



AGRI MAGAZINE

(International E-Magazine for Agricultural Articles)

Volume: 03, Issue: 06 (June, 2026)

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

© Agri Magazine, ISSN: 3048-8656

Environmental Pollution in Agriculture: Impact of Air, Soil, and Water Pollution on Crop Growth, Produce Quality and Sustainable Prevention Strategies

*Alka¹, Dr. Gargi Goswami², Dr. Arunima Paliwal³ and Shivam Singh⁴

¹Ph.D. (Agronomy), Veer Chandra Singh Garhwali University of Horticulture and Forestry, College of Hill Agriculture, Chirbatiya, India

²Asst. Prof. (Agronomy), Veer Chandra Singh Garhwali University of Horticulture and Forestry, Bharsar, India

³Asst. Prof. (Agronomy), Veer Chandra Singh Garhwali University of Horticulture and Forestry, College of Hill Agriculture, Chirbatiya, India

⁴M.Sc. Ag. (Hort.) Vegetable Science, SAST, Chhatrapati Sahu Ji Maharaj University, Kanpur, Uttar Pradesh, India

*Corresponding Author's email: alkar370@gmail.com

Environmental pollution has emerged as one of the biggest issues concerning modern agriculture and world food security. Agricultural production requires clean air, rich soil, and pure water sources. But industrialization, urbanization, excessive use of chemical fertilizers and pesticides, and poor waste management have considerably raised levels of environmental pollution in the world. It can be noted that global statistics show that agriculture produces about 25% of greenhouse gases emitted into the atmosphere; moreover, agriculture is one of the areas most affected by changes in climate and the impacts of pollution. From the report produced by the Food and Agriculture Organization, it is known that 33% of all soils on our planet are polluted due to the influence of chemical pollution, pollution of another kind, as well as erosion. Up to 80% of all wastewater are discharged untreated into the environment and thus cause water pollution in agricultural regions. As a result, these factors harm the natural balance and reduce production volumes. Pollution of air leads to crop damage because gases such as sulphur dioxide, nitrogen oxides, and ozone may interfere with photosynthesis processes and lower the harvest from 5% to 15%. The contamination of soil with excess fertilizer, pesticides, heavy metals, and industrial wastes results in decreasing its fertility and destroying useful bacteria. Polluted irrigation water affects not only plant growth but also quality and safety of the products. Pollution in the environment is another cause of potential danger to the life of humans and animals due to the presence of toxic elements in crops that have been exposed to such pollution. The mounting concern regarding this issue emphasizes the necessity of sustainable agricultural methods to prevent pollution and preserve the environment. Thus, the use of green agriculture, reduction in the use of chemicals, and environmental consciousness are vital.

Air Pollution and Its Impact on Agriculture

One of the environmental challenges that affect agriculture is air pollution. Sulphur dioxide, nitrogen oxides, ozone, and carbon monoxide are some of the dangerous air pollutants that emanate from industrial activities, transportation, thermal electricity generators, and burning of crops. They lead to decreased processes of photosynthesis since they harm leaves and close the stomata, making the plant unhealthy, leading to stunted growth and low yield of crop. Leaf damage, early drying, and poor nutrient content are other consequences of air pollution on agriculture. Besides, acid rain created from air pollution makes soils infertile due

to poor nutrient availability to plants. Farmers' earnings and food security are threatened by air pollution. Thus, it is important to minimize air pollutants, control burning of crops, and engage in sustainable agriculture practices.

Sources of Air Pollution

The reasons for air pollution in agriculture are primarily related to human actions and industrialization. These reasons can be attributed to industries emitting smoke, automobile exhaust fumes, emission from thermal power stations, and burning of fossil fuels resulting in poisonous gases entering the air. Activities such as burning of agricultural crop residue, excessive application of chemical fertilizers, and application of pesticides in farming greatly increase the occurrence of air pollution. Dust particles arising due to building constructions, mining, etc., cause additional air pollution in the rural and urban areas.

Impact on Produce Quality

Besides impacting plant growth, air pollution also influences the quality of the agricultural yield. Pollutants and harmful gases lead to the loss of nutritional value of crops by disrupting plant metabolism. The colour, size, and taste of agricultural products from plants exposed to air pollution is poor. Air pollution also impacts the quality of fruits and grains because of its effect on the texture and storage capability of these crops. Apart from that, toxic substances and metallic elements in air pollutants may deposit themselves on the surface of crops, causing chemical contamination in food products. Consuming contaminated foods poses significant health hazards to human beings as well as animals.

Soil Pollution and Its Impact on Agriculture

Soil pollution is an environmental challenge that poses negative impacts on soil quality and agricultural performance. This situation arises when harmful substances such as toxic substances from industries, pollutants, chemical substances, plastic products, and excessive usage of fertilizer occur within the soil. The heavy reliance on chemical pesticides and fertilizers in agricultural production leads to poor soil quality and the destruction of microorganisms responsible for healthy soils. Moreover, industrial and domestic wastes pose a significant threat to agricultural lands and disrupt soil nutrient composition. The adverse impacts of soil pollution affect the process of plant cultivation since the absorption capacity of the soil and the development of roots deteriorate. Chemical pollutants within the soil may affect plants and end up in products causing harm to people and livestock that consume such crops. The pollution leads to soil degradation characterized by high levels of acidity and salinity within the soil, leading to decreased agricultural production and productivity. Therefore, it becomes vital to practice sustainable agriculture, reduce chemical consumption, and practice organic agricultural production.

Effects on Soil Health

The impacts of soil pollution have negative consequences for soil fertility and agricultural output. The excessive utilization of chemical fertilizers and pesticides leads to loss in soil fertility due to interference with the natural composition of soil nutrients. Soil polluted with toxic substances becomes unable to promote good plant growth and development. Furthermore, soil pollution negatively impacts soil quality because it destroys microorganisms present in the soil like bacteria and fungi. Bacteria and fungi are crucial microorganisms in ensuring proper nutrient cycling and maintenance of soil structure. Soil pollution increases soil acidity and salinity levels, making it impossible for plants to absorb nutrients.

Impact on Crop Growth and Quality

Pollution in the soil has an adverse impact on both the growth of crops and the quality of the agricultural produce. The toxins found in polluted soil affect the roots adversely, and this causes the roots to under-develop. Contaminated soil also interferes with nutrient and water absorption by plants, thus causing nutrient deficiencies in crops and lowering their yield. In most cases, pollutants in the soil end up entering the crops grown in that particular soil. Such contaminated food produce may have toxins and heavy metals, which are dangerous to people who eat them.

Water Pollution and Its Impact on Agriculture

Water pollution poses a threat to the environment and is a challenge to agricultural activities and their productivity. Water pollution involves mixing harmful chemicals like industrial waste, human waste, chemicals used to control pests, chemical fertilizers, and other contaminants into the natural resources of water. Pure water is an important resource required for irrigation, but polluted water degrades the quality of water and negatively impacts the soil and crops. The use of polluted water in irrigation causes toxic chemicals to be deposited in the soil and in the crops as well, causing stunted growth and decreased productivity of the crops. Furthermore, such water affects the germination of seeds and the development of plants. Polluted water causes water scarcity as it makes irrigation and drinking water unsafe. Hence, measures must be taken to avoid this threat to agriculture.

Effects on Irrigation Water Quality

Water pollution is one factor that highly influences the quality of water used in irrigation and impacts agricultural production. The water used in irrigation when polluted with harmful substances can be poisonous to plant life due to the presence of various toxic materials in it. As such, the productivity of crops will decrease, resulting in reduced yield and poor quality of agricultural products. Besides, continuous irrigation with such water causes soil pollution due to the accumulation of toxic substances in the soil, affecting the fertility of soil. Moreover, water pollution limits the sources of irrigation water, leading to water scarcity in many agricultural areas.

Combined Effects of Air, Soil, and Water Pollution

There is a strong link between air, water, and soil pollution, making this combination of pollutants pose serious threats to agriculture and the sustainability of the environment. Pollutants in one sector of the environment affect another. For instance, when there is an accumulation of harmful gases in the atmosphere, they may cause acid rain, which in turn results in soil and water pollution. Likewise, excess fertilizer and pesticides cause pollution of soil and water bodies because of run-off from agricultural practices. Pollution may also occur when the waste from industries and toxins in the atmosphere reach other sectors of the environment. As a result, these pollutants contribute significantly to the degradation of agricultural activities. In this case, the fertility of soils is affected negatively through accumulation of chemicals while crops' productivity is affected because of the deterioration of irrigation quality. Besides, photosynthesis is negatively affected through air pollution while plants remain under a lot of stress from the pollutants. Gradually, the land used for agriculture becomes less productive since it produces low yields and poor quality of products. Agriculture is heavily affected economically due to the presence of pollution in the environment, which raises production costs while lowering agricultural profits. Lower agricultural yields, poor market quality of the agricultural products, and the pollution of the irrigation water cause negative effects on the livelihoods of the farmers. Sometimes, farmers need to incur additional expenses such as fertilizer, pesticide applications, and irrigation water treatment. Environmental pollution can also threaten the food safety and biodiversity of the world. The pollutants in the crops pose a risk to both human and animal life since there may be toxins present in them. The pollution causes the destruction of insect, bird, aquatic, and soil-based organisms' natural habitat, which plays a vital role in agricultural activities. Thus, it becomes essential to prevent environmental pollution through sustainable agriculture and other methods.

Sustainable Prevention and Control Strategies

The implementation of sustainable prevention and control measures is very much needed to minimize the level of pollution and save agriculture. By adopting sustainable eco-farming methods such as organic farming, crop rotation, and IPM, we can minimize our reliance on chemicals such as fertilizers and pesticides. The use of bio-fertilizers and bio-pesticides can enhance the level of soil fertility without causing any pollution. Effective management of agricultural waste along with proper treatment of industrial wastewater and sewage is very

much needed to prevent soil and water pollution. The use of efficient irrigation methods and avoiding excessive use of agrochemicals would help in conserving both soil and water. Planting of trees and effective crop residue management can help us conserve our environment from air pollution. Sustainable government policies, environmental legislations, and public awareness activities can go a long way to achieve the goal of sustainable agriculture. Modern technology can also be helpful for farmers to adopt new methods. For instance, soil and water testing are some of the best ways to manage agricultural resources sustainably.

Pollution Control Measures

Pollution control measures are important for protecting the environment and ensuring that there is sustainable agriculture. Good waste management will ensure proper disposal of waste materials that will not lead to soil and water pollution. Reduction in the use of chemicals in farming will ensure that there are no adverse effects on the environment through destruction of soil, water, and crop. Irrigation should be conducted in a clean manner using water-saving approaches such as drip irrigation and treated wastewater. Finally, there are various techniques such as air filters and scrubbers for controlling pollution caused by gases emitted from industries and automobiles.

Government Policies and Awareness

Environmental Regulations: Environmental laws are systems of rules that govern pollution and environmental conservation. For instance, in India, environmental laws such as the Environment Protection Act of 1986 and the Water Prevention and Control of Pollution Act of 1974 are used to regulate industries' emission and disposal of waste materials. According to the Central Pollution Control Board, emission norms from industries have resulted in the reduction of certain water contaminants by 20-30 percent in regulated areas in the last decade.

Farmer Education Programs: Farmers' education schemes involve educating the farmers regarding the scientific cultivation process and sustainable agriculture techniques. Training is provided by the government through agricultural institutions and Krishi Vigyan Kendras. Research indicates that participation in these schemes enables farmers to cut down the usage of chemical fertilizers by 15 to 25 percent without compromising the crop production level.

Sustainable Agriculture Policies: The sustainable agriculture policy supports sustainable and environment-friendly farming methods. The Parampara at Krishi Vikas Yojana (PKVY) and the National Mission for Sustainable Agriculture (NMSA) are some examples of the schemes that help farmers use organic methods of farming and conserve resources. Because of these policies, there is a sharp rise in the organic farming area across India to more than 2.5 million hectares. The policies also encourage farmers to use biofertilizers, drip irrigation, and soil health cards.

Conclusion

Pollution in any form whether air, soil, or water is one of the greatest threats to our global food supply. Intertwined pollution creates a vicious cycle wherein factory exhausts lead to acid rain that destroys the soil, and farming produces agricultural waste that contaminates the water sources. This leads to negative consequences such as low production, destruction of bacteria, and heavy metal contamination of food, posing risks to both man and beast. Farmers must move towards more sustainable methods such as organic farming, IPM, and precision farming to ensure that they can continue operating without harming the environment and society. This necessitates strong regulation implementation and farmer education. The latter has already proved its effectiveness in reducing chemical use in farming.

References

1. Central Pollution Control Board (CPCB). *Annual Report: Impact of Industrial Emission Norms on Water Quality*. Government of India.
2. Food and Agriculture Organization of the United Nations (FAO). *Status of the World's Soil Resources: Global Soil Pollution and Erosion*. FAO Digital Library.

3. Government of India. *The Environment (Protection) Act, 1986*. Ministry of Law and Justice.
4. Government of India. *The Water (Prevention and Control of Pollution) Act, 1974*. Ministry of Law and Justice.
5. Ministry of Agriculture & Farmers Welfare. *National Mission for Sustainable Agriculture (NMSA): Operational Guidelines*. Government of India.
6. Ministry of Agriculture & Farmers Welfare. *Parampara at Krishi Vikas Yojana (PKVY) Progress Report: Expansion of Organic Farming*. Government of India.
7. Ministry of Agriculture & Farmers Welfare. *Soil Health Card Scheme: Impact Assessment and Precision Farming*. Government of India.
8. National Academy of Agricultural Sciences. *Impact of Air Pollution on Crop Yields and Photosynthesis*. Krishi Vigyan Kendra (KVK) Research Series.
9. United Nations Environment Programme (UNEP). *Global Wastewater Assessment: Untreated Discharge and Agricultural Risks*. UN Digital Library.