ACADEMICIA: An International Multidisciplinary Research Journal
ISSN: 2249-7137 Vol. 11, Issue 11, November 2021 SJIF 2021 = 7.492
A peer reviewed journal

AGRICULTURE'S IMPACT ON WATER POLLUTION AND ITS REDUCING STRATEGIES

Shakuli Saxena*

*Department of Agricultutal Sciences,
Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, INDIA
Email id: shakuli.agriculture@tmu.ac.in
DOI: 10.5958/2249-7137.2021.02573.8

ABSTRACT

Water is regarded as the world's most important resource for long-term development. It is necessary not only for agriculture, industry, and economic processes, but it is also the most vital component of the environment, having a significant impact on human health and environmental preservation. Agriculture's water contamination is well-known. globally. Non-point source (NPS) pollution, on the other hand, has been shown to be more harmful than pollution from point sources around the world. Due of its intrinsically diffuse character. it is difficult to handle successfully. The polluting of water is known as water pollution. When pollutants are released directly into bodies of water, pollution ensues. or inadvertently into bodies of water without proper treatment to remove hazardous substances. There are two types of water, surface water - rivers, lakes, and oceans (Uses: drinking, recreational (fishing, boating, etc.)) are polluted. Nitrates are the major pollutant of groundwater. Groundwater is a significant source of drinking water in any country. Groundwater in numerous regions has become so polluted that it can no longer be utilized as drinking water according to current regulations. The economic value of improvements in water quality is an important part of evaluating programs to prevent pollution caused by agricultural activity. Many farmers can adopt a variety of initiatives to reduce agricultural pollution loads on water resources. This study discovered that there are both structural and management approaches available for more efficiently managing water and chemical inputs, as well as regulating runoff to reduce irrigation water pollution.

KEYWORDS: *Agriculture, Groundwater, Pollutant, Water Pollution.*

1. INTRODUCTION

Agricultural pollution refers to the living and non-living bi-products of farming activities that pollute the environment and adjacent ecosystems, as well as harm humans and their economic interests. Pollution can occur from a variety of sources, ranging from direct pollution to more diffuse, landscape-level causes, often known as non-point source pollution(1)(2)(3).The amount and impact of these contaminants are influenced by management techniques. Animal management and housing, as well as the spread of pesticides and fertilizers in worldwide agricultural practices, are all examples of management approaches.Non-point sources have the following characteristics: they respond to hydrological circumstances, are difficult to monitor or regulate directly, and specialize in land and associated management techniques(4)(5)(6). Two or

more criteria that reflect the "healthiness" of water are asked in Water Quality Indices. In certain instances, indices represent ecosystem activities, while in others, they reveal aquatic environment conditions.

The effects of growing conventional crops as feedstock for first-generation biofuels on water quality are similar to those of other agricultural crops. Pollution from intensive agricultural production using fertilizers and various types of pesticides (herbicides, insecticides) has direct effects on water quality.Integrated pest management (IPM) is a pest-control approach that combines a number of complimentary tactics to decrease pests, expenses, and the need for chemical pesticides. Herbicides (weed killers), insecticides (insect killers), fungicides (fungi killers), nematocides (nematode killers), and rodenticides (vertebrate poisons) are all examples of this in agriculture(7)(8)(9). Irrigation in agriculture has consequences as well; for example, salt runoff causes salinization of surface waterways, while fertilizer and pesticide runoff causes ecological harm and bioaccumulation in edible fish species. Chemical oxygen demand (COD), biological oxygen demand (BOD), ammonia nitrogen (NH3-N), total phosphorus (TP), total nitrogen (TN), and metals are the most common contaminants found in animal faces(10).

The polluting of water bodies is known as water pollution. Agricultural water pollution has an impact on the plants and creatures that live in these bodies of water, and in the majority of instances, this has a negative impact on both individual species and populations, as well as natural biological communities. Pollutants are dumped directly or indirectly into water bodies without sufficient treatment to remove hazardous chemicals, resulting in irrigation water contamination (11).

1. Sources of water pollution:

Pollution may originate from a number of sources, which are listed below: -

1.1.Pollution from a single source:

It is described as discharge into surface waters from a pipe, outfall, or ditch at a particular place. Furthermore, it is the flow of contaminants into a surface or subterranean water body that is visible, particular, and restricted. Surface water discharges from feedlots, food processing facilities, and agrochemical manufacturing industries, for example, as well as chemical spills polluting groundwater(11).

1.2.Pollution from non-point sources (NPSP):

Non-point source pollution, often known as "diffuse" source pollution, results from a diverse range of human activities with no apparent point of entry into receiving watercourses (FAO, 1996). Beginning pollution, on the other hand, refers to operations in which wastewater is discharged directly into receiving water bodies through, for example, discharge pipes, where it will be easily monitored and managed. Pollution from non-point sources is far more difficult to detect, quantify, and manage than pollution from point sources. The word "diffuse" source should be avoided since in the United States, it has a legal meaning that currently includes some kinds of point sources.

The effects of agricultural inputs on water quality,the effects of growing conventional crops as a feedstock for first-generation biofuels on water quality are the same as they are for other agricultural crops. Pollution from fertilizers and other kinds of pesticides (herbicides,

insecticides, fungicides) used in intensive agricultural production, as well as other agricultural malpractices such as ploughing of unsuitable soils, have direct effects on water quality, first and foremost Pesticides have a big impact on water quality and aquatic life. Pesticide residues may induce acute poisoning (e.g. fish deaths) and chronic poisoning in ponds, rivers, and lakes owing to surface runoff or spray drift. Reduced fish egg production and hatching, poorer disease resistance, decreased body size, and reduced predator avoidance are some of the negative impacts on fish that receive repeated sub-lethal pesticide dosages(12)(13)(14). Population abundance may suffer as a result of the overall effects(15)(16)(17). When predators eat pesticide-affected prey, there's a danger of secondary poisoning. This is especially true when it comes to persistent pollutants that build up and travel through food systems. When ecosystems or food chains are altered, such as when pesticides reduce insect populations that feed fish and other aquatic species, indirect impacts may occur. Pesticides stored in poor conditions are hazardous to both human health and the environment, especially when maintained near water bodies or in metropolitan areas. Farmers that lack pesticide management expertise are more likely to employ older, more hazardous, and more persistent pesticides. This may be a particular issue in certain underdeveloped nations. The issue is exacerbated by the lack of strict rules or the failure to enforce those that do exist(18)(19)(20). Fertilizers are a kind of fertilizer that is used to increase the growth of plants Fertilizers used to boost agricultural yields, particularly nitrogen (N) and phosphorous (P), may wind up in rivers and groundwater. They have the potential to degrade groundwater and river water quality, as well as eutrophicate wetlands and aquatic bodies(21)(22)(23). High nutrient concentrations encourage algal development, resulting in unbalanced aquatic ecosystems with phytoplankton blooms, excess organic matter production, and increased oxygen demand, resulting in oxygen deprivation and mortality of benthic species living on or near the bottom. Nine nations surround the Baltic Sea, while five additional countries are in the drainage basin but do not border the sea. Fertilizer runoff from nearby agricultural areas adds to a high nutrient load in the Baltic Sea, which has evolved from an oligotrophic clear-water sea to a eutrophic marine ecosystem with midsummer algal blooms, particularly of blue-green algae.

Most OECD countries have monitoring networks to measure the actual state of water pollution of water bodies, while some countries use risk indicators that provide estimates, usually based on models of contamination levels. However, monitoring of agricultural pollution of water bodies is more limited with just over one-third of OECD member countries monitoring nutrient pollution and even fewer countries tracking pesticide pollution. Certain farm pollutants are recorded in more detail and with greater frequency (e.g. nutrients, pesticides), whereas an indication of the overall OECD situation for water pollution from pathogens, salts and other agricultural pollutants is unclear. Moreover, pollution levels can vary greatly between countries and regions depending mainly on soil and crop types, agro-ecological conditions, climate, farm management practices, and policy.

The limitations to identifying trends in water pollution originating from agriculture are in attributing the share of agriculture in total contamination and identifying areas vulnerable to agricultural water pollution. In addition, differences in methods of data collection and national drinking and environmental water standards hinder comparative assessments, while monitoring agricultural water pollution is poorly developed, especially for pesticides, in a number of countries, such as Australia, Italy, Japan and New Zealand. The extent of agricultural

groundwater pollution is generally less well documented than is the case for surface water, largely due to the costs involved in sampling groundwater, and because most pollutants take a longer time to leach through soils into aquifers.

The remainder of this section examines agricultural pollution in terms of the main agricultural driving forces impacting on water pollution, especially the use of nutrient and pesticides inputs. In turn depending on farming practices and systems, the use of farm inputs will affect the state of the environment with regard to rates of soil erosion (which affects the leaching of pollutants), water quality and impacts on aquatic ecosystems (either in fresh or marine waters). The fourth section examines the policy responses across OECD countries to the state of water pollution, which in turn act as a driving force on the farm systems, practices and inputs used by agriculture.

2. DISCUSSION

For the management of marine ecosystems and the prevention of negative effects on them, diagnosis, prediction, and monitoring are essential. Managers, planners, and legislators must understand the state of aquatic ecosystems, the nature and dynamics of the drivers and pressures that lead to water-quality degradation, and the impacts of such degradation on human health and the environment in order to design cost-effective measures for preventing pollution and mitigating risks(24). The sections below provide an overview of the causes and consequences of water pollution in agriculture, as well as potential actions to avoid pollution and ameliorate its affects, using the logic of the Drivers-Pressures-State change-Impact-Response (DPSIR) framework. Figure 1 shows the DPSIR framework for agricultural water pollution analysis.

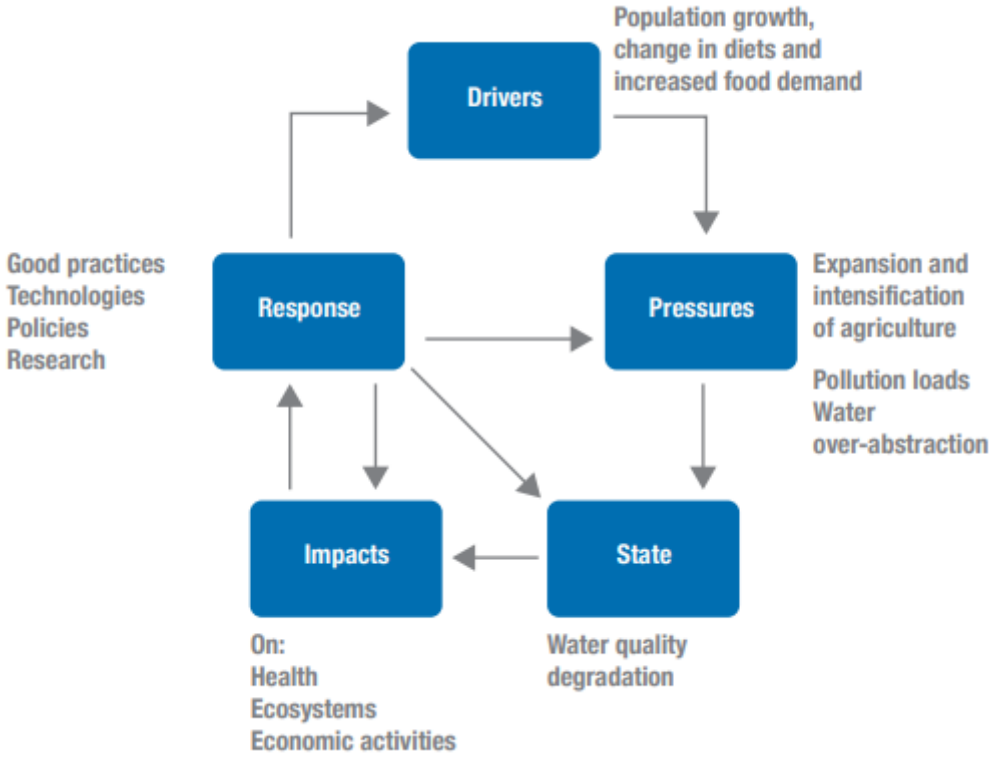

Figure 1: DPSIR Framework for Agricultural Water Pollution Analysis.

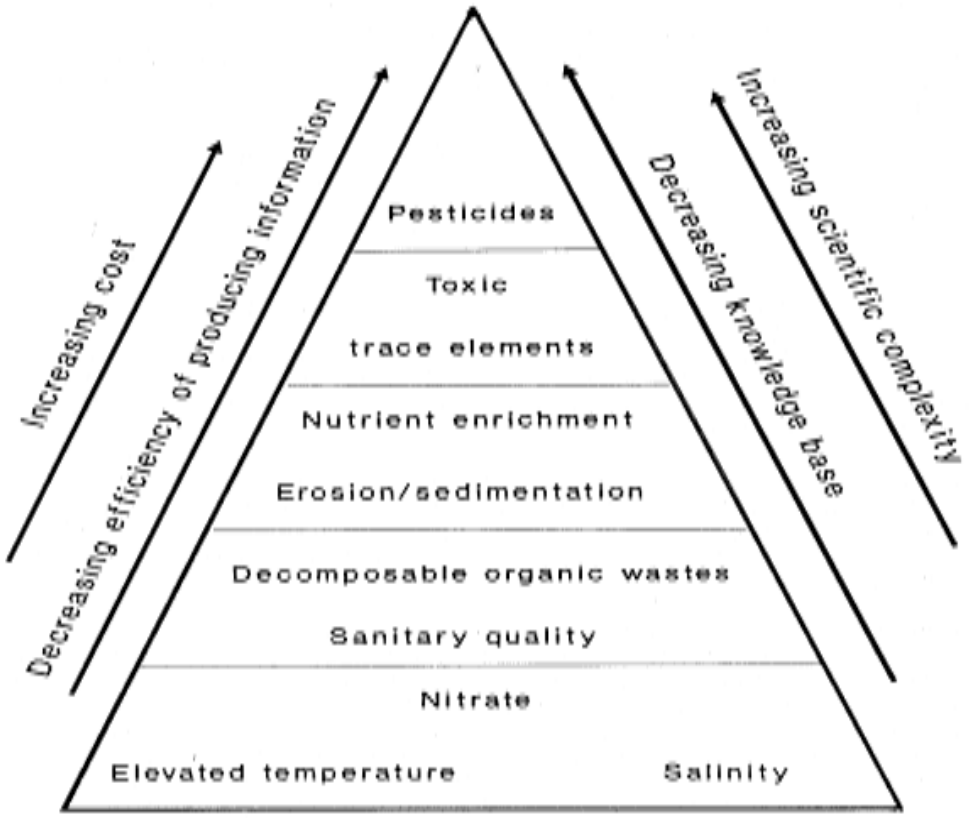

Figure 2: Illustrates the diverse steps of increasing cost.

Agricultural water quality has been identified as a major environmental issue in Organisation for Economic Co-operation and Development (OECD) countries, and as a topic for policy analysis is an issue of relevance across all OECD countries. The primary agricultural sector is mainly responsible for nitrate, phosphorus, pesticide, soil sediment, salt, and pathogen pollution of water from crop and livestock activities, but it can also play a role under certain farm practices in terms of improving water quality through a water purification function. Water pollution from agriculture has associated costs in terms of removing pollutants from drinking water supplies, as well as damage to ecosystems and commercial fishing, recreational, and cultural values associated with rivers, lakes, groundwater and marine waters. Agricultural water pollution is a focus of attention for policy-makers in most OECD countries due to the following (the importance of these issues varies within and across countries). Figure 2 illustrates the diverse steps of increasing cost.

- Reduction in pollution by non-agricultural polluters, which has been more rapid than for agriculture, especially nitrate, phosphorus and pesticide pollution.
- Increase in point pollution from agriculture linked to the intensification of livestock farming, especially in the pig, poultry and dairy sectors.
- Greater public awareness of the damage to aquatic ecosystems from certain agricultural practices.

- Growing concerns related to groundwater and coastal pollution, especially from the leaching of phosphorus and pesticides.
- Uncertainty over the extent and severity of those water pollutants derived from farming that are in general poorly monitored (e.g. pathogens, salts, heavy metals).

The European Union Nitrate Directive, for example, defines areas vulnerable to nitrates in its member states, and sets guidelines to establish the maximum permitted level of nitrates in water. Moreover, the action programmes developed to implement the Directive, establish the necessary measures to ensure that nitrogen of animal origin spread on the land (manure fertilization) does not exceed 170 kg/hectare. It also makes it mandatory for farmers to ensure that fertilizer use is well balanced to supply the needs of crops. European Union member states have designed and implemented some agri-environmental measures to further reduce nitrogen losses in water that go beyond the statutory obligations. Reduced use of fertilizers, converting arable land to extensive grassland (pasture), green cover and crop rotation are the main instruments implemented by member states to reduce nitrates in water. In addition, the European Union Water Framework Directive imposes the objective of achieving good water status by 2015(25).

3. CONCLUSION

In most developing nations, water is regarded as the most important resource for long-term development. It is not only necessary for agriculture, industry, and economic processes, but it is also the most vital component of the environment, having a significant effect on human health and environmental conservation. Surface water contamination poses a health concern since such streams are often exploited as clean water sources and therefore utilized for drinking water, or is linked to shallow wells used for drinking water. Waterways also serve as essential washing and cleaning facilities, as well as fishery and fish farming and leisure. Groundwater, which is filtered via subterranean layers of sand, clay, or rocks, is another important source of beverage. Groundwater has low pathogen concentrations on a regular basis. Toxic substances like arsenic and fluoride, on the other hand, are often absorbed into groundwater from soil or rock strata. Chemicals may enter rivers via both point and nonpoint sources. Pollution from a single source, such as an industrial site, is referred to as point-source pollution. NPS (non-point-source) pollution is made up of a lot of tiny sources that add up to a lot of pollution. Rain or irrigation water, for example, takes up pollutants such as fertilizers, herbicides, and insecticides and transports them to rivers, lakes, reservoirs, coastal waters, or groundwater.

REFERENCES:

1. Tal A. Making conventional agriculture environmentally friendly: Moving beyond the glorification of organic agriculture and the demonization of conventional agriculture. Sustain. 2018;

2. Jain N, Awasthi Y. WSN-AI based Cloud computing architectures for energy efficient climate smart agriculture with big data analysis. Int J Adv Trends Comput Sci Eng. 2019;

3. Kumar S, Shamim M, Bansal M, Gangwar B, Aggarwal RP. Computational modeling and emerging trend in agriculture. In: 2015 International Conference on Computing for Sustainable Global Development, INDIACom 2015. 2015.

4. Dwivedi S, Shikha D. Water pollution: Causes, effects and control. Biochem Cell Arch.

2016;

5. Choudhary M, Jayanand, Padaria JC. Transcriptional profiling in pearl millet (Pennisetum glaucum L.R. Br.) for identification of differentially expressed drought responsive genes. Physiol Mol Biol Plants. 2015;

6. Bhardwaj P, Rai DV, Garg ML. Zinc inhibits ovariectomy induced microarchitectural changes in the bone tissue. J Nutr Intermed Metab. 2016;

7. Schwarzenbach RP, Egli T, Hofstetter TB, Von Gunten U, Wehrli B. Global water pollution and human health. Annu Rev Environ Resour. 2010;

8. Kashyap K, Sharma TK, Rajpurohit J. Logistic map and wavelet transform based differential evolution. Int J Syst Assur Eng Manag. 2020;

9. Sharma TK, Prakash D. Air pollution emissions control using shuffled frog leaping algorithm. Int J Syst Assur Eng Manag. 2020;

10. OECD. Water quality and agriculture: meeting the policy challenge. Key Messages and Executive Summary. OECD Stud water. 2012;

11. Land, agriculture and the environment. In 2002.

12. Cuttle SP, Newell-Price JP, Harris D, Chadwick DR, Shepherd MA, Anthony SGA, et al. A method-centric "User Manual" for the mitigation of diffuse water pollution from agriculture. Soil Use Manag. 2016;

13. Kumar N, Singh A, Sharma DK, Kishore K. Novel Target Sites for Drug Screening: A Special Reference to Cancer, Rheumatoid Arthritis and Parkinson's Disease. Curr Signal Transduct Ther. 2018;

14. Goswami G, Goswami PK. Artificial Intelligence based PV-Fed Shunt Active Power Filter for IOT Applications. In: Proceedings of the 2020 9th International Conference on System Modeling and Advancement in Research Trends, SMART 2020. 2020.

15. FN C, MF M. Factors Affecting Water Pollution: A Review. J Ecosyst Ecography. 2017;

16. Shabbir M. Textiles and clothing: Environmental concerns and solutions. Textiles and Clothing: Environmental Concerns and Solutions. 2019.

17. Stojkovikj S, Oklevski S, Jasuja OP, Najdoski M. Visualization of latent fingermarks on thermal paper: A new method based on nitrogen dioxide treatment. Forensic Chem. 2020;

18. Moss B. Water pollution by agriculture. Philosophical Transactions of the Royal Society B: Biological Sciences. 2008.

19. Kumar A, Ishwar B. Linear Stability Of Triangular Equilibrium Points In The Photogravitational Restricted Three Body Problem With Triaxial Rigid Bodies, With The Bigger One An Oblate Spheroid And Source Of Radiation. Publ Korean Astron Soc. 2015;

20. Sharma P, Berwal YPS, Ghai W. Enhancement of plant disease detection framework using cloud computing and gpu computing. Int J Eng Adv Technol. 2019;

21. Gray MW. Water Pollution and Agriculture. Trans Kansas Acad Sci. 1967;

22. Tesfahun AA, Chawla AS. Risk perceptions and adaptation strategies of smallholder farmers to climate change and variability in North Shoa Zone, Ethiopia. Manag Environ Qual An Int J. 2020;

23. Rosha P, Ibrahim H, Nanda AK, Mohapatra SK, Mahla SK, Dhir A. Effect of hydrogen-enriched biogas induction on combustion, performance, and emission characteristics of dual-fuel compression ignition engine. Asia-Pacific J Chem Eng. 2020;

24. Liakos KG, Busato P, Moshou D, Pearson S, Bochtis D. Machine learning in agriculture: A review. Sensors (Switzerland). 2018.

25. Kaur R, Shikha D, Kaushal A, Gupta R, Singh SP, Chauhan RP, et al. Measurement of indoor 222Rn, 220Rn and decay products along with naturally occurring radionuclides in some monuments and museums of Punjab, India. J Radioanal Nucl Chem. 2021;