CHAPTER:15

AGRICULTURAL POLLUTION: A CONCERNING ISSUE

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Abstract

Agriculture is the production of food and associated products through farming. Agriculture, like other aspects of development, has been a major cause of environmental pollution and waste generation. Waste generated as a result of various agricultural processes is referred to as agricultural waste. It comprises garbage from farms, slaughterhouses, and poultry houses as well as waste from harvesting operations, fertiliser runoff from fields, pesticides that end up in water, the atmosphere, or soils, and salt and silt that has been drained from fields. Agriculture management is a challenging process that necessitates individualised attention to resolve problems with all essential elements, including water, fertilisers, and biocides.

Keywords: Agriculture, pollution, hazardous, waste, fertilisers, contamination.

1. Introduction:

Agriculture is the term used to describe the process of producing food and related products through farming. It is perhaps man's earliest contribution to the continued existence and welfare of the human race. Human population growth and accompanying activities have placed huge strain on natural resources (water, air, and soil). Uncontrolled industrial effluent discharge into rivers resulted in an increase in effluent concentration, which swiftly altered the ecosystem's composition and harmed the health of people, plants, and animals. Hazardous substances can reach the environment in huge quantities and through a variety of routes (Wang et al., 2022; Dong et al., 2023). Environmental deterioration is one of the primary concerns that the world is presently dealing with. From a primitive beginning characterised by the "gathering" of food, man transformed agriculture into a vast, technology-driven sector. The scope and application of knowledge from disciplines like chemistry, engineering, even mathematics and law to agriculture are expanding along with the global human population. Without a doubt, modern agricultural technologies have played a critical role in expanding food production around the world. At the same time, agriculture, like other aspects of development, has been a major cause of environmental pollution and waste generation.

These two interconnected agricultural outputs result from a variety of actions, and materials which were employed to improve efficiency and expand global agro production. Conversion of vast stretches of waste lands into arable lands, development of ground water resources and subsequent over-extraction of water, excessive use of inorganic fertilisers, unscientific pesticide deployment, and adoption of incompatible agro methods are some of the issues that have resulted in often irreparable and irreversible environmental changes. Organic and inorganic pollutants are the most common, and both anthropogenic and naturally occurring activities discharge them into the environment. Pesticides, chlorophenols, phenolic compounds, nitro compounds dyes, polyaromatic organometallic compounds, and other organic contaminants are examples of inorganic pollutants. The bulk of inorganic pollutants are persistent in nature and can cause genotoxicity, teratogenicity, carcinogenesis, and mutagenesis even at low concentrations (Saxena et al., 2020). Agricultural waste is defined by United Nation as "waste produced as a result of various agricultural operations." It comprises agricultural trash, poultry waste, and slaughterhouse waste; harvest waste; fertiliser run-off from fields; pesticides that enter water, air, or soils; and salt and silt drained from fields.

Air pollution from agriculture is relatively low, with emissions from agricultural machinery and open burning of agricultural wastes being standard practises in many developing countries. Agriculture is a major polluter of water and land resources. Given the immensity of agriculture-related water contamination, this subject is given considerable attention here. Agriculture is widely regarded to be the largest user of freshwater resources, accounting for 70% of all surface water supplies globally (Ongley, 1996). As a result, agriculture is a significant contributor to the degradation of surface and groundwater resources. Pollutant sources could be 'point or non-point'. The principal mechanisms responsible for decreasing the quality of receiving water bodies are erosion and post-precipitation run-off of chemicals used in fertiliser and pesticide formulations. Additionally, agricultural run-off may harm people's health. For instance, receiving flowing and stagnant water basins may have much higher pathogen loads. Waterborne illnesses may manifest when these sources are exploited to satisfy drinking demands, particularly in remote areas.

2. Agriculture and air pollution

The word "air pollution" refers to contamination brought on by undesired solid, liquid, or gaseous chemicals present in the environment.

There are two ways that agriculture and air pollution are connected:

- Agricultural activities produce pollutants that damage the air, environment, and other places.
- Non-agricultural resources produce air pollutants that can directly affect agricultural crops.

It has a negative effect on agricultural yield, quality, and productivity. Crops can suffer significant damage, but the extent depends on the level of pollution and other factors that are detrimental to the development of the crops (Agrawal 2005). These pollutants may include hazardous chemicals, greenhouse gases, and other airborne contaminants. The following list of these contaminants is described:

2.1. Ozone

According to Roy et al. (2009), ozone is regarded as a significant contaminant and its severe impacts on agricultural growth were first noticed in 1944. It is created as a result of intricate photochemical processes involving nitrogen oxides, carbon monoxide, and volatile chemicals that take place in the troposphere. These chemicals, which aid in the creation of ozone, are created by the burning of fossil fuels and by gasoline-powered vehicles (Guderian 1985). Numerous plant species, including the cucumber, grape, tomato, onion, potato, radish, and tobacco crop, are susceptible to damage from it (Griffiths 2003). Since the cuticle is resistant to it, it penetrates through stomata, which are tiny openings in the leaves (Del Valle-Tascon and Carrasco-Rodrigue 2004).

2.2. Sulphur dioxide

It is a mixture of sulphur and oxygen compounds that is directly released into the atmosphere as a main pollutant. Additionally, it is the primary cause of acidic rain, which harms plant species' root and shoot systems and leaches away many crucial minerals and nutrients from the soil and crops (Tabatabai and Olson 1985). Acid rain is created when the gases sulphur dioxide and oxygen combine to generate sulphur trioxide, which then combines with airborne water vapour to produce sulfuric acid. Both sulfuric and sulphurous acids have the potential to indirectly harm plants and trees (Matsubara et al. 2009).

2.3. Flouride

After ozone and SO_3, fluoride is regarded as the most significant contaminant (Telesiski et al. 2011). Hydrogen fluoride, which is present as fluoride, is released when rocks, clays, kilns, and companies that make fertilisers like aluminium and phosphate fertilisers are heated (Khan 2012). It can lead to a variety of physiological changes in plants. Fluorine-contaminated water exposure that is prolonged has a negative impact on the yield. Its high concentration hinders seed germination, slows down photosynthesis, alters membrane permeability, and may also cause other changes in the physiological and biochemical makeup of crops (Gautam et al. 2010).

3. Impact of agriculture on Air quality

This part focuses upon the impact of agricultural technology on air pollution. Different processes are carried out in this field, which badly affect the environment.

3.1. Agriculture Burning

It is the process of burning waste material coming from agricultural practices and is carried out for clearance of land, shrubs, pests, and production of better quality crops by getting nutrients from the land. The by-products of this process include certain chemical substances, smoke, and particulate matter, which pollute the air and are harmful for health. This also releases carbon, carbon dioxide, carbon monoxide, and sulphur dioxide, which not only affect atmosphere but also the crops (Jenkins et al. 1996).

3.2. Use of fertilisers

Fertilisers are applied to the soil to boost its fertility and nutrient content in order to improve crop output. These can be chemical or mineral fertilisers, and the key nutrients in these fertilisers are nitrogen, phosphorous, and potassium. They play a significant role in maize production. Increased use of chemical fertilisers to plants affects the air and releases nitrogen oxides such as NO, NO_2, and N_2O, resulting in air pollution (Savci 2012).

The use of fertilisers has been reduced in wealthy countries due to its environmental impact, but it is still used excessively in developing countries. Fertilisers release 1.2% of greenhouse gases into the environment (Kongshaug 1998). Ammonia gas is produced as a byproduct of ammonium fertilisers. Through the oxidation process, ammonia is transformed to nitric acid, resulting in acidic rain, which then harms crops. Nitrous oxide is created during soil nitrification and denitrification. Nitric acid is also responsible for the production of nitrous oxide, as previously described.

3.3. Particulate matter

Particulate Matter is a mixture of sulphate, organic and elemental carbon, solid compounds, dust, nitrate, smoke, and small droplets of liquid (Jacob and Winner 2009). The diameter of particulate matter ranges from >2.5 µm to <10 µm. It can also be caused by wind erosion, tillage to prepare land for agricultural purposes, crop burning, and can be formed during the reactions of sulphur and nitrogen oxides.

3.4. Rice Fields as a Methane Gas Source

Rice fields are flooded with water (paddy fields), which is a key source of methane gas production (Zhuang et al., 2009). These fields give methanogenic bacteria with favourable conditions such as humidity, organic compounds, and an oxygen-limited environment. Carbon dioxide, hydrogen gas, and acetate are created as organic matter decomposes. These chemicals are converted by methanogenic bacteria into methane gas, which eventually pollutes the air (Sandin, 2005).

4. Water Pollution by agriculture

According to current Environmental Protection Agency (EPA) reports, agriculture is the sole cause of river and stream disruption, as well as the third greatest source of pond, lake, and reservoir contamination. According to the National Summary of Assessed Waters Report statistics from 2010, around 53% of global rivers and streams have been considered unfit for their intended usage (Rabotyagov et al., 2012). Phosphorus, nitrogen, and a few other minerals are examples of scarce elements that have been greatly depleted from landscapes as a result of significant deforestation and agriculture (Likens et al., 1977). Natural landscapes that have not been disturbed are better equipped to preserve soil particles and minerals.

Furthermore, naturally selected species have an efficient root system and microorganisms capable of preserving soil particles and minerals through the formation of protective soil crusts. Natural calamities such as volcanoes, hurricanes, and tree falls will inevitably damage such landscapes, but such natural phenomena are unavoidable. Furthermore, aftereffects such as soil exposure and erosion can be mitigated by successful succession of species, which finally stabilises the soil surface (Moss, 2008).

Before looking into agricultural water contamination, let us first take a look at the other ecological and physiological abnormalities generated by agriculture on this planet. Agriculture interferes with the natural soil and nutrient conservation mechanisms. It displaces the sources of wood waste, eliminates predators such as wolves and bears to protect domestic animals, and may fundamentally modify the complex biological and physiological flood system to enhance irrigation and drainage.

Furthermore, it may create significant changes in the prey-predator relationship by favouring the generation of specific fish species as a result of nutrient enrichment, leading in aberrant web chains (Vanni et al., 2005). It also introduces new species, such as biocides, which cannot survive for long because to a lack of protective systems. Because these species have spent less time evolving, they cannot live in natural aquatic environments such as ponds (Williams et al., 2004), wet meadows, and fens (Wheeler, 1980). To summarise, agriculture has no beneficial influence on the ecological functioning and biodiversity of aquatic ecosystems. Agriculture-selected and exploited landscapes pose a major danger to water biodiversity (Moss, 2008). Agriculture, however, is an unavoidable fact for humans, and it can never be disregarded in order to feed a massive human population. It is estimated that in the next 50 years, an additional 10^9 hectares of natural landscapes will be converted to agriculture, increasing eutrophication by two to three folds (Tilman, 2001) to approximate the conversion of 5×10^9 ha land from natural ecosystem (Millennial Ecosystem Assessment Board, 2005). Certain activities, such as atmospheric control, hazard regulation, water purification and storage, bug control facilities, supporting natural grazing, and timber production, can be fostered (Moss, 2008). Maintaining compliance with environmental legislation while maintaining productive and intensive agriculture is undoubtedly a policy challenge (Sutton et al., 2011).

As a result, eco-efficiency has become an increasingly popular subject in both environmental and agricultural fields (Picazo-Tadeo et al., 2011).

5. Climate change and environment

Climate change is defined as changes and fluctuations in climate that last for a long time, ranging from a few years to several decades. There are numerous causes for climate change, including natural processes in the earth's atmosphere and anthropogenic changes (human impact on the environment). Agriculture has taken on a prominent role in research on the potential effects of climate change (Decker et al., 1986). Agriculture's effects on the climate and the effects of climate change on agriculture are inextricably intertwined. The most crucial link between these two is "the greenhouse gases." A greenhouse gas is one that absorbs and ejects radiations in the thermal infrared spectrum, causing the greenhouse effect. These gases contain water vapour, methane from wetlands, carbon dioxide from the combustion of fossil fuels, and ozone and nitrous oxide from microbial activity in the soil. These gases occur naturally at low concentrations in the atmosphere, but their concentrations are greatly enhanced due to human impacts such as industrial and agricultural activity. Agriculture emits a range of GHGs into the environment, including CO_2, CH_4, and N_2O. These trace gases cause environmental changes such as temperature increases, precipitation changes, and extreme weather conditions. Increased GHG levels will cause the Earth's average temperature to rise by about 0.3° Celsius every decade (Houghton et al., 1990).

Global warming in the twentieth century was mostly caused by anthropogenic increases in GHG (Crowley, 2000). A high concentration of greenhouse gases causes radiative forcing, which warms the earth's surface (Houghton et al., 2001). The rising concentration of greenhouse gases has resulted in increased global warming due to positive radiative forces. Carbon dioxide emissions have increased due to the growth of agricultural area, as well as the usage of fossil fuels and the burning of green vegetation and forests. Carbon dioxide and methane concentrations are the most significant contributors to global warming. Carbon dioxide is emitted primarily as a result of microbial decomposition or combustion of soil organic matter (SOM) and plant litter (Janzen, 2004; Smith, 2004). Methane emissions from enteric fermentation are one of agriculture's most significant sources of GHG emissions. It contributes for roughly 4-5% of global anthropogenic petrol emissions (Scialabba and Lindenlauf, 2010). Despite the fact that several programmes have been established to reduce GHG emissions, growing food demand has kept the release of these gases at a higher rate. Reduced tillage systems, crop residue management, nutrient and pest management and control, agroforestry, the use of biochar as a soil amendment, and other agricultural technologies are some recommended management practises that will help reduce the impact of agriculture on climate and environment (Tavi and Lal, 2013).

6. Soil pollution

Soil pollution is defined as the presence of poisonous compounds and materials, xenobiotic chemicals, minerals or other salts, radioactive substances, or agents that cause various diseases in the soil. These contaminants have a harmful impact on plants, humans, and the environment. The four most common types of soil pollutants are as follows:

(a) Industrial pollutants

(b) Municipal pollutants

(c) Nuclear pollutants

(d) Agricultural pollutants

Aside from trash disposal on land, soil can be polluted by a variety of pollutants; the pollutants can be agricultural (pesticides) or industrial (various types of hazardous chemicals) that produce land pollution. A large amount of chemicals are sprayed to soils, resulting in increased levels of heavy metals such as cadmium, arsenic, and lead (Atafar et al., 2010). Pesticide consumption and variety have expanded dramatically over the world as food consumption has increased compared to crop yield. Pesticides have been widely used, resulting in their misuse, creating major environmental and health dangers.

Pesticides are any compound or combination of substances that are intended to prevent, destroy, or repel any pest (EPA, 2009). The usage of pesticides is critical to ensuring greater productivity and meeting the population's food needs. However, excessive or abusive use leads to significant difficulties (Pimentel, 2009). Pesticides and byproducts of pesticide breakdown can escape into the environment, soil, or rivers, eventually leading to harmful chemical accumulation. Pesticides as DDT (dichloro diphenyl trichloroethane), chlorinated hydrocarbons, dieldrin, and organophosphates are absorbed by soil particles and contaminate root crops cultivated in soil. As a result, the usage of such contaminated crops allows pesticide particles contained in the crop to enter human biological systems, producing various ailments.

Organochlorine pesticides (OCPs) are bio-accumulative and highly hazardous subtypes of persistent organic pollutants (POPs). Heavy metals like cadmium (Cd), zinc (Zn), lead (Pb), and copper (Cu) are abundant in the upper layers of soil, particularly in rice fields. Heavy metal deposition in fields and vegetation has a negative impact on human health when absorbed through the food chain. Copper is commonly used in animal feeds, and the addition of such manure to crops increases the risk of soil pollution (Xiong et al.2010). Fertilisers with high levels of salt and potassium affect soil pH, degrade soil structure, and diminish crop efficiency (Savci, 2012). In comparison to other fertilisers, phosphate fertilisers constitute a significant source of cadmium metal buildup.

7. Genetic Engineering Leading to Gene Flow and Plant Contamination

Genetically modified crops (GM crops) are created when their DNA is altered by adding desired genes for desirable characteristics using genetic engineering procedures. These are incredibly accurate and specific mutagenesis techniques in which the plant is exposed to radiations or chemicals to cause DNA alterations. Crops that have been genetically modified have a longer shelf life, better nutrition, are resistant to herbicides and stress, and have a higher production. Recombinant biotechnology and the products derived from it have created major and dangerous biosafety issues. The introduction of genetically modified (GM) crops has aroused concerns about their safety and potential consequences on health and agriculture (Brookes and Barfoot2010; Zdjelar et al., 2011).

The absence of barriers to the introduction of transgenes or gene flow during sexual reproduction poses a concern to genetically modified crops. This could be related to the transfer of these transgenic genes to weedy species through mechanisms like hybridization (Kaiser2010). Genetic engineering may enhance the potential of transgene escape (Bergelson et al. 1998). Gene flow is a key method for transgenes to spread from transgenic crops to their wild cousins. Pollen or hybridization can spread genes from crops to similar wild-type species (Ellstrand and Elam, 1993). These transgenes that can spread in the environment pose ecological problems. These foreign genes, which are resistant to biotic and abiotic stressors, might cause unpredictability in the environment.

8. Health and agriculture

Since the late 1900s, several reforms have been implemented in the agricultural industry to improve the health and safety of farmers and other agricultural workers. These changes include advancements in technology, increased public knowledge of health risks, and personal protection. The Food Quality Protection Act (1996) and the Worker Protection Standard (1992) are two examples of regulatory initiatives implemented to reduce occupational and environmental health dangers induced by agricultural practises. The current situation demonstrates that there is still a need for agricultural health and safety research and education. Steps must be taken to educate farmers and others involved in the agricultural industry.

8.1. A Dangerous Occupation

According to a study conducted by the Bureau of Labour Statistics, farming has been designated as a very precarious industry. Physical effort, contact with animals, use of machinery, and a high risk of exposure to toxic compounds all contribute to injuries, illnesses, and fatalities among agricultural workers (US Department of Labour, Bureau of Labour Statistics2007). The average age of farm workers is 54.3 years old. There are numerous causes for this, including:

1. Aging- As a farmer ages, he becomes more vulnerable to negative consequences, and because he has been exposed to harmful chemicals for years (occupational exposure), he may develop respiratory and musculoskeletal problems.

2. No prior experience- farm employees employed for entry-level positions in the agricultural sector. They lack prior understanding of how activities on agricultural farms are carried out.

3. Language barrier- If there is a language barrier, it may impede information exchange on critical issues such as agricultural safety and labour practises.

4. Ethnic variation- Ethnic differences may potentially pose possible health risks in particular races due to hereditary reasons.

5. Hiring farm labour contractors- Farm labourers should be engaged by farm owners, not farm labour contractors. Hiring contractors who are unaware of agricultural conditions and risks poses new health and safety problems.

8.2. Physical Illnesses and Diseases

The entrance of the technological revolution in the agricultural sector greatly improved living and working circumstances, but it also introduced a number of inhalative risks. Biological, chemical, and physical threats are among these dangers. Tuberculosis, tularemia, and Q fever are examples of biological dangers. There have also been reports of allergic dusts emanating from vegetable fields. Chemical dangers include pesticides and fertilisers, whereas physical hazards exist in places where agricultural machines are fixed. Asbestosis and silicosis are two examples. A variety of unspecified dusts can also be hazardous to one's health.

8.3. Dust

8.3.1. Inorganic Dusts

There are numerous agricultural practises that promote exposure to inorganic dusts. Field activities such as tractor tilling, haying, ploughing, and harvesting are included. Inorganic dust is mostly composed of silicates, either crystalline (quartz) or noncrystalline (diatomite), derived from diatomaceous earth. Silica can also be found in aerosolized rice stubble during the burning process. Inorganic dusts account for 15-43% of total exposure to dusts. Pneumoconiosis is a restricted lung condition caused by silica. People who have pneumoconiosis have abnormal radiography findings. Inorganic dusts serve a minor role, are non-toxic, and so cause fewer respiratory ailments than organic dusts.

8.3.2. Organic Dusts

Most studied agricultural respiratory diseases are those caused due to exposures to organic dusts coming from confined animal feeding operations (CAFOs) and grain processing. Swine confinement facilities have been associated with mucous membrane inflammation syndrome, sinusitis, bronchitis and non-immunogenic bronchospasm. Organic dusts cause ODTS (organic dust toxicity syndrome), asthma, asthma-like syndrome, farmer's lung [farmer's hypersensitivity pneumonitis (FHP)], and chronic bronchitis. They also impose biological hazards due to the presence of proteins that can be proinflammatory and allergenic. Toxic exposures both additive and synergistic can damage respiratory health (Von Essen and Donham 1999).

8.4. Allergens

Animal dander, grain dusts (wheat sorghum and soy), fungal moulds, insect pieces, pollens, and microorganisms are all potential allergens in grain and animal confinement. Allergen exposure in enclosed environments causes upper respiratory tract disorders such as asthma and bronchial hyperreactivity (particularly common in swine confinement), wheezing, and non-IgE-induced asthma-like syndrome. Food proteins in animal feeds, type 1 allergens in pig saliva and urine, and epithelial and storage mites in *Acarus siro*, *Lepidoglyphus destructor*, and *Glycyphagus domesticus* are just a few examples of allergies found in agricultural settings.

8.5. Crop Protection Substances

Pesticides are better known for their effects on the human neurological system. They also have an impact on the lungs. Paraquat (herbicide) causes free radical generation, which results in fibrosis. When Roundup (glyphosate) is ingested, it causes chemical pneumonitis. Bronchoconstriction is caused by brief exposure to organophosphates and carbamates. Only a few chemicals have been linked to pulmonary illnesses. Acute pesticide exposure can trigger hypersensitive reactions, however chronic pesticide exposure can cause major health concerns such as the onset of cancer or neurological difficulties (Amoguis et al., 2010). According to a study conducted on Ethiopian farmers, the most common pesticide poisoning symptoms identified were 58.8% headache, 38.2% vomiting and salivation, 36.5% nausea, and 12.5% sneezing (Karunamoorthi et al., 2012).

8.6. Farmer's Hypersensitivity Pneumonitis

Hypersensitivity pneumonitis (allergic alveolitis) is a lung infection caused by hypersensitivity reactions to inhaled antigens (mainly organic dusts). It depicts a variety of clinical expositions. It's extremely frequent among farmers. Farmer's lung or hypersensitivity Pneumonitis is primarily caused by inhaling biological dusts and agricultural goods such as mould spores, straw, feed, and hay dusts. Farmer's lung is caused by spores of *Micropolyspora faeni*, *Saccharopolyspora rectivirgula*, *Aspergillus* species, and *Thermophilic actinomycetes*. FHP exhibits symptoms similar to ODTS. Long-term exposure to FHP allergens can produce fibrotic changes in the lungs and lead to emphysema.

Alveolar infiltrates and oxygen desaturation might be seen on radiographs during the acute phase. Antibodies against moulds and thermophilic microorganisms known as precipitins have also been discovered. It is more common in cold, humid areas. Nonsmokers are more likely to have FHP, but smokers have a more chronic form of FHP. Natural ecosystems have been severely damaged or deteriorated, and the services given by these ecosystems have been reduced to nil, as if they were nonentities (MEA, 2005).

Biodiversity losses are the direct result of this agricultural revolution, and there are a wide range of species on the verge of extinction as a result of these massive agricultural practises that have drastically impacted the last century and the coming century. According to IUCN data, agriculture is the primary cause of bringing all types of species to the verge of extinction or extinction around the world. This is what has occurred in the past and is currently anticipated to occur. The predicted increase in global food demand by 2050 is expected to be twice (Tilman et al., 2002). According to additional estimates, in order to meet the world's food demand, agricultural land would also need to be increased (by, say, 25%) in developing regions (Balmford et al., 2005). Furthermore, as industrialisation increases, correspondingly increases the demand for raw materials for bioenergy (Field et al., 2008). Sugarcane and oil palm plantations provide an unfavourable habitat for a number of species that contribute to biodiversity (Petit and Petit 2003; Aratrakorn et al., 2006).

9. Agricultural Sustainability

According to Malthusian theory, the rate of increasing population exceeds the capacity of the earth's resources. This would result in environmental degradation as well as food security difficulties. The current population of the Earth is around six to seven times greater than the population number when Malthus made his estimate regarding population growth principles. As a result, agricultural sustainability is critical for addressing challenges such as food security and environmental degradation, as these issues are inextricably tied to agricultural sustainability. Threats to agricultural sustainability might also occur as a result of the perception of merely obtaining quick profit and production goals. Agriculture can only be sustainable if we prioritise long-term benefits like ecological stability and biodiversity protection over short-term benefits like yield growth and economic goals.

In short, agricultural sustainability involves continuous productivity without exhaustion, and agricultural practises must be environmentally friendly to achieve this. Agricultural sustainability practises should have three characteristics: no negative effects on the ecosystem, be easily accessible to farmers, and boost food production (Pretty, 2007). Herbicides with unique properties should be developed to overcome weed resistance to currently existing herbicides (Duke, 2012).

9.1. Pest management

Pesticides are used to control pests such as weeds, insects, and illnesses since these pests reduce agricultural productivity. However, the usage of these pesticides contributes to agricultural contamination. As a result, it is critical to create, build, and deploy such precision agriculture pest management technology. Pesticides that are safe to use can help reduce human diseases and ecosystem harm (Rossi et al., 2012).

9.2. Agricultural Waste Management

Agricultural waste management is a complex of several things, such as waste treatment, agricultural patterns, and rural progress. Aside from farmers, a variety of other parties play an essential role in agricultural waste management. The agricultural industry generates a wide range of nonnatural wastes, including pesticides, fertilisers, silage films, horticulture films, unused pharmaceuticals, syringes, needles, and mechanical wastes. These nonnatural agricultural wastes are linked to environmental and human health risks. To control agricultural pollution, these wastes should be handled and recycled. Another option is to use reusable containers.

9.3. Eco-agriculture

Eco-agriculture combines agricultural sustainability with biodiversity conservation. Investments are needed to develop strategies and technology that can increase productivity while decreasing costs while preserving biodiversity. It is also critical to offer farmers with possibilities to increase eco-agriculture proportionally. Otherwise, farmers' economic and social difficulties will have an impact on biodiversity protection. For eco-agriculture, there needs be a sufficient number of community-level organisations. Strategies should be developed in order to achieve the maximum benefits from eco-agriculture. Another critical issue is the generation and dissemination of eco-agriculture knowledge. Priorities must be established in order to gain an understanding of the relationships between conservation and production areas.

9.4. Compost Application in a Cropping System

Using compost in the cropping system can help to reduce agricultural pollution. Compost is made from manure and other agricultural waste. It offers numerous advantages, including reduced soil erosion, improved soil texture, and reduced fertiliser consumption. Its primary roles are to provide a source of nutrients and to reduce plant diseases. Compost helps to reduce soil erosion by providing structure to the soil to which it is put. It contains beneficial microbes that work to decrease plant diseases. Different amounts of compost are used in different locations to achieve the same results.

10. Conclusions and Future Perspective

Agricultural Policy, agricultural Production, and agriculture Pollution are all interconnected. Environmental contamination is thought to have an impact on agriculture, but there is always another side to the story. Two areas of agriculture have been thoroughly examined. The first is pollution caused by agriculture, and the second is pollution's impact on agriculture. It has been demonstrated that there is a complex relationship between the two, and the subsequent results indicate that dealing with such problems is difficult. There is no doubt that agriculture plays a significant part in a country's economy and food industry. This sector produces a wide range of staple crops, cereals, and fruits, which contribute significantly to the export economy. However, as time passes, this area is becoming more problematic for the surrounding ecosystem.

Agricultural pollution not only affects air, water, and soil, but it has also been linked to health and biodiversity issues due to the usage of fertiliser, pesticides, organic matter, and greenhouse gas emissions. There would be an unsettling situation when agricultural pollution reduces agricultural yield.

The public is becoming increasingly concerned about agricultural pollution and its impact on the environment. To meet the increasing demand for food, agricultural productivity must be maximised. Farmers are now employing innovative ways to boost agricultural yield and quality, but this industry is not following the laws and regulations that have been set in other industries. As a result, the primary focus should be on strengthening regulatory programmes to prevent agricultural pollution and its disastrous impacts on the ecosystem. Proper policies should be implemented on a local to global scale to reduce the effects on our environment and to improve yield, quality, agricultural practises, and the well-being of humans and biodiversity.

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