversity, and water efficiency while simultaneously reducing the burden on chemical dependency. The study also examines integrated agricultural approaches that combine biological, mechanical, and cultural practices to ensure sustainable production. National and international organizations that support pesticide-free and organic agriculture through training, certification, and financial support are also cited. The study concludes that promoting pesticide-free agriculture is vital for creating a healthier agricultural ecosystem and recommends integrating such practices into national agricultural policies.

Introduction

Today, healthy and safe food production and consumption have become even more important with the rapidly increasing world population, changing lifestyles and environmental problems. People's quest to improve their quality of life has led to the need to learn more about the safety of

1 Prof. Dr., Munzur University, Faculty of Economics and Administrative Sciences, Department of Political Science and Public Administration, Department of Urbanization and Environmental Issues, Tunceli, Turkiye, ORCID: 0000-0003-1573-080X

2 Prof. Dr., Munzur University, Faculty of Fine Arts, Design and Architecture, Department of Gastronomy and Culinary Arts, Department of Gastronomy and Culinary Arts, Tunceli, Turkiye, ORCID: 0000-0002-6310-4240

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the food they consume and the production processes. At this point, food products free of pesticide residues are of critical importance in terms of both individual health and environmental sustainability (Nugrahini, 2023).

While pesticides provide an effective solution to combat harmful organisms, their uncontrolled and excessive use has brought many problems. These chemicals can have long-term negative effects on human health, reduce soil fertility, pollute water resources and disrupt the balance of the ecosystem. Therefore, alternative production methods that minimize or completely eliminate the negative effects of pesticides are at the center of today's agricultural policies(Funsho et al., 2024).

Pesticide-free farming not only provides healthy products, but also contributes to the preservation of natural resources, the increase of biodiversity and the reduction of carbon footprint. This production approach is a guide for the development of sustainable agricultural practices (Graud et al., 2024).

In this study, the importance of pesticide-free products and their production processes will be discussed in detail. In addition, the environmental and economic advantages of these products, the critical role that consumers play in this process and the dissemination of conscious consumption habits will be emphasized. The study also mentions solution partners who offer national and international suggestions for pesticide-free production. The aim of the study is to provide a guide for the dissemination of pesticide-free products and to increase awareness throughout society.

How to Obtain Pesticide-Free Products?

The production of pesticide-free products involves a range of methods that minimize chemical use and prioritize natural processes. These methods produce positive results in many different areas, from preserving soil fertility to increasing biodiversity.

Use of Natural Fertilizers: Using organic fertilizers instead of synthetic fertilizers preserves the natural structure of the soil and prevents products from containing chemical residues. The most well-known types of organic fertilizers include compost, animal manure, green fertilizers and plant waste (Kumar, 2024).

Compost Usage: Compost, which is obtained by the controlled decay of household organic waste, garden residues and food waste, increases the humus ratio of the soil and provides a balance of plant nutrients. Compost increases the water retention capacity of the soil and helps prevent erosion (Arfa et al, 2024).

Animal Manure: Fertilizers obtained from the feces of animals such as cows, sheep and goats contribute to the growth of plants, especially thanks to their rich nitrogen and phosphorus content. However, it is important that animal manure undergoes a fermentation process before use to eliminate harmful pathogens (Kopiński and Watch, 2023).

Green Fertilizers: Green fertilizers obtained by mixing nitrogen-fixing plants such as legumes into the soil both increase the organic matter content of the soil and accelerate the nutrient cycle. This method ensures that the soil remains fertile in the long term (Suntoro et al., 2024).

Plant Wastes: Wastes such as stalks, straw, leaves, etc. generated during agricultural production can also be used as natural fertilizers. These wastes increase the organic content of the soil and provide an environmentally friendly solution (Anambattu et al., 2024).

Biological Control

Fighting pests with natural methods instead of chemicals is an important part of pesticide-free production. In this method, balance is achieved in agricultural areas by using natural enemies of pests. Biological control is very effective in terms of preserving the natural balance of the ecosystem and minimizing chemical intervention (Edgar et al., 2024).

Beneficial Insects: Beneficial insects, such as ladybugs, wasps, and spiders, naturally combat harmful organisms. For example, ladybugs protect plants by consuming aphids, and wasps help control harmful larvae (Mounika et al., 2024).

Natural Parasites and Predators: Natural parasites and predators play a critical role in the biological control of pests. For example, nematodes target soil-destroying insect larvae, while parasitic wasps such as Trichogramma attack the eggs of pests and prevent their reproduction (Alexander et al., 2023).

Microorganisms: Beneficial microorganisms are also used in biological control. Some fungi and bacteria provide a natural defense mechanism against pests.

Biological Traps and Pheromones: Biological traps and pheromones used to attract and control pests reduce the need for pesticides. Pheromones contribute to population control by disrupting the mating behavior of pests (Bhaskaralingam et al., 2025).

Herbal Extracts: Natural substances of plant origin, such as neem oil and garlic, provide an effective and environmentally friendly defense against pests. Such substances are preferred as an alternative to chemical intervention against pests (Yayla et al., 2025).

Rotation and Polyculture

Growing different plants in the same field (polyculture) and crop rotation instead of monoculture are among the most important elements of pesticide-free agriculture.

Crop rotation reduces soil fatigue by preventing the same type of crop from being grown continuously in the same area. This method prevents pests from constantly being present in a certain area and keeps the spread of diseases under control. For example, growing different crop groups, such as cereals and legumes, in sequence increases productivity by maintaining the nitrogen balance of the soil (Chanal et al., 2025).

The polyculture system involves growing more than one species together in a field. This method creates symbiotic relationships between plants, creating a natural defense mechanism against pests. For example, growing plants such as corn and beans together increases soil fertility and helps control pests. At the same time, the polyculture system increases biodiversity and maintains the balance of the ecosystem (Rpeder et al., 2022).

Rotation and polyculture practices increase the population of natural enemies and support biological control of pests. They also help improve soil structure, use water more efficiently and prevent erosion. These methods provide great advantages to farmers both economically and ecologically. They play a critical role in obtaining healthy and pesticide-free products that are resistant to pests and diseases (Chalal et al., 2025).

Mechanical and Physical Methods

Mechanical and physical methods aim to completely eliminate or minimize the use of pesticides in pest control. These methods have an important place in environmentally friendly and sustainable agricultural practices. Rakes, hoes and other mechanical tools used in agricultural areas provide physical removal of weeds. Thus, the use of chemical herbicides is prevented. Mechanical control is widely applied especially in organic farming areas (Singh et al., 2024).

Light Traps: Light traps are an effective method for pesticide-free control by attracting and neutralizing harmful insects. This method is especially useful for pests that are active at night (El Mamun et al., 2023).

Covering Materials: Covering materials placed around plants prevent pests from reaching the products. At the same time, they support plant growth by preserving soil moisture. These materials optimize the production process by adapting to environmental conditions (Liu et al., 2024).

Physical Barriers: Nets or physical barriers used in greenhouses keep pests away from plants. They also increase the effectiveness of biological control by allowing natural predators to enter the greenhouse (Noemie et al., 2023).

Heat Treatment and Steam Application: Heat treatment or steam applications used to destroy pests accumulated on the surface of the soil are an effective alternative for pesticide-free agriculture. This method prevents pests as well as some soil-borne diseases (Sujatha et al., 2024).

Certified Organic Seeds: The organic certification of seeds used in pesticide-free agriculture ensures that the products have not been chemically treated. These seeds are more resistant to natural conditions and do not need chemical support. Certified seeds also increase biodiversity and encourage the use of genetically diverse species. Certified organic products are products that are grown, processed or produced in accordance with certain organic farming and production standards. Chemical fertilizers, pesticides, genetically modified organisms (GMOs) and synthetic additives are not used in the production process of these products. Organic farming is known as an environmentally friendly, sustainable and healthy farming method (Chen-Fy et al., 2023).

The characteristics of certified organic products are:

-The soil and water resources used for growing organic products are free of chemical substances. Natural fertilizers and biological control methods are preferred to increase soil fertility in organic farming.

-Organic products must have certificates proving that they were produced in accordance with the requirements of a specific country or international standards. In Turkey, these certificates are shown with labels such as “Organic Agriculture” and “Organic Product”. The European Union and the USA also have their own organic certification systems.

-Synthetic chemical fertilizers, pesticides and other chemical additives are prohibited in the production of organic products. Instead, natural fertilizers, biological pest control and other organic methods are used.

-Organic products cannot be produced by genetic engineering applications. In other words, organic certified products must be GMO-free.

-Organic farming aims to protect the environment. It prevents soil erosion, supports biodiversity and prevents pollution of water resources (Juma et al., 2025).

Integrated Agriculture Approaches

Integrated Pest Management (IPM) is a system in which biological, mechanical and cultural methods are used together. IPM allows farmers to produce while maintaining the ecological balance. Determining threshold levels for pests allows intervention only when necessary. This significantly reduces pesticide use and preserves the natural balance. Integrated agriculture is an approach in which different agricultural methods are used together to provide environmentally sensitive, economically sustainable and efficient agricultural production. This approach combines traditional agriculture with organic and modern agricultural techniques, but the goal is always to protect the environment and use natural resources efficiently while increasing productivity (Perović et al., 2025).

Main components of integrated agriculture

Integrated Pest Management (IPM)

integrated agriculture, biological, mechanical and cultural methods are preferred over chemical pesticides for pest control. IPM minimizes pest damage by monitoring pests and using natural enemies (e.g. predatory insects and parasites) or making plants resistant to pests. However, when necessary, chemical interventions can also be done in a controlled manner (Shunbao et al., 2024).

Integrated Plant Nutrition

Plant nutrition is provided by the balanced use of organic fertilizers, natural fertilizers and chemical fertilizers. This approach aims to improve soil health and increase productivity. In addition, soil pH, microorganism activity and other environmental factors are taken into account during plant nutrition (Islam et al., 2023).

Soil Conservation and Management

Integration to keep the soil productive includes optimizing tillage techniques and implementing methods to prevent erosion. For example, minimum tillage, use of cover crops and mulch to prevent soil erosion are often preferred (Usman, 2025).

Biodiversity and Ecosystem Services

Integrated agriculture, it is important to maintain biodiversity in agricultural areas using ecosystem services. This includes ecosystem services provided by pollinators (e.g. bees) and natural enemies (e.g. insects that eat pests) (Cabot et al., 2025).

Sustainable Economic Practices

Integrated farming takes environmental impacts into consideration while trying to control costs to ensure the economic sustainability of farmers. This can be supported by methods such as benefiting from the marketing of organic products or creating alternative sources of income (Fatima et al., 2024).

Establishing Circular Systems on the Farm

Integrated farming, it is important to recycle waste materials within the farm, such as plant residues and animal manure. This circular system allows for more efficient use of resources and reduction of waste (Praveen et al., 2024).

Social Dimension and Agricultural Communities

Integrated agriculture also considers the rights of farm workers and local communities. This approach aims to improve the education, health and social well-being of farmers. It is also important to support smallholder farmers and provide access to local markets. Integrated agriculture aims to achieve productive and healthy products while ensuring environmental, economic and social sustainability. This approach combines the best features of organic farming and conventional farming methods and generally creates a more balanced production process (Medici et al., 2021).

Effective Use of Water

In a pesticide-free farming system, efficient use of water is of great importance because when pesticides are not used, the biodiversity and health of soil and water are more affected. In this type of farming, efficient and sustainable management of water ensures healthy plant growth while also helping to minimize environmental impacts. Efficient use of water in pesticide-free farming is one of the key elements of creating an environmentally friendly, sustainable production process. These methods not only save water, but also support biodiversity, soil health and ecosystems in agricultural areas. Here are a few important strategies for efficient use of water in pesticide-free farming (Ederer et al., 2024).

Drip Irrigation and Micro Irrigation Systems: Drip irrigation minimizes water loss by providing water directly to the root zone of the plant. This method can be very effective, especially in areas where water is limited. Micro irrigation systems direct water only to the areas where it is needed, which allows for more efficient use of water. It also minimizes the contact of the soil surface with water, preventing evaporation and surface runoff (Ma et al., 2025).

Soil Conservation and Erosion Control: In pesticide-free agriculture, soil tillage methods are very important for soil fertility and water retention. Techniques such as minimum tillage or no-till (farming without tilling the soil) prevent the degradation of soil structure and allow water to penetrate the soil better. At the same time, they prevent soil erosion, slow down water flow and help water to remain in the soil for longer periods (Edabu et al., 2022).

Use of Organic and Natural Mulch: Using organic mulch (dry leaves, straw, compost, etc.) to cover the soil surface allows water to be retained in the soil for a longer period of time. Mulch prevents evaporation from the soil, helps balance soil temperature, and allows water to be used more efficiently. In addition, organic mulches improve soil structure, increase microorganism activities, and support soil health (Yan et al., 2025).

Plant Selection and Sensitive Species: In pesticide-free agriculture, plant species selection is important for efficient use of water. Plants that are resistant to water, drought tolerant and adaptable to local climate conditions should be preferred. Such plants require less water and help use water efficiently. In addition, providing diversity among plants ensures that water is used more balancedly by different plants (Jia et al., 2024).

Improving Soil Health: Improving soil health is a critical element in pesticide-free agriculture to increase water efficiency. The use of organic fertilizers and compost improves soil structure and increases the soil's water-holding capacity. Additionally, as the amount of organic matter in the soil increases, the rate of water infiltration into the soil increases (Congreves and Wu, 2024).

Monitoring Temperature and Climate Conditions: Monitoring climate and weather conditions is important in pesticide-free agriculture to determine irrigation requirements. While more water may be needed in hot weather, irrigation requirements may decrease during rainy periods. Therefore, irrigation should be done considering local weather conditions and soil moisture.

Pesticide-free production methods not only increase environmental sustainability but also economic efficiency. These methods respect the natural cycles of the soil, resulting in a healthier and safer agricultural ecosystem for both producers and consumers.

Pesticide-free farming and organic farming practices are supported by many organizations interested in sustainable farming methods. These organizations offer training, consulting services, certification processes, financial support and technology solutions to reduce pesticide use in agriculture. Here are some important organizations that offer solution partners in this field (Yu et al., 2025).

National Level Organic Agriculture Development Organizations and Certification Organizations

There are many local and international certification organizations working on organic farming and pesticide-free farming. These organizations guide farmers to adopt organic production methods and ensure that products receive organic certification. Here are some examples of these organizations:

Istanbul Organic Agriculture Association (İOTAD): It is an association that provides support to organic agriculture producers in Turkey and provides training on organic agriculture.

Development Agencies and Agricultural Credit Cooperatives: Development agencies in Turkey provide financing to projects that support organic farming and sustainable agricultural practices.

Aegean Agricultural Research Institute: It is an institute that conducts research to develop organic farming practices in Turkey and provides training to farmers.

Republic of Turkey Ministry of Agriculture and Forestry – Organic Agriculture Monitoring and Certification: Manages organic agriculture certification processes in Turkey and offers certification programs that limit pesticide use in agriculture.

Agriculture and Rural Development Support Institution (TKDK): Provides support to rural development projects in Turkey. Provides programs that provide financial support to pesticide-free agriculture and organic agriculture projects.

Organic Farming Cooperatives: Organic farming cooperatives in Turkey provide their members with training in pesticide-free farming and support with product sales. For example, organizations such as Bursa Organic Farming Cooperative and Çiftçi-Sen can help local farmers.

Universities and Research Centers: Many universities and research centers conducting research on pesticide-free agriculture provide farmers with scientific and technical information, helping them reduce pesticide use in agriculture.

Ankara University Faculty of Agriculture: Conducts training and research to reduce pesticide use.

Ege University Faculty of Agriculture: Conducts various researches in the fields of organic agriculture and pesticide-free agriculture and provides technical consultancy to farmers.

Doğa College and Agricultural Platforms: Organizes training programs to inform farmers about organic and pesticide-free agricultural practices and to enable them to produce sustainably.

Organizations Conducting Sustainability Studies in the Agriculture and Food Sector at the International Level

Many international organizations work to promote pesticide-free farming and spread sustainable agricultural practices. These organizations can provide training, technical support, and financial resources to farmers.

FAO (Food and Agriculture Organization of the United Nations): FAO provides alternatives and educational programs on pesticide use to promote sustainable agriculture worldwide.

IFOAM – World Association for Organic Agriculture: IFOAM is an international organization that promotes organic farming practices and pesticide-free agriculture. It creates a global network and provides educational programs to support the spread of organic agriculture.

The Rainforest Alliance: This organization supports sustainable farming practices and offers farmers solutions that preserve biodiversity instead of pesticides.

AgroSmart: This company offers digital solutions for sustainable and pesticide-free farming. It provides solutions for efficient use of water with smart irrigation systems and data analytics.

UNDP (United Nations Development Programme): Provides financial support to agricultural development projects and funds projects that promote pesticide-free agriculture.

Serving as solution partners in pesticide-free agriculture, these organizations provide both training and financial support to farmers who

want to achieve sustainability in agriculture, making significant contributions to reducing the use of pesticides in agriculture.

Conclusion and Recommendations

Pesticide-free production methods should be aimed at meeting the food needs of the increasing world population for environmental sustainability and eliminating the negativities that will affect the health of living beings. These methods will also reduce the cost of pesticide use and increase economic efficiency. These methods will also contribute positively to the natural structure and habitat of the soil and provide a healthier and more reliable agricultural ecosystem for both producers and consumers.

Organic farming practices, which are meant by pesticide-free farming, are supported by many national and international organizations interested in sustainable farming methods in various activities. The duties of these organizations are to provide training to minimize or, if possible, not use pesticides for sustainable farming and agricultural policies. Consulting firms that provide services on these issues, certification processes, financial support and technology solutions are offered. These solution suggestions should also be presented to farmers and agricultural policies should be made mandatory on a state basis.

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