

## Original Research Article

# Agricultural Practices and Their Impact on Community Health: A Global Review

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### Abstract

Agricultural practices play a critical role in shaping not only food production systems but also the overall health and well-being of communities worldwide. With the increasing global demand for food, agricultural intensification has led to both positive and negative health outcomes. This review examines the complex relationship between agricultural practices and community health, highlighting key factors such as pesticide usage, water management, soil health, and livestock production systems. While modern agriculture has significantly improved food security and economic stability, it has also contributed to environmental degradation, chemical exposure, and the emergence of health risks among farming communities and consumers. The review further explores the role of sustainable agricultural practices, including organic farming, integrated pest management, and agroecological approaches, in mitigating health risks and promoting ecological balance. Special emphasis is placed on the socio-economic determinants influencing farmers' adoption of safe and sustainable practices, particularly in developing countries. Additionally, the study discusses the impact of climate change on agriculture and its indirect effects on public health through food insecurity, malnutrition, and the spread of vector-borne diseases. Overall, the paper underscores the need for a multidisciplinary approach involving policymakers, agricultural experts, and public health professionals to ensure that agricultural development aligns with health and environmental sustainability goals. Promoting safer and more sustainable farming practices is essential for improving community health outcomes globally.

**Keywords:** *Agricultural practices, community health, sustainable agriculture, pesticide exposure, food security.*

## 1. Introduction

Agriculture has been a cornerstone of human civilization, providing food, livelihoods, and economic stability for billions of people worldwide (1). Over the past century, advancements in agricultural technologies, including mechanization, chemical fertilizers, and high-yield crop varieties, have significantly increased food production and contributed to global food security (3,6). However, these advancements have also introduced a range of environmental and health challenges that directly and indirectly affect community well-being (5). The interaction between agricultural practices and community health is complex and multifaceted, encompassing issues related to environmental pollution, occupational hazards, food safety, and socio-economic disparities (4). One of the major concerns associated with modern agricultural practices is the widespread use of chemical pesticides and fertilizers. While these inputs are essential for enhancing crop productivity, their excessive and improper use has been linked to adverse health effects, including respiratory disorders, neurological problems, and certain types of cancer among farmers and rural populations (2,5). Additionally, pesticide residues in food and water sources pose significant risks to consumers, raising concerns about food safety and long-term health implications (2). In many developing countries, lack of awareness, inadequate training, and limited access to protective equipment exacerbate these risks (11). Water management practices in agriculture also play a crucial role in determining community health outcomes. Irrigation systems, if not properly managed, can lead to waterlogging, salinization, and contamination of drinking water sources (10). Furthermore, stagnant water in poorly managed irrigation systems can serve as breeding grounds for disease vectors such as mosquitoes, increasing the prevalence of vector-borne diseases like malaria and dengue fever (13). Thus, sustainable water management is essential not only for agricultural productivity but also for safeguarding public health (10). Soil health is another critical factor influencing both agricultural productivity and human health. Degraded soils with low nutrient content can result in poor crop quality, leading to micronutrient deficiencies among populations dependent on these crops (15). Conversely, healthy soils rich in organic matter and microbial diversity contribute to the production of nutritious food, thereby supporting better health outcomes (15,16). The growing emphasis on sustainable soil management practices, such as crop rotation, organic amendments, and conservation tillage, reflects the recognition of soil as a vital component of the food-health nexus (16). Livestock farming, an

integral part of agricultural systems, also has significant implications for community health. While it provides essential sources of protein and income, intensive livestock production systems can contribute to the spread of zoonotic diseases, antimicrobial resistance, and environmental pollution (13,18). The improper handling of animal waste can contaminate water sources and increase the risk of disease transmission, highlighting the need for improved livestock management practices (13). In recent years, the concept of sustainable agriculture has gained prominence as a means to balance productivity with environmental conservation and health protection. Approaches such as organic farming, agroecology, and integrated pest management aim to reduce reliance on harmful chemicals and promote ecological balance (8,17). These practices not only enhance environmental sustainability but also contribute to improved health outcomes by minimizing exposure to toxic substances and ensuring the availability of safe and nutritious food (4). Moreover, climate change has emerged as a significant factor influencing agricultural practices and community health. Changes in temperature, precipitation patterns, and extreme weather events affect crop yields, food availability, and the distribution of pests and diseases (14). These changes can lead to food insecurity, malnutrition, and increased vulnerability to health risks, particularly in resource-poor communities (7,19), understanding the linkages between agricultural practices and community health is essential for developing effective policies and interventions. A holistic approach that integrates agricultural development with public health considerations is necessary to ensure sustainable and healthy communities worldwide (1).

### 1.1 Pesticide Use and Health Implications

The widespread use of chemical pesticides has become an integral component of modern agricultural systems, primarily aimed at controlling pests, diseases, and weeds to enhance crop productivity and ensure food security. While pesticides play a significant role in minimizing crop losses and improving yields, their extensive and often indiscriminate use has raised serious concerns regarding their impact on human health and the environment. Farmers and agricultural workers are particularly vulnerable to pesticide exposure due to their direct involvement in handling, mixing, and applying these chemicals. Exposure can occur through multiple pathways, including inhalation of spray droplets, dermal contact during application, and accidental ingestion due to inadequate safety practices. Short-term or acute exposure to pesticides often results in immediate health effects such as headaches, dizziness, nau-

sea, vomiting, skin irritation, and respiratory distress. These symptoms are commonly observed among farm workers who lack proper protective equipment or training in safe pesticide handling. However, the long-term or chronic effects of pesticide exposure are far more severe and pose significant public health challenges. Prolonged exposure has been linked to the development of chronic diseases such as cancer, endocrine disruption, reproductive disorders, and neurological impairments, including conditions like Parkinson's disease. Children and pregnant women are especially susceptible to these effects due to their increased sensitivity to toxic substances. In addition to occupational exposure, pesticide residues present in agricultural produce pose risks to consumers. Residues can remain on fruits, vegetables, and grains even after harvesting, processing, and cooking, leading to dietary exposure. Continuous consumption of contaminated food can result in the accumulation of toxic substances in the human body, increasing the risk of long-term health complications. Furthermore, pesticides can leach into the soil and contaminate groundwater and surface water sources, thereby extending their impact beyond agricultural fields. This environmental contamination not only affects human populations but also disrupts ecosystems, harming beneficial organisms such as pollinators, soil microbes, and aquatic life. The persistence and bioaccumulation of certain pesticides further exacerbate their negative impacts. Persistent organic pollutants can remain in the environment for extended periods and accumulate in the food chain, affecting higher trophic levels, including humans. This highlights the need for more sustainable and safer alternatives to conventional chemical pesticides. To mitigate these risks, the adoption of integrated pest management practices is essential. Integrated pest management combines biological, cultural, mechanical, and chemical control methods to minimize pesticide use while maintaining effective pest control. The use of biopesticides, which are derived from natural sources such as plants, microorganisms, and minerals, offers a safer and environmentally friendly alternative. Additionally, promoting farmer education, proper use of personal protective equipment, and strict regulation of pesticide usage can significantly reduce exposure risks. Overall, transitioning towards sustainable pest management strategies is crucial for protecting both human health and environmental integrity.

## **1.2 Water Management and Disease Transmission**

Water management in agricultural systems is a critical factor that directly influences both crop productivity and community health. Agriculture is the largest con-

sumer of freshwater resources globally, and inefficient water use practices can have serious environmental and health consequences. Improper irrigation methods, such as excessive flooding or poor drainage, often lead to water stagnation in fields. Stagnant water provides ideal breeding grounds for disease vectors such as mosquitoes, which are responsible for transmitting diseases like malaria, dengue, and chikungunya. These vector-borne diseases are particularly prevalent in tropical and subtropical regions, where climatic conditions further support vector proliferation. In addition to vector-borne diseases, poor water management can contribute to the spread of waterborne diseases. Agricultural runoff containing fertilizers, pesticides, and organic waste can contaminate nearby water bodies, including rivers, lakes, and groundwater sources. This contamination degrades water quality and introduces harmful pathogens and chemicals into drinking water supplies. Consumption of contaminated water can lead to gastrointestinal infections, diarrhea, cholera, and other serious health conditions. Vulnerable populations, including children and the elderly, are especially at risk. Nutrient runoff from agricultural fields is another major concern. Excessive use of fertilizers leads to the accumulation of nutrients such as nitrogen and phosphorus in water bodies, causing eutrophication. This process results in the excessive growth of algae, which depletes oxygen levels in water and harms aquatic life. The degradation of aquatic ecosystems not only affects biodiversity but also impacts communities that depend on these water resources for food and livelihood. Efficient water management practices are essential for reducing these health risks and promoting sustainable agriculture. Technologies such as drip irrigation and sprinkler systems provide controlled water application, minimizing water wastage and preventing waterlogging. These systems ensure that water is delivered directly to the plant root zone, improving water use efficiency and reducing the likelihood of vector breeding. Proper drainage systems are equally important, as they prevent the accumulation of stagnant water and maintain soil aeration. Water quality monitoring and treatment are also critical components of sustainable water management. Regular testing of water sources helps identify contamination issues and enables timely intervention. Additionally, the implementation of buffer zones, such as vegetation strips around water bodies, can help filter pollutants and reduce runoff. Community awareness and education play a vital role in improving water management practices. Farmers need to be trained in efficient irrigation techniques and the safe use of agrochemicals to minimize environmental contamination. Policymakers and

stakeholders must also collaborate to develop and enforce regulations that promote sustainable water use. In conclusion, effective water management is essential not only for agricultural productivity but also for safeguarding community health. By adopting efficient irrigation practices, improving water quality, and reducing contamination, it is possible to minimize disease risks and ensure sustainable use of water resources.

### **1.3 Soil Health and Nutritional Outcomes**

Soil health is a fundamental component of agricultural systems and plays a crucial role in determining both crop productivity and the nutritional quality of food. Healthy soils are characterized by adequate nutrient content, good structure, and a diverse microbial community that supports plant growth. However, intensive agricultural practices, excessive use of chemical fertilizers, and environmental degradation have led to widespread soil depletion and degradation. This decline in soil quality has significant implications for human health, as it directly affects the nutritional value of crops. Degraded soils often lack essential nutrients such as nitrogen, phosphorus, potassium, and micronutrients like zinc and iron. Crops grown in such soils tend to have lower concentrations of these nutrients, leading to reduced nutritional quality. Consumption of nutrient-deficient food contributes to malnutrition and micronutrient deficiencies, which are major public health concerns, particularly in developing countries. These deficiencies can result in weakened immune systems, impaired cognitive development, and increased susceptibility to diseases. Soil contamination is another critical issue affecting food safety and health. The accumulation of heavy metals, pesticide residues, and industrial pollutants in soil can be taken up by plants and enter the food chain. Long-term exposure to contaminated food can lead to serious health problems, including organ damage, developmental disorders, and chronic diseases. Therefore, maintaining soil quality is essential for ensuring the safety and nutritional value of food. Sustainable soil management practices are key to improving soil health and enhancing nutritional outcomes. Organic farming practices, which rely on natural inputs such as compost, manure, and green manure, help restore soil fertility and improve nutrient availability. Crop rotation and intercropping are also effective strategies for maintaining soil health, as they prevent nutrient depletion and reduce the buildup of pests and diseases. The use of biofertilizers is gaining increasing attention as a sustainable alternative to chemical fertilizers. Biofertilizers contain beneficial microorganisms that enhance nutrient availability and promote plant growth. These microorgan-

isms play a vital role in nutrient cycling, making essential nutrients more accessible to plants. Additionally, they improve soil structure and increase its capacity to retain water and nutrients. Healthy soils also support a diverse microbial ecosystem that contributes to plant health and resilience. Soil microorganisms help decompose organic matter, fix atmospheric nitrogen, and protect plants from pathogens. This biological activity is essential for maintaining soil fertility and ensuring sustainable agricultural production, soil health is directly linked to nutritional outcomes and public health. By adopting sustainable soil management practices, it is possible to improve crop quality, ensure food safety, and address issues of malnutrition. Protecting soil resources is therefore essential for achieving long-term food security and human well-being.

### **1.4 Livestock Farming and Zoonotic Diseases**

Livestock farming is a vital component of agricultural systems, providing essential sources of food, income, and livelihood for millions of people worldwide. Animal products such as meat, milk, and eggs are important sources of protein and essential nutrients, contributing to food security and nutrition. However, livestock farming also presents significant health challenges, particularly in relation to zoonotic diseases, which are infections that can be transmitted from animals to humans. Zoonotic diseases, such as avian influenza, brucellosis, and tuberculosis, pose serious threats to public health. The risk of disease transmission is particularly high in intensive livestock production systems, where animals are kept in high densities under confined conditions. Such environments facilitate the rapid spread of infectious agents among animals, increasing the likelihood of transmission to humans. Poor hygiene practices, inadequate sanitation, and lack of proper veterinary care further exacerbate these risks. Human exposure to zoonotic diseases can occur through direct contact with infected animals, consumption of contaminated animal products, or interaction with contaminated environments. Farmers, veterinarians, and workers in the livestock sector are at higher risk due to their close contact with animals. In addition, outbreaks of zoonotic diseases can have significant economic impacts, leading to loss of livestock, reduced productivity, and disruptions in food supply chains. Another major concern associated with livestock farming is the widespread use of antibiotics. Antibiotics are often used not only for treating diseases but also for promoting growth and preventing infections in animals. This overuse has contributed to the development of antimicrobial resistance, a global health crisis that threatens the effectiveness of antibi-

**Table 1.** Agricultural Practices, Associated Risks, and Health Impacts

<b>Agricultural Practice</b>	<b>Key Activities/Inputs</b>	<b>Associated Risks</b>	<b>Health Impacts on Communities</b>	<b>Environmental Effects</b>
Chemical Pesticide Use	Spraying insecticides, herbicides, fungicides	Toxic exposure, residue accumulation	Acute poisoning, chronic diseases, neurological effects	Soil and water contamination, biodiversity loss
Intensive Irrigation	Flood irrigation, poor drainage	Water stagnation, contamination	Vector-borne diseases, waterborne infections	Waterlogging, reduced soil fertility
Excessive Fertilizer Use	High nitrogen and phosphorus application	Nutrient runoff, eutrophication	Contaminated drinking water, metabolic disorders	Algal blooms, aquatic ecosystem degradation
Soil Mismanagement	Over-tillage, monocropping	Soil degradation, nutrient depletion	Reduced food quality, micronutrient deficiencies	Soil erosion, reduced productivity
Livestock Intensification	High-density animal farming	Disease transmission, antibiotic overuse	Zoonotic diseases, antimicrobial resistance	Waste accumulation, greenhouse gas emissions

**Table 2.** Sustainable Agricultural Practices and Their Benefits for Health and Environment

<b>Sustainable Practice</b>	<b>Description</b>	<b>Agricultural Benefits</b>	<b>Health Benefits</b>	<b>Environmental Benefits</b>
Integrated Pest Management	Combining biological and minimal chemical use	Reduced pest damage, lower chemical dependency	Reduced pesticide exposure, safer food	Conservation of beneficial organisms
Drip and Sprinkler Irrigation	Efficient water delivery systems	Improved water use efficiency, better crop growth	Reduced vector-borne diseases	Water conservation, reduced runoff
Organic Farming	Use of natural inputs and eco-friendly methods	Improved soil fertility and crop quality	Reduced chemical exposure, healthier food	Enhanced biodiversity, reduced pollution
Crop Rotation and Diversification	Alternating crops across seasons	Improved soil health, pest control	Nutritional diversity, improved food security	Reduced soil degradation and disease cycles
Biofertilizers Use	Application of beneficial microorganisms	Enhanced nutrient availability and plant growth	Improved nutritional quality of crops	Sustainable soil fertility management
Improved Livestock Practices	Better hygiene, vaccination, reduced antibiotics	Increased productivity and disease control	Reduced zoonotic disease risk	Lower environmental contamination

otics in treating human diseases. Resistant pathogens can be transmitted from animals to humans, making infections more difficult to treat. To address these challenges, the adoption of sustainable and responsible livestock management practices is essential. Proper animal husbandry practices, including adequate housing, nutrition, and hygiene, can reduce the incidence of diseases and improve animal health. Vaccination programs are also crucial for preventing the spread of infectious diseases and protecting both animal and human populations. Improved sanitation and waste

management practices are equally important in reducing environmental contamination and disease transmission. Proper disposal of animal waste and maintenance of clean farming environments help minimize the spread of pathogens. Additionally, the implementation of biosecurity measures, such as controlling animal movement and monitoring health status, can further reduce the risk of disease outbreaks. Reducing the use of antibiotics and promoting alternative approaches, such as probiotics and improved management practices, can help combat antimicrobial resis-

**Table 3.** Agricultural Practices and Their Effects on Community Health

<b>Agricultural Practice</b>	<b>Description</b>	<b>Positive Impacts on Health</b>	<b>Negative Impacts on Health</b>
Pesticide Use	Application of chemical agents to control pests	Increased crop yield and food availability	Toxic exposure, cancer risk, neurological disorders
Fertilizer Application	Use of chemical and organic fertilizers to enhance soil fertility	Improved crop productivity	Water contamination, nitrate toxicity, soil degradation
Irrigation Practices	Supply of water through canals, sprinklers, or drip systems	Improved crop growth and food supply	Waterlogging, vector-borne diseases (malaria, dengue)
Mechanization	Use of machinery in farming operations	Increased efficiency and reduced labor burden	Occupational hazards, accidents
Livestock Farming	Rearing animals for food and income	Improved nutrition (protein intake)	Zoonotic diseases, antimicrobial resistance
Crop Diversification	Growing multiple crops	Improved dietary diversity and nutrition	Minimal risks if managed properly
Organic Farming	Farming without synthetic chemicals	Safer food, reduced chemical exposure	Lower yields in some cases
Monocropping	Cultivation of a single crop repeatedly	Simplified management	Soil degradation, pest outbreaks, reduced nutritional diversity

**Table 4.** Pathways Linking Agricultural Practices to Community Health Outcomes

<b>Agricultural Practice</b>	<b>Description</b>	<b>Positive Impacts on Health</b>	<b>Negative Impacts on Health</b>
Pesticide Use	Application of chemical agents to control pests	Increased crop yield and food availability	Toxic exposure, cancer risk, neurological disorders
Fertilizer Application	Use of chemical and organic fertilizers to enhance soil fertility	Improved crop productivity	Water contamination, nitrate toxicity, soil degradation
Irrigation Practices	Supply of water through canals, sprinklers, or drip systems	Improved crop growth and food supply	Waterlogging, vector-borne diseases (malaria, dengue)
Mechanization	Use of machinery in farming operations	Increased efficiency and reduced labor burden	Occupational hazards, accidents
Livestock Farming	Rearing animals for food and income	Improved nutrition (protein intake)	Zoonotic diseases, antimicrobial resistance
Crop Diversification	Growing multiple crops	Improved dietary diversity and nutrition	Minimal risks if managed properly
Organic Farming	Farming without synthetic chemicals	Safer food, reduced chemical exposure	Lower yields in some cases
Monocropping	Cultivation of a single crop repeatedly	Simplified management	Soil degradation, pest outbreaks, reduced nutritional diversity

tance. Education and awareness programs for farmers are also essential to encourage responsible use of antibiotics and adoption of best practices, while livestock farming is essential for food production and economic development, it must be managed carefully to minimize health risks. By adopting sustainable practices, improving animal health management, and addressing antimicrobial resistance, it is possible to reduce the impact of zoonotic diseases and ensure safer and more sustainable livestock systems.

## 2. Conclusion

Agricultural practices have a profound impact on community health, influencing food quality, environmental conditions, and exposure to various health risks (4). While modern agricultural advancements have significantly improved food production and economic development, they have also introduced challenges such as chemical exposure, environmental degradation, and the spread of diseases (5). Sustainable agricultural practices, including organic farming, integrated pest management, and efficient water and soil management, offer viable solutions to mitigate health risks and promote long-term well-being (8,16). Policymakers, researchers, and farmers must work collaboratively to implement strategies that reduce harmful practices and encourage safer alternatives (19), aligning agricultural practices with public health objectives is essential for building resilient and healthy communities (1). A holistic and interdisciplinary approach is necessary to ensure that agriculture contributes positively to both human health and environmental sustainability on a global scale.

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