

Impact on Water and Soil Quality due to Modern Agricultural Practices

Abeer Sohrab

*Master of Technology, Amity School of Engineering and Technology, Amity University, Noida
E-mail: abeersohrab@gmail.com*

Abstract—This is a review article on how the modern agriculture techniques are harming the water quality and are responsible for polluting environment in day to day life. The dramatic change in the agricultural practices over the last 50 years is one of the main reasons for environmental degradation. Surely, with developed farming methods we have increased the agricultural yield but have also built pathways for agricultural pollution. Slowly these harmful methods are degrading the ecosystem. Furthermore, this article explains the factors which lead to water pollution through agriculture. It characterizes the agricultural pollution into water pollution, soil pollution and nutrient pollution. It also summarizes the effect of these practices on soil properties. This paper elaborates in detail the various problems and health effects of these widely acceptable modern agriculture practices. This article makes us aware of how some modern methods of farming are a bane for environment along with suggesting some solutions to this problem.

1. INTRODUCTION

The increase in population all over the world has placed an unprecedented demand on the agricultural sector to keep up with providing food and resources at the same rate. This increased pressure has led to many innovations and practices which have increased the production rate of the agriculture industry manifold. Yield rates have been improving and increasing every decade and further improvements are required. This is possible due to an increase in: land area, improving techniques, genetically modifying seeds for higher yields and higher frequency of cultivation. In India the average yield per hectare for all food-grains has recorded an increase from 5.5 quintals in 1949-50 to 7.6 quintals in 1964-65 and then to 18.98 quintals in 2008- 09 showing an annual growth rate of 1.4 per cent during 1950-65 and 2.4 per cent during 1965-2007[1]. This increase was possible with huge advances in technology and excessive use of agro-chemicals and pesticides.

2. AGRICULTURAL POLLUTION

With increasing global population, there is an immense pressure on the agriculture sector. Moreover due to constant use of the cultivated land the soil quality has degraded over the years. Therefore, to meet the need of the hour, modern agriculture techniques have been practiced worldwide. And

some of these harmful practices had given birth to a new term 'agricultural pollution'. Agricultural pollution is the contamination and degradation of the environment cause by various modern methods used in farming these days.

Agricultural pollution has been defined as:

Agricultural pollution comprises liquid and solid wastes from all types of farming activities, including run-off from pesticide and fertilizer use, and from feedlots; erosion and dust from ploughing; animal manure and carcasses; and crop residues and debris [2]. Agricultural pollutant has been defined as:

A **pollutant** is a substance including those:

- **Deliberately introduced into the environment** (e.g. Pesticides, fertilizers, GMO crops and sewage sludge)
- **Produced by agricultural as wastes** (e.g. silage effluent and livestock slurry).
- **Produced by enhancement of natural processes in the course of agricultural activity** (e.g. increased nitrous oxide emissions from cultivated soils or soil erosion).[3]

Substances entering the environment may only cause pollution if they are:

- Present in excessive quantities – concentration effects
- In the 'wrong place at the wrong time'.
- Transformed into harmful 'secondary pollutants' as a result of biological or chemical processes.

Pollution from agricultural systems and processes have a major impact in the immediate surroundings, food products upon distribution leading to human impact and the local environment i.e. groundwater and the atmosphere. The overall impact can be categorized into the following:

- Impact on Natural resources, the physical, biological and chemical condition on Soil, Air and Water.

- Impact on ecosystems, on biodiversity and habitat quality.

Since its independence, India has witnessed large variations in growth trends in the agriculture sector. Due to green revolution in 1970s and 1980s, India was able to mark the highest growth rate in its agriculture history. However these growth rates have been fluctuating since then, but India has managed to set an overall growth rate compared to the times before independence. With its wide population, India is not only self sufficient in feeding its people but it is also a marginal exporter.

Agricultural pollution can be classified into water pollution, soil pollution and nutrient pollution based on its impact on these sectors.

3. WATER POLLUTION BY AGRICULTURE

Farming accounts 70% of the water used in the world. Water used in irrigation is either evaporated or pass through the layers of earth and joins ground water or flows as surface water. Therefore being a major component of agriculture, effect of the same on water quality needs to be thoroughly analyzed and monitored. Due to the pressure of serving the needs of the growing population, attempts are made to increase the agricultural yield through modern agricultural practices. These practices include usage of pesticides, agrochemicals, fertilizers and manure to a great extent. Excess chemicals used which are not taken by the crops get washed into the water bodies via surface runoff or groundwater. Excessive ploughing and tillage results in soil erosion which runoff into the water contaminating the surrounding water bodies. The main causes of water pollution due to recent agriculture trends and their impact on environment are described as follows:

3.1 Water pollution due to pesticides, fertilizers and heavy metals

Pesticides and fertilizers are among the most common pollutants that degrade water quality. Pesticides are chemicals use to control pests. These chemicals get washed due to rains and enter water bodies causing various harmful effects on environment. Additionally, they contain POPs which are cancerous and also cause birth defects. Presence of POPs in fertilizers and pesticides has been one of the major concerns in water pollution due to agriculture. Commonly used pesticides such as endosulphan and DDT cause bio-magnification and affects human endocrine system. The Endosulfan pesticide-poisoning episode spanning over two decades in Kerala, took a major toll on the environment and human health. The pesticide was used widely on crops like cashew, cotton, tea, paddy, fruits and others until 2011, when the Supreme Court banned its production and distribution(kota sriraj,oped,2017). Recently 66 pesticides were proposed to be banned but only 18 were considered harmful for human health and are banned

by ministry of agriculture, India in 2016. But sadly, government fails to put an end to other 48 pesticides which were equally harmful to environment or find an alternative for them.

Fertilizers are usually phosphorus and nitrogen nutrients. If present in excessive amount causes algae growth which results in depletion of oxygen thus harming aquatic life. It leads to eutrophication and cause bad taste and odour.

3.2 Water pollution by soil erosion and sedimentation

Soil erosion from the farmland is not only harmful for crop production but it also has negative impact on the environment. Activities such as tillage and crop harvest expose the soil surface to erosion. The surface soil gets lost with the water or carried away by wind thus degrading the soil quality. Suspended sediments in the water affect the water quality by making it turbid and reduce the light penetration. It scours the surface of water bodies thus providing an unhealthy environment for aquatic life and also effect temperature and dissolved oxygen content of water. The soil which is eroded blocks the water bodies increasing the risk of flooding and decreasing the reservoir capacity. Suspended soil particles also affect drinking water by making it toxic. Soil erosion of farming land also causes siltation of river beds.

3.3 Water pollution by irrigation

Excessive or unplanned irrigation of a farmland may cause water logging, soil salinity and drainage problems. The increase in the water level reduces the agriculture production. It is said lower the irrigation efficiency, higher the losses. The stagnant water also causes water borne diseases such as malaria, dengue, etc. Also in past few years trace of toxic elements such as Mo, Se and As has been found in drainage water (Letey et al., cited in Rhoades, 1993).

The various causes and effects of water pollution caused by agriculture are summarized below in table 1.

Table 1. Causes and effects of agriculture on water

S. No.	CAUSES OF WATER POLLUTION BY AGRICULTURE	EFFECTS
1	Pesticides	Bio-magnification, high risk of cancer, premature delivery of a newly born child, birth defects
2	Soil erosion and sedimentation	Siltation of river beds, loss of habitat, turbidity
3	Excessive irrigation	Water logging, salinity, economic loss
4	Contaminated water by heavy metals	Toxicity, various health effects
5	Agrochemicals	Eutrophication, declination in oxygen concentration

4. SOIL POLLUTION BY AGRICULTURE

Farming on land has been done on earth since the existence of mankind. The pressure of sufficient food production to meet the needs of the ever-increasing population has led to efficient use of farming land making the soil lose its natural nutrient and structure, also making it less productive. Improper land use and cropping patterns have resulted in soil degradation – both physical and chemical. Subsequent use leads to decrease in soil porosity and nutrient concentration. Due to the use of agrochemicals soil becomes toxic thus unfit for production. Excessive irrigation which leads to water logging and salinity also adversely affects the soil properties and slows down its production capacity. Major causes of soil pollution because of agriculture include:

1. Clear cutting and deforestation: roots of trees hold the upper layer of soil and keep the crops intact. Cutting of trees is responsible for the loss of rich upper layer of soil, thus affecting the productivity of crops.

2. Livestock grazing: degradation of soil and its erosion are the results of the grazing of livestock.

3. Poor farming methods: excessive use of land area cause depletion of nutrients. Some agriculture practices can cause pollution in soil due to presence of nutrients, pesticides, water salinity, etc. Poor cropping pattern leads to loss of nutrients which are recovered by addition of fertilizers. However, over fertilization is harmful for the soil as well as plants.

4. Excessive irrigation: improper irrigation can cause water logging and water salinity which disturb physical, biological and chemical activities in soil due to low temp., excess soluble salts and very low infiltration rates. Water logging and salinity also increases toxicity of soil.

5. NUTRIENT POLLUTION BY AGRICULTURE

It is a kind of water pollution caused by excessive inputs of nutrients like nitrogen and phosphorous in the water body. It is one of the most widespread and challenging environment issues. One of the major causes of this problem is modern farming. Use of fertilizers, manure and soil erosion are responsible for the addition of these nutrients in the water bodies. It has various health and environment effects. Nutrient pollution causes algae growth and eutrophication which produce toxins in water. Health issues like respiratory and neurological problems are instigated by drinking contaminated water. It is a serious threat to aquatic life and a reason for acid rain.

6. SOLUTIONS AND CONCLUSION

In the past few decades agriculture patterns have changed drastically all over the globe. Modernization in agriculture has led to the excessive use of machinery and chemical products. To increase the crop yield, we have put our environment and health on stake. According to WHO about 20,000 people in developing countries die each year due to consumption of pesticides through food or water. There is a need to take serious step to prevent these harmful impacts. Conservation tillage should be adopted in order to slow down soil erosion. Regular soil testing should be done to keep phosphorous and nitrogen levels in check. Proper land management, rotation of crops and plantation of legumes can help soil to retain back its strength. Use of harmful pesticides and chemicals should be reducing. Proper irrigation and drainage system should be managed. Sustainable agriculture should be put into use

REFERENCES

- [1] Vidya sethi, agricultural production and productivity in India
- [2] Glossary of environment statistics, studies in methods, series F, no.67, United Nations, New York, 1997.
- [3] Graham Merrington, Linton Winder, Robert Parkinson, Mark Redman, (2002).Agricultural pollution, environmental problems and practical solutions, London, new York,2002.
- [4] Lucilia Candela, Suresh Rao, Mario Margiotta, Aldo Reboucas, 1998.IHP-V, technical documents in hydrology, no. 19 UNESCO, Paris, 1998.
- [5] Brain Pain, Steve Jarvis, Bob Clements, 1991. Impact of agricultural practices on soil pollution, published in sage journal, vol 20, issue 3, 1991.
- [6] Kota Sriraj,2017. "lives, not just business, at stake", oped, the pioneer,2017.
- [7] Silke Skytte Johannsen and Patrick Armitage, agricultural practices and effects of agricultural land use on water quality, freshwater forum, 2010.
- [8] Brian moss, 2008, water pollution by agriculture, philos trans R soc lond B biol sci, 2008.
- [9] Papendick, Robert I., Elliot Lloyd F., Dahlgren, Robert B., 1986, " Environmental consequences of modern production agriculture: how can alternative agriculture address these issues and concerns?" American journal of alternative agriculture,Vol. 1, No. 1, pp. 3-10.
- [10] Vishwa mohan, 2017, "Centre to ban use of 18 pesticides harmful to humans and animals" , the times of india, 2017.