

Chemical Pesticides in Agriculture: Threatening Human Health and the Environment

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ABSTRACT

Agriculture aims to cater the current food needs of the society as well as ensuring the additional availability of foods to export and for the future goal. Improved productivity and output of agriculture have been largely attributed to the increased use of chemical inputs, especially pesticides. Pesticides are chemical or biological agents designed to eliminate agricultural pests that damage crops and livestock. Their widespread use has been instrumental in addressing food crises, especially following the Green Revolution in India. But careless pesticide use has resulted in major long-term issues for the ecosystem and health of the human. The main issue facing India, the biggest producer of pesticides in Asia, is pesticide residue and its detrimental impact on human's health and their environment. As this article discusses how pesticides affect people's health, the need for safer substitutes and strategies for ending the cycle of chemical pesticide dependence through sustainable farming methods.

Keywords: Agriculture, Environmental impact, Health risks, IPM and Pesticides etc.

Introduction

Agriculture is one of the building blocks for serving the food needs of present-day societies as well as for exporting and for any contingencies in future. Pesticides, chemical or biological agents used to destroy pests, have played a vital role in improving agricultural yields by reducing crop and livestock losses. The Green Revolution in India saw a massive rise in the use of pesticides and agricultural chemicals, which were crucial in mitigating the food crises of the day.

In contemporary times, India is Asia's biggest pesticide manufacturer and the 12th largest consumer of pesticides across the world. While India has lower per capita pesticide intake than industrially developed countries, pesticide residues are a growing difficulty. The underlying issue is that, while pesticides have virtues, their misuse has advantages. As the use of pesticides develops, the magnitude of environmental injury and human-health-related effects grows. These challenges underscore the urgent need to adopt safer alternatives, sustainable agricultural practices and robust regulation to curtail their harm.

Impact of Pesticides On Human Health

Short-Term Effects

Acute symptoms include:

- **Eye irritation:** Redness, watering, and burning sensation.
- **Skin issues:** Rashes, itching, and hypersensitivity.
- **Gastrointestinal problems:** Nausea, vomiting, and abdominal pain.
- **Neurological effects:** Dizziness, headaches, and confusion.
- **Respiratory distress:** Difficulty breathing, wheezing, and coughing.

Global case studies:

- Fieldworkers in **Ethiopia, Brazil, and Costa Rica** frequently report severe respiratory and skin-related symptoms due to pesticide exposure during application and handling.
- **India:** Reports of accidental poisoning due to improper pesticide storage and handling practices.

Long-Term Effects

Chronic exposure can lead to severe health conditions, such as:

- **Cancer:** Increased risks of leukemia, lymphoma, and cancers of the liver, prostate, and breast.
- **Reproductive harm:** Reduced fertility, miscarriages, and developmental delays in offspring.
- **Neurological disorders:** Memory loss, reduced cognitive function, and conditions like Parkinson's disease.
- **Endocrine disruption:** Hormonal imbalances leading to metabolic disorders and early puberty.

Special concerns:

- Birth defects, congenital disabilities, and immune system suppression linked to pesticide residues in food and water.
- Higher prevalence of pesticide-related illnesses in children due to their developing immune systems.

Preventive Measures

Alternative Methods

- **Integrated Pest Management (IPM):** Combines biological control agents, resistant crop varieties, and judicious pesticide use to reduce reliance on chemicals.
- **Crop rotation:** Disrupts pest cycles and improves soil health.
- **Companion planting:** Certain plants repel pests and improve crop yield.
- **Biopesticides:** Use of natural predators, parasites, and plant-derived substances like neem oil.
- **Genetically modified crops:** Engineered for pest resistance, reducing pesticide dependency.

Education and Training

Training farmers and field workers on:

- Safe handling, storage, and application of pesticides.
- Use of protective equipment like gloves, masks, and coveralls.
- First-aid procedures in case of accidental exposure.

Awareness programs to promote eco-friendly pest management techniques.

Organic Farming

Organically grown crops:

- Contain fewer pesticide residues, making them safer for human consumption.
- Offer higher nutritional value and promote ecological balance.

Community-supported agriculture (CSA) and farmer cooperatives: Enhance the adoption of organic practices.

Policy Measures

- **Regulation and restriction:** Ban or limit the use of highly hazardous pesticides (HHPs).
- **Promotion of alternatives:** Financial incentives for adopting sustainable practices, like subsidies for biopesticides and organic inputs.
- **Stringent monitoring:** Regular checks on pesticide residues in food, water, and the environment.
- **Research and development:** Support for innovations in sustainable pest control methods and safer pesticide formulations.
- **International collaboration:** Implementation of global frameworks like the **Stockholm Convention on Persistent Organic Pollutants** to phase out harmful pesticides.

Technological Interventions

- Development of **precision agriculture tools** to optimize pesticide application and minimize wastage.
- Use of **drones** and automated sprayers for targeted pesticide delivery, reducing exposure risks.
- Mobile applications to provide real-time pest management advice to farmers.

Community Engagement

- Awareness campaigns on the risks of pesticide misuse and benefits of alternative practices.
- Encouraging local governance and community-driven efforts to adopt safer farming methods.

Conclusion

Pesticides have revolutionized agro-productivity so that farmers can meet the increasing demand for food. But this has resulted in huge repercussions on human health and also on the ecosystem. Acute effects like dermatitis and respiratory distress bear chronic sequelae like cancer, endocrine disruption, and neurological disorders which illustrate the high exposure risk linked to pesticides. The environmental impact such as agro-chemicals leaching into water bodies and soil quality decline is an added challenge. Hence a shift to more sustainable forms of agriculture is needed to address these problems. Methods used will include organic farming, IPM, and crop rotation which will reduce chemical pesticides yet maintain yield levels. The triad of education for farmers, protective equipment for them, and stricter laws concerning pesticide usage are essential steps forward.

Further, research and development investment into biological pest management approaches and green alternatives must be coupled with residue monitoring programs that have teeth. Only through cooperative action among agricultural producers, policy shapers, researchers generating new knowledge, and informed consumers can we find the balance necessary between productive agriculture and ecological sustainability in an enhanced safe environment promoting human health while resilient agricultural systems for generations to come.

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