



AGRI MAGAZINE

(International E-Magazine for Agricultural Articles)

Volume: 02, Issue: 07 (July, 2025)

Available online at <http://www.agrimagazine.in>

© Agri Magazine, ISSN: 3048-8656

The Double-Edged Sword of Agrochemical Use in Indian Agriculture: Implications for Health and Environment

*Swati Dhiman, Diksha and Dinesh Sou

Department of Extension Education, Punjab Agriculture University,
Ludhiana, Punjab-141004, India

*Corresponding Author's email: swatidhimanpkt@gmail.com

The rapid expansion of agrochemical uses in Indian agriculture, initiated during the Green Revolution, has significantly boosted crop productivity and helped ensure food security for the nation. However, the excessive and often improper application of chemical fertilizers, pesticides, herbicides, and fungicides has given rise to serious environmental and human health concerns. Soil and water contamination, biodiversity loss, pest resistance, and alarming health issues among farmers and rural populations have underscored the darker side of chemical dependence in farming. This article examines patterns of agrochemical consumption across India, the environmental and human health impacts, and the economic costs associated with pest infestations. It highlights the urgent need for adopting sustainable agricultural practices, including biopesticides, integrated pest management (IPM), and stronger regulatory frameworks. A balanced approach is imperative to safeguard both agricultural productivity and ecological integrity while protecting the well-being of farming communities.

Introduction: Boon or Burden?

India, with its diverse agricultural landscapes, has long been reliant on rice as a staple food crop and a source of livelihood for millions of farmers. States like Punjab, Haryana, West Bengal, Uttar Pradesh, and Andhra Pradesh are key rice producers, sustaining the nation's food security. However, behind the flourishing fields lies a growing concern: how the excessive use of chemical fertilizers and pesticides is silently degrading the environment and jeopardizing the health of farming communities across the country. Over time, farmers have developed and adopted various new technologies to increase their productivity to earn profit and also to meet the rising food demands. Without a doubt, the rise and adoption of these new technologies have helped farmers tackle various problems. However, there are a number of problems faced by agriculturists such as numerous diseases, dangerous pests, and weed attacks in their crops, which can lead to crop failure and great financial losses. As a solution to these problems, agrochemicals were created and have been widely used by farmers to save their crops.

The Rise of Agrochemical Use in India

Technological Adoption and Need for Agrochemicals

Agrochemicals refer to chemical products used in agriculture to promote plant growth and protection. They include insecticides, pesticides, fertilizers, herbicides, fungicides, and more. Farmers have adopted various technologies and inputs to increase productivity and meet growing food demands. These chemicals are also known as agrichemicals.

For decades, chemical inputs have been seen as essential for boosting yields and supporting the demands of a growing population. This practice, initiated during the Green Revolution, has helped prevent food shortages but has also caused soil degradation, water contamination, biodiversity loss, and adverse health effects.

What Are Agrochemicals?

Agrochemicals refer to products used in agriculture for crop enhancement and protection. These include:

- Fertilizers: Improve plant nutrition
- Pesticides/Insecticides: Control harmful insects
- Herbicides: Manage unwanted weeds
- Fungicides: Fight plant diseases

Why Agrochemicals?

Farmers face multiple threats such as insect pests, fungal infections, and nutrient deficiencies. Agrochemicals have helped reduce crop failures, boost yields, and close the gap between food production and consumption.

Agrochemical Consumption Patterns in India

Pesticide Use in India

Table 1.1: Consumption of different Pesticides (Technical Grade) in India

Pesticide	2019-20	2020-21
Insecticides	10656.56	6668.73
Fungicides	9115.81	10318.29
Weedicides	4275.31	3296.73
Rodenticides	283.60	316.90
(In Metric Tonne)		

Source: India stat

Fertilizer Consumption Trends

India is one of the top producers and consumers of fertilizers, ranking third in fertilizer production and second in consumption, with Gujarat being the largest fertilizer producer.

Table 1.2: Consumption of major fertilizers in India (In lakh Tonne)

Year	N	P	K	Total (N+P+K)
2010-11	165.58	80.50	35.14	281.22
2011-12	173.00	79.14	25.75	277.90
2012-13	168.21	66.53	20.62	255.34
2013-14	167.50	56.33	20.99	244.82
2014-15	169.46	60.98	25.32	255.76
2015-16	173.72	69.79	24.02	267.53
2016-17	167.35	67.05	25.08	259.49
2017-18	169.58	68.54	27.79	265.91
2018-19	176.28	69.68	27.79	273.75

Source: India stat

The top three pesticide-consuming states—Andhra Pradesh, Maharashtra, and Punjab—account for nearly 50% of India's pesticide use. In contrast, rainfed farming systems using crops like sorghum and pearl millet use fewer pesticides.

Environmental and Health Consequences

Soil and Water Contamination

Only 0.1% of insecticides used actually reach the target pests. The remaining 99.9% end up contaminating the soil, water, and air, affecting ecosystems and beneficial organisms. Fertilizer strategies also have a major impact on sustainability, environmental emissions, and the economic performance of agriculture.

Biodiversity Loss and Resistance Development

Pest resistance and resurgence, coupled with the decline in populations of beneficial insects and natural enemies, are escalating concerns. Many agricultural exports worth over Rs 1,000

crore are rejected annually due to chemical residues. According to FAO, more than 500,000 tonnes of obsolete pesticides are posing global environmental risks.

Human Health Impacts: The Silent Suffering of Farmers

Health hazards from agrochemical exposure occur during application, storage, transport, and consumption. Between 1996 and 1999, India recorded 15,500 cases of pesticide poisoning and 7,500 fatalities.

Farmers, agricultural laborers, and rural communities are among the most vulnerable to the harmful effects of pesticides and other agrochemicals. Prolonged exposure to these substances can lead to a wide range of acute and chronic health issues:

- **Skin Disorders:** Continuous handling of chemical pesticides without proper protective gear can result in skin irritation, rashes, burns, and in severe cases, chronic dermatitis.
- **Respiratory Problems:** Inhalation of pesticide fumes or aerosols during spraying can cause coughing, wheezing, breathlessness, and increase the risk of chronic respiratory diseases such as asthma and bronchitis.
- **Neurological Effects:** Exposure to organophosphate pesticides is known to affect the nervous system, leading to headaches, dizziness, confusion, and in severe cases, long-term neurological damage or developmental disorders.
- **Cancers:** Several studies have linked pesticide exposure to various forms of cancer, including non-Hodgkin's lymphoma, leukaemia, prostate cancer, and skin cancer.
- **Reproductive and Endocrine Disorders:** Some agrochemicals are known endocrine disruptors, potentially causing reproductive health issues, hormonal imbalances, and birth defects.
- **Acute Poisoning:** Accidental ingestion or improper handling can lead to acute pesticide poisoning, symptoms of which include nausea, vomiting, abdominal pain, seizures, and in extreme cases, death.

Despite the serious health risks, awareness regarding the safe handling and application of agrochemicals remains low in many farming communities across India. The lack of protective equipment, improper storage of chemicals, and limited access to healthcare services further exacerbate the situation. There is a pressing need for educational programs, stricter regulation, and increased accessibility to safer alternatives to reduce the health burden on India's farming population.

The Potential of Biopesticides: Greener Alternatives

Biopesticides microbial biological pest control agents are safer alternatives that leave no harmful residues. When locally produced, they can be more cost-effective and sustainable than chemical pesticides.

The Importance of Plant Protection for Food Security

Pest and Disease Control in Agriculture

Over 10,000 insect species, 30,000 weed species, 100,000 plant diseases, and 1,000 nematode species threaten global agriculture. In India, weeds alone reduce productivity by 31.5%, costing the economy over INR 1050 billion annually.

The Cost of Pest Infestations: Economic Losses and Pesticide Dependency

Despite using over 2 million tonnes of pesticides annually, one-third of agricultural produce is lost to pests. In India, pests cause over Rs 6,000 billion in losses every year:

Diseases: 26%

Insects: 20%

Birds/Rodents: 10%

Other causes: 11%

With new pests and diseases emerging, pesticide dependency is likely to increase unless alternative strategies are adopted.

Toward Sustainable Agricultural Practices

Integrated Pest Management (IPM)

IPM integrates biological, mechanical, and limited chemical methods to achieve effective, sustainable pest management.

Policy Recommendations for a Healthier Future

- Expand use of biopesticides
- Strengthen pesticide regulation and residue monitoring
- Educate farmers on safe chemical use
- Promote organic and low-chemical farming mode

Conclusion: Balancing Productivity with Environmental & Human Health

Agrochemicals have played a crucial role in enhancing India's agricultural productivity. However, their excessive and improper use has led to serious environmental degradation, biodiversity loss, and health risks. A balanced approach, including the adoption of sustainable alternatives and improved policies, is essential to secure a healthier future for both people and the planet.

References

1. A J Princy (2020) Agrochemicals and their importance in agriculture. Retrieved from <https://researchdive.com/blog/agrochemicals-and-their-importance-in-agriculture> on 1 July 2025.
2. Bernardes M F F, Pazin M, Pereira L C, and Dorta D J (2015) Impact of pesticides on environmental and human health. *Toxicology studies-cells, drugs and env.* 195- 233.
3. Bunch M J, Suresh V M, and Kumaran T V (2003). Environment and health aspects of pesticides use in Indian agriculture. In *Int Conference on Env and Health*. 15:17.
4. Dhaliwal G S, Dhawan A K, and Singh R (2007). Biodiversity and ecological agriculture:Issues and perspectives. *Indian J of Ecol* 34(2):100-109.
5. Fenner K, Canonica S, Wackett, L P, and Elsner M (2013) Evaluating pesticide degradation in the environment: blind spots and emerging opportunities. *Science*. 341 (6147):752-758.
6. Remor A P, Totti C C, Moreira D A, Dutra G P, Heuser V D, and Boeira J M (2009) Occupational exposure of farm workers to pesticides: biochemical parameters and evaluation of genotoxicity. *Environment international* 35(2): 273-278.