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REVIEW ARTICLE **OPEN ACCESS**

Impact of Agriculture on Water Pollution and Its Minimization Strategies: A Review

[1]Sonia Goel, [2] Meenakshi Devi, and [3] Anshul Arya, [4]Prafull Kumar, [5] Manoj Kumar Mishra
[1]Assistant Professor (Biotechnology), [2]Assistant Professor (Entomology), [3]Assistant Professor (Plant Pathology),
[1, 2, 3] Shree Guru Gobind Singh Tricentenary University, Gurugram-Badli Road, Gurugram
[4,5]Sanskriti University, Mathura, Uttar Pradesh
Email Id- [1]drsonia.fas@sgtuniversity.org, [2]meenakshi_fasc@sgtuniversity.org, [3]anshul_fasc@sgtuniversity.org, [4]sanpubip@gmail.com

ABSTRACT
The impact of agriculture on surface and groundwater is determined as negative. On the other side, wastewater and contaminated groundwater have a detrimental impact on agriculture. Water contamination in irrigation is well-known around the world. However, unlike point sources, non-point source (NPS) contamination has proved to be difficult to successfully handle due to its intrinsically dispersed existence. Water waste is the poisoning of bodies of water (e.g. lakes, rivers, oceans, and groundwater). Water waste happens as contaminants are released into bodies of water, either directly or indirectly, without sufficient care to eliminate toxic substances. Surface water and groundwater are the two types of polluted water. Groundwater is being polluted mainly by nitrates. Groundwater is an important source of drinking water in the world. The economic importance of improvements in water quality is an important aspect of the economic evaluation of agricultural emissions control policies. Many farmers may take various measures to reduce agricultural pollutant loadings into water supplies. This analysis found that both structural and management practices are available for more effective water and chemical input management, as well as managing runoff to mitigate irrigation water emissions. Effective irrigation water control, integrated pest management, systematic nutrient management preparation, livestock waste management, organic agriculture, solid waste, sanitation, and stormwater pre-treatment are among the activities.
KEYWORDS: *Agriculture, Fertilizer, Irrigation, Pollution, Water.*

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INTRODUCTION

The impact of agriculture on surface and groundwater is determined as negative. Water contamination is caused by a variety of agricultural practices such as cattle raising, chemical usage, fertilization, and unsustainable land use. Aquatic habitats and river banks are also harmed by agricultural activities. Water contamination is caused by plant and livestock operations in the agriculture sector. Agricultural waste applies to all living and non-living byproducts of agricultural activities that end up contaminating or degrading the landscape and surrounding habitats, as well as causing harm to humans and their economic interests [1], [2].Agriculture pollutes water supplies as a result of the use of agrochemicals, biological compounds, and saltwater runoff, according to United Nations Environment Program UNEP (2016), and waste endangers marine environments and human health. A working group established by the Global Food Security Program holds the same view, citing agriculture's effect on water quality through the release of nutrients and other contaminants into bodies of water, as well as improvements in the physical habitat of rivers[3], [4].

According to the Organization for economic co-operation and Development OECD (2012), agricultural water toxins include nutrients and chemicals, soil sediments, and other contaminants. Water waste harms coastal species as well as commercial freshwater and marine fisheries[5]. Pollution also reduces the social benefits of water supplies such as swimming and waterscapes, as well as having a detrimental effect on public health. According to various authors, the major water polluters from farming operations are chemical and mineral fertilizers, surface degradation, and wastewater from livestock farms. The authors summarize the causes of nitrate pollution of water from agricultural sources, such as higher yields from

planted crops, a lack of understanding of soil nitrogen storage, uneven soil fertilization, and improper fertilizer storage [6], [7].

Other factors contributing to agriculture's detrimental effect on water quality include an increase in pollution. The author assumes that the intensification of development as a result of rising food demand has a detrimental effect on water quality. Cropping, poultry, and aquaculture both have a negative effect. Agriculture has a detrimental effect on water, according to scientists, as a result of population development and improvements in dietary habits. Polluted water also has a detrimental effect on agriculture because it decreases farm production. A. E. Evans *et al.* [8] create a correlation between wastewater and springs. Due to interaction with dirty water, toxic springs have a detrimental effect on agriculture and the health of farmers. According to agriculture is also a victim of water contamination because contaminated soil and groundwater have a detrimental impact on crops and cause various diseases in consumers and farm workers[9].

T. Sarathamani et al. [10]consider that water pollution leads to additional costs. Integrated pest management (IPM) is a pest control technique that employs a variety of complementary techniques to eliminate pests, costs, and, as a result, the use of chemical pesticides. This includes herbicides (weeds), mosquitoes, and fungi in cultivation. Irrigation has consequences as well; for example, salt runoff results in salinization in surface waters; manure and chemical runoff results in surface waters with aquatic degradation and bioaccumulation in edible fish species.

Water Pollution:

Water waste is the poisoning of bodies of water (e.g. lakes, rivers, oceans, and groundwater). Agricultural water runoff affects the plants and animals that live in these bodies of water, and in most instances, the impact is detrimental to human species and ecosystems, as well as natural ecological systems. Water waste from irrigation happens as contaminants are dumped directly or indirectly into bodies of water without proper care to remove toxic compounds [11], [12].

Sources of Water Pollution:

The pollution may come from a variety of sources, which are discussed as follow.

Point Source Pollution:

It is characterized as discharge into surface waters through a drain, outfall, or ditch at a specific location. Furthermore, it is a noticeable, specific, and restricted discharge of toxins into a body of surface or underground water. Groundwater discharges from feedlots, food manufacturing facilities, and agrochemical processing plants.

Water Quality Indices for Application to Agricultural Water Quality Issues:

Functions that show how safe the water is are the water quality indices. In some cases, indices represent ecological conduct; in others, they suggest conditions in the aquatic environment. These indices are often used to track the environmental instability potential and provide insight into sources of emissions and control decisions of the sources. Indices are generally used for easier analysis and are not specifically used for the management of water quality in the field. Indexes are needed to quickly measure the effects of farm erosion and to assume the number of effects in time as a result of organizational decision-making[13], [14].As a means of measuring the economic impacts of agricultural runoff, indices that attribute groundwater resource impacts to external factors relative to both upstream sources and downstream consequences may be created. Currently, water quality indices are of the following types:

Standard Water Chemistry was accompanied by Numerical Indices:

Six indexes are commonly used to combine various chemical measures of water quality into a single optimized index. Minerals, microbiology, dissolved oxygen, and, at occasional times, metals are normally present. These are also used to calculate river reaches as descriptive devices. The most successful indices describe a particular class of water pollutant effect using a limited number of parameters. A paper may be the most recent and detailed reference (in Dutch).

Effect Indicators/Indices:

Many types of impact metrics are often grouped into an index. There are usually indicators of a biological response to marine contaminants. Many of these are used as "screening" instruments (as described above), which may assist managers in assessing the character and severity of pollutant effects spatially and causally.

Agricultural Inputs and Its Impacts on Water Quality:

The results of planting traditional crops as feedstock for first-generation biofuels on water quality are the same as those of other field crops. Pollution from drainage or industrial crop cultivation using fertilizers and numerous forms of pesticides (herbicides, insecticides, fungicides) as well as other agricultural malpractices such as tillage of unsuitable lands have a significant effect on water quality [15], [16].

Pesticides:

The overall effects may reduce the accumulation of the number. Secondary toxicity is also possible as depredators eat prey contaminated with pesticides. This is especially true for the accumulation and flow of persistent chemicals in food chain systems. Negative costs also occur when habitat or food chains are altered, for example by reducing the number of neonicotinoid species that feed fish and other aquatic animals. In poor conditions, pesticides are threatening both human health and the environment, especially when stored in towns or near water bodies. Older, dangerous, and environmentally prolonged pesticides are often more likely for farmers who cannot monitor pesticides. In several developing countries, this may be a common problem. The failure to implement current regulations or strict legislation is contributing to the problem [17], [18].

Sediments:

Sediment pollution is often linked to agricultural activities, as they may cause flooding and sedimentation, which may have physical (e.g., turbidity of water) and chemical consequences.

Manure and Sludge:

Compost and sewerage sludge can be valuable nutrient sources for maintaining/improving soil carbon content and productivity. However, organic matter runoff, particularly when distributed on frozen soil, can lead to higher levels of pathogen, metal, phosphorus, and nitrogen contamination of receiving waters, leading to eutrophication and potential contamination. Furthermore, groundwater can be polluted, especially by nitrogen.

Irrigation:

Irrigation has consequences as well; for instance, salt runoff encourages salinization of surface waters; manure and biochemical runoff cause aquatic destruction and bioaccumulation in edible fish species. The irrigation procedure plays a key role in the growth of the crop in a pragmatic manner to improve overall productivity.

Plowing& Tillage:

Inadequate soil laying and bridging will increase both the sediment/turbidity of river banks and ecology loss and breeding grounds. Tillage and plugs should also be taken into account since they enhance erosion while harvesting agricultural waste for lingo cellulosic processes.

Minimization Strategies for Agricultural Water Pollution:

There are structural and maintenance practices required for more effective water and chemical input management, as well as managing runoff to mitigate irrigation water emissions. Good irrigation water management, comprehensive pest management, a comprehensive resource management approach, animal waste management, organic agriculture, and organic waste and sewage surface modification are among these operations[19].

Industrial Waste and Sewage Pretreatment Program:

Wastewater disposal plants collect wastewater from agricultural consumers in addition to wastewater from domestic and commercial sources. Aerobic composting, sanitary landfills, and incineration are examples of solid waste disposal and resource recycling systems that can be used (FAO, 2013).

Aerobic Composting:

The method employs precise temperature, carbon, humidity & nitrogen ratio, and ventilation requirements, as well as the use of commonly spread in nature microbes, fungi, actinomycete (bacteria), and/or other microorganisms to biodegrade organic household waste into healthy humus (used as fertilizer). The compost substance is dark brown and smells like dirt; it works well as a soil conditioner for the soil reaction [20].

Sanitary Landfill:

Domestic waste is buried in a sanitary landfill. This necessitates stringent conditions to deter rainwater runoff, and the landfill's bottom is sealed to prevent waste liquids from percolating through groundwater and contaminating.

Incineration:

Incineration is a method of burning waste in high-temperature ovens that are commonly used around the world. If not done correctly, this procedure will contain a lot of poisonous gases &by-products during the combustion process.

The Regulatory Framework to Control Irrigation Water Pollution:

Water contamination in irrigation is well-known around the world. However, unlike point sources, non-point source (NPS) emission has proven to be difficult to efficiently control due to its intrinsically diffuse existence. The water framework directive employs advanced water supply control.

Using Compost to Reduce Water Pollution:

Organic wastes such as compost, wastewater treatment solids, and even grass clippings are significant sources of nonpoint source contamination. Composting is a procedure that takes these raw materials and stabilizes them under stable conditions. Stabilizing the cloth connects the nutrients, such as nitrogen,

within the organic matter of the compost. The nutrients are gradually released over time, increasing the possibility of plant uptake and reducing downstream water contamination issues. As a consequence, the Non-Point programmer has designated composting as a Better Management Method when opposed to raw manure[21], [22]. Not only is composted manure less polluting but as a processed commodity, it may be shipped farther from the point of generation. Composting has several advantages wherein composting increases soil water dynamics by increasing water infiltration, percolation, and water holding capacity. This will reduce the need for irrigation and the resulting leaching potential. For example, a study in Florida's degraded sandy soils found that annual applications of compost per acre resulted in increased soil moisture and decreased water usage [23], [24].

Comprehensive Nutrient Management:

Improved land, water, and fertilizer management practices are needed to increase irrigated agriculture's the production and environmental efficiency. Sustainable agricultural production and productivity were based on the premise that natural resources can be used to maximize output and profits without depleting the natural resource base. In this sense, integrated nutrient management protects soils as reservoirs of plant nutrients needed for vegetative growth. The aim of integrated nutrient management INM is to combine the use of all-natural and man-made plant nutrients so that crop production improves in a productive and environmentally sustainable manner, without sacrificing the soil productivity of future generations. INM is dependent on some considerations, including proper fertilizer application and conservation, as well as the flow of data regarding INM activities to farmers and researchers[25], [26].

Storm-Water Treatment

That is the process of removing toxins from rainwater before releasing it into the municipal stormwater system. The practice of avoiding interaction between rainwater and possible pollutant sources is known as source protection. Development programmers that have permanent storm-water treatment dependent on soil or vegetation will protect water quality while also reducing the frequency of treatment facility maintenance. The bulk of soil-based treatment schemes consists of bio-retention areas and bio-swales, which are swales lined with grass or other vegetation. Such methods include but are not limited to, paver systems, vertical pipes/boxes or dry food boxes made of a combination of clay, sand, and rock, and other systems as new methodologies emerge[27], [28].

Capturing and Recycling Agricultural Runoff as Pollution Prevention Strategies:

Capture and recycling technologies started as a means to save water and reduce water and energy costs. A recycling scheme can also be used to manage storm water. The cost of installing a system is determined by a variety of factors, including the amount of runoff to be collected and topographic features that decide the number of retention basins required to catch runoff. A network of channels and ditches captures runoff irrigation water from nursery beds and diverts it to basins that store the water in the catch and recycle scheme[29], [30]. The water will then be drained back into the processing areas or a holding tank from these drainage basins. Another benefit of recycling is that it may result in a slight reduction in fertilizer costs due to the recycling of nutrients within irrigation water. Furthermore, the catch-and-recycle method provides greater management flexibility in the usage of different types of fertilizers, timing fertilizer treatments, and the use of specific pesticides in reducing insect outbreaks. High Phytophthora levels can necessitate disinfection of recycled water from high turnover retention basins or sumps. Water should also be filtered before reuse to eliminate the bulk of contaminants. Retaining collected runoff in basins decreases pathogen quantities by natural mechanisms such as settling and biological and physical deterioration [31], [32].

CONCLUSION AND IMPLICATIONS

Water is considered the most critical resource for sustainable development in most developing countries. It is vital not only for agriculture, manufacturing, and economic processes, but it is also for the most important part of the ecosystem, having a direct effect on health and nature conservation. Surface water can be contaminated by chemicals since they commonly serve as pure water supplies and hence for drinking water or are linked to shallow wells used for drinking water. This may be dangerous to health. Waterways also serve key roles in washing and drying, fisheries and fish breeding, and tourism. Groundwater is also a significant drinking source since it is pushed into subterranean sand, mud, and rocks and leads to minimal pathogens.

Toxic contaminants such as arsenic and fluoride, on the other hand, are often absorbed into groundwater from soil or rock layers. Chemicals are available at points of access to the rivers and from nonpoint sources. Point-point pollution is from single source discharges such as a production facility. A large number of small causes combined to generate major pollution are responsible for NPS (non-point-source) pollution. For example, precipitation is flooded and transported through rivers and lakes, reservoirs, coastal water, and groundwater by contaminants such as fertilizers, herbicides, and pesticides. Stormwater, which accumulates by street, then connects rivers or rivers, is another non-point outlet.

Control of water contamination requires interference at all stages of the system. The only way to reduce diffuse chemical emissions of wetlands is to reduce or eliminate the use of chemicals for commercial, agricultural, and household uses.

Adaptation of methods such as organic agriculture and integrated pest control can help waterway conservation. Cleaner production procedures may decrease chemical contamination of industrial emissions from waterways. The most important contaminants of animal waste include chemical oxygen demand (COD), biodiversity oxygen (BOD), ammonia nitrogen (NH3-N), overall phosphorus (TP), total nitrogen (TN), and metals. An essential part of an economic assessment of agricultural emission control measures is the economic significance of improvements to water quality.Additional steps include adequate disposal and recycling for hazardous waste and for chemicals comprising recycled materials to limit the accumulation of solid waste and toxic chemical wastes into waterways. A variety of technical techniques are available for filtering otherwise innocuous chemical waste from manufacturing activities.

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CONFLICT OF INTEREST

The authors have no conflict of interest

AUTHOR CONTRIBUTIONS

Dr. Sonia Goeland Dr. Meenakshi Deviconducted the research, analyzed the data, proposed the methodology, and wrote the initial draft; Dr. Anshul Arya and Dr. Prafull Kumarmodified and supervised the initial draft; Dr. Manoj Kumar Mishrasupervised the research and wrote the final version of the manuscript. All authors had approved the final version.

REFERENCES

1. E. Panjaitan, L. Sidauruk, D. Indradewa, E. Martono, and J. Sartohadi, (2020). Impact of agriculture on water pollution in Deli Serdang Regency, North Sumatra Province, Indonesia, *Org. Agric.*, vol. 10, no. 4, pp. 419–427, doi: 10.1007/s13165-020-00282-7.
2. A. E. Lawniczak, J. Zbierska, B. Nowak, K. Achtenberg, A. Grześkowiak, and K. Kanas, (2016). Impact of agriculture and land use on nitrate contamination in groundwater and running waters in central-west Poland, *Environ. Monit. Assess.*, vol. 188, no. 3, p. 172, doi: 10.1007/s10661-016-5167-9.
3. Z. Stoyanova and H. Harizanova, (2019). Impact Of Agriculture On Water Pollution, *AGROFOR*, vol. 4, no. 1, doi: 10.7251/AGRENG1901111S.
4. K. Parris, (2011). Impact of Agriculture on Water Pollution in OECD Countries: Recent Trends and Future Prospects, *Int. J. Water Resour. Dev.*, vol. 27, no. 1, pp. 33–52, doi: 10.1080/07900627.2010.531898.
5. M. S. Aulakh and S. S. Malhi, (2005). Interactions of Nitrogen with Other Nutrients and Water: Effect on Crop Yield and Quality, Nutrient Use Efficiency, Carbon Sequestration, and Environmental Pollution, *Advances in Agronomy*, vol. 86. pp. 341–409, doi: 10.1016/S0065-2113(05)86007-9.
6. N. Hassanain (2021). Adverse Impacts of Water Pollution from Agriculture (Crops, Livestock, and Aquaculture) on Human Health, Environment, and Economic Activities, *Egypt. J. Aquat. Biol. Fish.*, vol. 25, no. 2, pp. 1093–1116, doi: 10.21608/ejabf.2021.171677.
7. H. Xu, Q. Gao, and B. Yuan,(2022). Analysis and identification of pollution sources of comprehensive river water quality: Evidence from two river basins in China, *Ecol. Indic.*, vol. 135, p. 108561, doi: 10.1016/j.ecolind.2022.108561.
8. A. E. Evans, J. Mateo-Sagasta, M. Qadir, E. Boelee, and A. Ippolito, (2019). Agricultural water pollution: key knowledge gaps and research needs, *Curr. Opin. Environ. Sustain.*, vol. 36, pp. 20–27, doi: 10.1016/j.cosust.2018.10.003.
9. L. Xiao, J. Liu, and J. Ge,(2021). Dynamic game in agriculture and industry cross-sectoral water pollution governance in developing countries, *Agric. Water Manag.*, doi: 10.1016/j.agwat.2020.106417.
10. T. Sarathamani, (2014). Economic Impact of Water Pollution on Agriculture and Rural Households, *IOSR J. Econ. Financ.*, vol. 3, no. 5, pp. 54–57, doi: 10.9790/5933-0355457.
11. S. L. Ullo and G. R. Sinha, (2020). Advances in Smart Environment Monitoring Systems Using IoT and Sensors, *Sensors*, vol. 20, no. 11, p. 3113, doi: 10.3390/s20113113.
12. M. Hanif, R. Miah, M. Islam, and S. Marzia, (2020). Impact of Kapotaksha river water pollution on human health and environment, *Progress. Agric.*, vol. 31, no. 1, pp. 1–9, doi: 10.3329/pa.v31i1.48300.
13. L. Vera-Herrera, S. Romo, and J. Soria, (2022). How Agriculture, Connectivity and Water Management Can Affect Water Quality of a Mediterranean Coastal Wetland, *Agronomy*, vol. 12, no. 2, p. 486, doi: 10.3390/agronomy12020486.
14. Shamima Shultana and Ruhul A. Khan, (2022). Water quality assessment, reasons of river water pollution, impact

on human health and remediation of polluted river water, *GSC Adv. Res. Rev.*, vol. 10, no. 2, pp. 107–115, doi: 10.30574/gscarr.2022.10.2.0053.
15. B. Moss, (2008). Water pollution by agriculture, *Philos. Trans. R. Soc. B Biol. Sci.*, vol. 363, no. 1491, pp. 659–666, doi: 10.1098/rstb.2007.2176.
16. M. L. Sall, A. K. D. Diaw, D. Gningue-Sall, S. Efremova Aaron, and J.-J. Aaron, (2020). Toxic heavy metals: impact on the environment and human health, and treatment with conducting organic polymers, a review, *Environ. Sci. Pollut. Res.*, vol. 27, no. 24, pp. 29927–29942, doi: 10.1007/s11356-020-09354-3.
17. X. nan ZHANG, Q. ping GUO, X. xue SHEN, S. wen YU, and G. yu QIU, (2015). Water quality, agriculture and food safety in China: Current situation, trends, interdependencies, and management, *Journal of Integrative Agriculture*, vol. 14, no. 11. pp. 2365–2379, doi: 10.1016/S2095-3119(15)61128-5.
18. G. O. Obiechina and R. Rimande Joel, (2018). Water Pollution and Environmental Challenges in Nigeria, *Educ. Res. Int.*, vol. 7, no. 1, pp. 109–117.
19. R. T. Kingsford, A. Basset, and L. Jackson, (2016). Wetlands: conservation's poor cousins, *Aquat. Conserv. Mar. Freshw. Ecosyst.*, vol. 26, no. 5, pp. 892–916, doi: 10.1002/aqc.2709.
20. Adrian Leip, Gilles Billen, Josette Garnier, Bruna Grizzetti, Luis Lassaletta, Stefan Reis, David Simpson, Mark A Sutton, Wim de Vries, Franz Weiss, (2015). Impacts of European livestock production: nitrogen, sulphur, phosphorus and greenhouse gas emissions, land-use, water eutrophication and biodiversity, *Environ. Res. Lett.*, vol. 10, no. 11, p. 115004, doi: 10.1088/1748-9326/10/11/115004.
21. N. Khatri and S. Tyagi, (2015). Influences of natural and anthropogenic factors on surface and groundwater quality in rural and urban areas, *Front. Life Sci.*, vol. 8, no. 1, pp. 23–39, doi: 10.1080/21553769.2014.933716.
22. T. Ahmed, M. Scholz, F. Al-Faraj, and W. Niaz, (2016). Water-Related Impacts of Climate Change on Agriculture and Subsequently on Public Health: A Review for Generalists with Particular Reference to Pakistan, *Int. J. Environ. Res. Public Health*, vol. 13, no. 11, p. 1051, doi: 10.3390/ijerph13111051.
23. M. Li, Q. Fu, V. P. Singh, D. Liu, and T. Li, (2019). Stochastic multi-objective modeling for optimization of water-food-energy nexus of irrigated agriculture, *Adv. Water Resour.*, vol. 127, pp. 209–224,, doi: 10.1016/j.advwatres.2019.03.015.
24. A. Kumar and J. P. Verma, (2018). Does plantMicrobe interaction confer stress tolerance in plants: A review?, *Microbiol. Res.*, vol. 207, pp. 41–52, doi: 10.1016/j.micres.2017.11.004.
25. W. De Lange, B. Mahumani, M. Steyn, and S. Oelofse, (2012). Monetary valuation of salinity impacts and microbial pollution in the Olifants Water Management Area, South Africa, *Water SA*, vol. 38, no. 2, pp. 241–248, doi: 10.4314/wsa.v38i2.9.
26. R. R. Carlson, S. A. Foo, and G. P. Asner, (2019.). Land Use Impacts on Coral Reef Health: A Ridge-to-Reef Perspective, *Frontiers in Marine Science*, vol. 6. doi: 10.3389/fmars.2019.00562.
27. J. A. Skinner, K. A. Lewis, K. S. Bardon, P. Tucker, J. A. Catt, and B. J. Chambers, (1997). An Overview of the Environmental Impact of Agriculture in the U.K., *J. Environ. Manage.*, vol. 50, no. 2, pp. 111–128, doi: 10.1006/jema.1996.0103.
28. S. A. A. Nakhli, M. Delkash, B. E. Bakhshayesh, and H. Kazemian, (2017). Application of Zeolites for Sustainable Agriculture: a Review on Water and Nutrient Retention,*Water, Air, Soil Pollut.*, vol. 228, no. 12, p. 464, doi: 10.1007/s11270-017-3649-1.
29. F. Agariga, S. Abugre, E. K. Siabi, and M. Appiah, (2021). Mining Impact on Livelihoods of Farmers of Asutifi North District, Ghana, *Environ. Manag. Sustain. Dev.*, vol. 10, no. 4, p. 29, doi: 10.5296/emsd.v10i4.19066.
30. [30] C. Muppala and V. Guruviah, (2020). Machine vision detection of pests, diseases, and weeds: A review, *J. Phytol.*, vol. 12, pp. 9–19, doi: 10.25081/jp.2020.v12.6145.
31. J. R. Fianko and M. B. Korankye, (2020). Quality characteristics of water used for irrigation in urban and peri-urban agriculture in greater accra region of ghana: Health and environmental risk, *West African J. Appl. Ecol.*, vol. 28, no. 1, pp. 131–143.
32. Amira Boukari, Sihem Benabdallah, Etienne Everbecq, Pol Magermans, Aline Grard, Hamadi Habaieb and Jean-Francois Deliege, (2019). Assessment of Agriculture Pressures Impact on the Joumine River Water Quality Using the PEGASE Model, *Environ. Manage.*, vol. 64, no. 4, pp. 520–535, doi: 10.1007/s00267-019-01207-1.

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