HARVESTING DILEMMA: ETHICAL CONSIDERATION IN THE USE OF AGROCHEMICALS

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I hereby declare that the data presented in this Dissertation report entitled **Harvesting Dilemma: Ethical Consideration in the Use of Agrochemicals** is based on the results of investigations carried out by me in the Discipline of Philosophy at the School of Sanskrit Philosophy and Indic Studies, Goa University under the Supervision of Ms. Rajavi Damodar Naik, Assistant Professor, and the same has not been submitted elsewhere for the award of a degree or diploma by me. Further, I understand that Goa University or its authorities will not be responsible for the correctness of observations / experimental or other findings given the dissertation.

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This is to certify that the dissertation report Harvesting Dilemma: Ethical Consideration In The Use Of Agrochemicals is a bonafide work carried out by Binesh A R under my supervision in partial fulfilment of the requirements for the award of the degree of Master of Arts in Philosophy in the Discipline of Philosophy at the School of Sanskrit Philosophy and Indic Studies, Goa University.

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PREFACE

Harvesting dilemma: The ethical concerns surrounding the use of agrochemicals, explores the complex ethical dilemmas associated with the widespread use of pesticides in agriculture, contrasting them with the urgent need for pesticides to address food security concerns in society.

My interest in this topic stems from a deep passion for advocating for human rights and an inherent curiosity about the ethical dimensions of agricultural practices. Also, I have grown up in a village where farming was a livelihood. Furthermore, the learning about the tragic events caused by pesticides, like the serious issues with endosulfan, and other issues from the schools and news made me do work on this topic.

When I decided to study the Harvest Dilemma, I recognized the global importance of this problem and the lack of a clear answer. It is my fervent hope that this thesis serves as a catalyst for thought-provoking discussions and critical reflections on the ethical imperatives that underpin our agricultural practices, ultimately leading to a more sustainable and ethically informed approach to food production.

As I start this journey of learning, I feel grateful for the chance to add my thoughts to the ongoing discussion about the ethical issues of using agrochemicals. I hope my work will be guided by fairness, kindness, and the search for truth

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ABSTRACT

This thesis explores the ethical concerns surrounding the use of agrochemicals in modern agriculture, focusing on the harmful health and environmental issues associated with their use. The research addresses the dilemma of the need for agrochemicals in present society due to food concerns, while also considering the ethical implications of their use. Drawing on literature from renowned environmentalists such as Rachel Carson and Vandana Shiva, as well as articles on the Endosulfan issues, the study aims to understand the complexity of the issues surrounding agrochemical use.

The research questions are designed to address the ethical dilemma and to understand the necessity of agrochemicals in present society for food concerns. Through qualitative analysis, including interviews with scientists and farmers, as well as a comprehensive literature review, the study examines the negative impacts of agrochemicals on human health and the environment. It also explores the ethical considerations surrounding the use of agrochemicals, considering factors such as sustainability, environmental justice, and the intrinsic value of human health and the environment. The findings of this research will contribute to the ongoing discussion on the ethical use of agrochemicals in agriculture and offer insights into potential alternatives and solutions.

CHAPTER I : INTRODUCTION

Agriculture is essential to sustaining human life and has been practised for millennia, with origins dating back about 12,000 years. In ancient times, agriculture was the main occupation of the majority of society, at that time fertile agricultural land and large agricultural production were considered valuable assets. But over time, our current society has changed significantly, with only a small portion of the population now participating in agricultural activities. Most farmers have been forced to switch to growing commercial crops leading to, the reduction in available agricultural land has led to an increase in pests and diseases, posing a significant challenge to agricultural production With this decline, there arises an indirect responsibility on these farmers for meeting the food needs of a growing global population, as well as the economic transition to cash crops, where the demand for cash crops has increased and the market value of food crops has not increased, making a shift of food crop production.

Pest infestations can lead to reduced yields and poor harvests, causing food shortages and insecurity in many countries. We can see in countries like India, people are having difficulty having a good meal every day. In India, according to the Food Security and Nutrition Report 2023, about 74.1% of the Indian population has difficulty or difficulty in having a healthy and suitable diet. In other words, more than a billion people in India cannot afford a healthy and adequate diet. It is not only the case of India, countries like Sudan, Somalia and other countries also have much worse food security problems than India (Food Security and Nutrition Report 2023).

With all these challenges that are faced by the farmers, they are forced to seek alternative methods of pest control and improve their productivity. To overcome this problem, a common approach among farmers is to use agrochemicals, such as pesticides and fertilisers, to control pests and improve crop yields. The background and history of its invention are covered in the following sections in this chapter.

These chemicals also known as agrochemicals were initially effective and widely accepted, because of their effectiveness in the agro production. Subsequently, the widespread use of agricultural chemicals has raised concerns about their adverse effects on human health and the environment. Studies in agrochemicals have found that these chemicals can contaminate soil, water sources, and food products, leading to harmful impacts on ecosystems and posing risks to human health from exposure.

As such with these problems, there is a pressing need to explore sustainable agricultural practices that minimise reliance on agrochemicals and prioritise the long term health of both ecosystems and human populations. Finding a balance between agricultural productivity and environmental stewardship is essential for ensuring food security and safeguarding the well-being of present and future generations. My Research on the topic “The Harvesting Dilemmas: The Ethical Consideration of Agrochemical Utilisation” focuses on the harmful effects and the violation of human rights with the use of agrochemicals, also it underline the ethical dilemmas which the agrochemicals leads if it is not been used. We know that agrochemicals were a cure and a possible remedy to food security on a global scale. But the side effects and the other issues it created makes it not for a long term cure, it's a short term cure, it can’t be taken for a sustainable future.

1.1 Background and Context

The history of agrochemicals spans millennia, where humans were trying to develop various substances and practices to enhance agricultural productivity. We can see from Egyptian civilization the use of chemicals in agriculture, where farmers employed natural substances to improve soil fertility and control pests. But the modern agrochemicals are totally different from those, the modern era of agrochemicals began in the late 19th and early 20th centuries with the development of synthetic pesticides and fertilisers. In the 19th century, scientists found a cure for the pest problem by inventing synthetic chemicals that could be used in agriculture to control pests (Egerton, et al 2009). The discovery of The chemistry of plant nutrients and nitrogen fixation revolutionised agriculture by providing a means to improve soil fertility and crop yields.

Later, during the 20th century, the use of agricultural chemicals became widespread and many new pesticides and synthetic fertilisers were introduced into the agricultural sector. With the discovery of synthetic pesticides such as DDT and the advent of chemical herbicides, modern agricultural chemicals have become a revolutionary tool in pest control and disease management.

Weed management helps increase crop productivity and improve agricultural efficiency. Also with the Green Revolution of the 1960s and 1970s, characterised by the introduction of high-yielding crop varieties and intensive use of agrochemicals, these synthetic chemicals became popular worldwide(Borlaug et al 1970).

Agrochemicals played an important role in this revolution by providing the means to control pests, manage weeds and improve soil fertility, allowing many people to survive the famine. The Green Revolution was seen as the solution to widespread food insecurity around the world. From India to the United States, these agricultural chemicals boost agricultural production, solve hunger and save billions of lives. But the rapid and indiscriminate use of agricultural chemicals has also led to unintended environmental consequences, with concerns about land degradation, water pollution and biodiversity loss (Pingali, 2012). Most of these chemicals have a strong effect on nature. The people were not concerned about the harmful effects of these synthetic chemicals in a long term exposure, the people were not aware of the damage that it did to the sustainable environment. These chemicals nowadays are being used all around the world, because it is effective for better production.

1.2 Research Objectives

The main goal of this research is to shed light on the ethical dilemma surrounding the use of synthetic chemicals in agriculture, especially in the context of the urgent need to increase food production. This dilemma arises from the tension between the need to meet growing food demands and the need to ensure environmental sustainability. This study examines the need for environmental sustainability and explores alternative pathways to better balance environmental sustainability and food production. By emphasising the need for environmental sustainability in agricultural practices, the research will emphasise the intrinsic value of the environment and recognize the interconnections between ecosystems.

Furthermore, by assessing the long-term consequences of agrochemical use in agricultural practices, the study highlights the importance of adopting sustainable approaches to minimise damage to the environment.

For achieving this aim, the research will be analysing the ethical frameworks relevant to agricultural practices involving, examining the principles, values, and moral considerations that guide decision making in agriculture. These frameworks provide guidelines for decision-making in agriculture and help us understand the moral considerations.

One key framework that is to be used for analysing will be environmental ethics, which emphasises the intrinsic value of the environment and stresses the importance of considering the long-term impacts of agricultural practices on ecosystems. By examining from this perspective of ethics, it can gain insights into the ethical values that underpin efforts to promote sustainability in agriculture. Theories and concepts utilitarianism and Hedonism, which seeks to maximise overall happiness or utility will be taken to account for analysing. In the context of agriculture, utilitarianism involves weighing the benefits of increased crop yields from the use of agrochemicals against the negative consequences for human health and the environment. This framework allows us to assess the ethical implications of different agricultural practices and identify approaches that maximise societal well-being.

Additionally to these theories stated above there are theories such as deontology that emphasise the importance of rules and obligations that are used in this research. Applying this theory to agriculture suggests that farmers and policy makers

have certain duties and obligations to act in a way that respects the rights of others, including animals and ecosystems. This will be discussed in detail in Chapter 4. Virtue ethics also focuses on the cultivation of virtuous qualities such as compassion, compassion, and wisdom in farmers and policy makers, and analyses the field of agriculture. This approach suggests that ethical decisions should be guided by a desire to foster these virtues and promote human flourishing and environmental well-being.

Furthermore, Justice Theory and Relational Ethics which deals with the fair distribution of benefits and burdens in society and the importance of relationships and interdependence in moral decision-making respectively will be taken into analysis on the ethical perspective.

In addition to that I will be examining the case studies of some specific cases of agrochemical related disasters, such as the Endosulfan issue in Kerala and the poisoning incidents in Punjab. By analysing these cases, we seek to understand the ethical failures that led to these disasters and the lessons that can be learned to prevent similar incidents in the future. These case studies will serve as powerful illustrations of the human and environmental costs of irresponsible agrochemical use.

To sum up, my research seeks to contribute to a deeper understanding of the ethical dimensions of agricultural practices involving chemical inputs. By underlining the environmental and human health risks associated with agrochemical use and examining the ethical principles that deal with these practices.

1.3 Research Questions

Research questions give a direction and focus of the dissertation in addition to the objective, it helps to provide a roadmap for the investigation, guiding the researcher towards a deeper understanding of the issues of the Harvesting Dilemma and the ethical perspective of the topic. The research questions that are designed to address key aspects of the harmful effects of agrochemicals and the ethical dilemmas surrounding their use in agriculture are mostly focused on Human health, Destruction of the environment, and the main harmful impacts. These questions will be answered in the analysis chapter of the research. The main question regarding the use of agrochemicals in agriculture encompasses a broad range including philosophical and ethical inquiries. All these inquiries seek to understand the complex interplay between agricultural practices, environmental sustainability, and human well-being.

One of the central questions is how agrochemicals contribute to the destruction of nature and what ethical considerations arise from this destruction. This question encompasses a range of issues, including the impact of agrochemicals on soil health, water bodies, and marine ecosystems. Agrochemicals can degrade soil quality, leading to erosion and loss of fertility, while runoff from fields can contaminate water sources and harm aquatic life. The use of agrochemicals also raises concerns about the health of human beings, both those who consume food treated with pesticides and those who work with these chemicals in agricultural settings. The ethical dilemma here is twofold, on the one hand, there is a need to increase agricultural productivity to feed a growing population, but on the other hand, this must be balanced against the potential harm to nature and human health.

Another key question is who is responsible for the negative effects of agrochemicals. This question delves into the complex web of stakeholders involved in agricultural production, including farmers, agrochemical companies, governments, and consumers. Each of these stakeholders has a role to play in the use and regulation of agrochemicals, and determining responsibility for the negative effects requires a careful examination of their respective contributions and obligations. Additionally, this question raises broader issues of justice and equity, as the negative effects of agrochemicals are often disproportionately borne by marginalised communities and vulnerable populations.

Lastly, the question regarding how to promote and implement alternative agricultural practices that reduce reliance on agrochemicals can address these ethical dilemmas. This question examines the potential of sustainable agriculture to reduce the harmful effects of pesticides while ensuring food security and economic viability for farmers. Alternative practices such as organic farming, integrated pest management, and agroecology offer promising solutions that prioritise environmental sustainability, human health, and social justice. Nevertheless, implementing these practices requires overcoming various challenges such as technological barriers, economic incentives, and cultural norms.

1.4 Significance of the Study

The above research questions and research objective gives some light into the significance of this research. The field of agriculture is having silent unspoken dilemmas that need to be balanced between the need for agrochemicals for better productivity and the harmful effects that it poses. This dissertation explores the

complexities of this problem, concentrating on the negative consequences of agrochemicals on human health and the environment, as well as the ethical quandaries that highlight the need for these chemicals in modern agriculture. At the centre of this dissertation are three key research questions that act as markers for inquiry as stated in the research objective. Firstly it examines the specific health risks provided by agrochemicals, acknowledging the significant impact these chemicals can have on the health of farmers, agricultural workers, and consumers. Secondly, take into account the environmental effects of pesticide use, namely the implications for soil health, water quality, and biodiversity. Finally, by addressing the ethical implications of this situation, debating the values that should guide the use of agrochemicals in a world increasingly concerned with sustainability and justice.

The significance of this research is that it gives an outlook in identifying significantly with the current agricultural situation. As the global population continues to grow, so does the demand for food, placing immense pressure on farmers to increase the crop yields. The need for agrochemicals is growing higher and higher, with its ability of increased productivity and pest control, have become indispensable tools in modern agriculture. Though, this reliance comes at a cost, as the widespread use of agrochemicals has been linked to various health and environmental hazards, all these issues are discussed in this work. This research aims to shed light on these concerns and issues made by the intensive use of agrochemicals by critically examining the existing practices and offering insights for a more sustainable and ethical future for agriculture.

One of the most significant issues regarding agrochemicals is its effect on human health. Pesticides, herbicides, and fertilisers have harmful compounds that can endanger farmers, agricultural workers, and consumers with its over and intensive use. By exposing ourselves to these substances can cause a variety of health problems, including respiratory troubles, neurological disorders, and cancer. The health concerns connected with pesticide use are especially acute in developing nations such as India, where agriculture provides a major source of income for millions of people. For example, the Endosulfan tragedy in Kerala, India, demonstrated the destructive consequences of agrochemicals on human health, with thousands of people suffering from serious health problems as a result of pesticide exposure.

In addition, the environmental impact with the use of agrochemicals cannot be overestimated, these chemicals have been found to pollute soils, water sources and ecosystems, leading to biodiversity loss and ecosystem degradation. Studies have proven that excessive use of nitrogen-based fertilisers has been linked to water pollution, with runoff from agricultural fields polluting rivers and lakes, harming aquatic life. Indiscriminate use of pesticides has also been linked to declines in populations of pollinators, such as bees by killing them, which play an important role in pollinating crops. Most of the cheap pesticides not only affect the targeted species, it also kills the natural farmers' friends like bees and earth worms etc.

In light of these challenges, the ethical dilemma surrounding the use of agrochemicals becomes clear. On the one hand, there is an urgent need to ensure food security for the growing population, which often requires the use of agrochemicals to increase agricultural productivity and on the other hand, there is a moral imperative to

protect human health and the environment that is threatened by the very chemicals used to increase food production. This ethical dilemma is further complicated by issues of social justice, as the negative impacts of agrochemicals are often borne by marginalised communities and developing countries. Beside these challenges this research also seeks to critically consider the ethical dimensions of the harvest dilemma, within different ethical frameworks to have an understanding of this issue.

1.4.1 Outcome of study

The possible outcome that is expected from this research in the ethical and philosophical perspective is multifaceted and has a lot of implications. First of all, on ethical frameworks the research can facilitate the development tailored to agricultural practices. By considering the ethical dilemmas inherent in the use of agrochemicals, such as the trade off between productivity and environmental sustainability, research can inform discussions on the principles that guide decision making in agriculture. Ethical frameworks can be built on principles such as ecological integrity, intergenerational equity and respect for biodiversity and these frameworks can provide guidance to policymakers, farmers, and other stakeholders on how to manage the ethical complexities of agricultural practices.

In the field of environmental ethics perspective, this research can improve the understanding of ethical responsibilities towards the environment by highlighting the importance of environmental protection in agriculture and underlining the environmental impacts of pesticides, such as soil degradation, water pollution, and biodiversity loss. Furthermore, this increased awareness of environmental ethics may lead to a reassessment of agricultural practices to prioritise sustainability and

biodiversity protection and can give importance to organic farming, and integrated pest management that are likely to gain greater recognition and support as ethically and environmentally responsible alternatives to conventional agriculture.

Finally, this research tries to uncover social injustices associated with pesticide use and highlight the need for social justice in agricultural practices, especially in marginalised communities and developing countries by documenting the impact of pesticides on vulnerable populations such as farm workers and rural communities. This recognition of social justice issues could stimulate efforts aimed at eliminating inequalities in access to resources, health care, and environmental protection and also help to make policies that developed to reduce the social inequalities perpetuated by pesticide use.

1.4.2. Abstract of methodology

The method used in this study is primarily a literature review of articles based on the harmful effects of pesticides written by scientists, professors, and environmental activists, highlighting the harmful effects of pesticides on land, water, and living things. Additionally, the perspectives of farmers, agriculture Scientists and NGOs actively working in this field are highlighted, to Underline the urgent need for sustainable agricultural practices.

To achieve this, a qualitative analysis approach is used. The qualitative aspect, aims to understand the perspectives of farmers and other stakeholders regarding the ethical implications of pesticide use. Data collected through interviews, questionnaires, and literature reviews are analysed using ethical frameworks such as

environmental ethics, utilitarianism, deontology, justice values, and virtue ethics. This qualitative analysis provides insight into the ethical considerations that influence agricultural practices and policy decisions.

Overall, this study aims to provide a comprehensive analysis of the ethical, environmental and health impacts of pesticide use in agriculture, by qualitative approaches aims to provide a nuanced understanding of the complex issues surrounding pesticides and contribute to the development of more sustainable and ethical agricultural practices.

1.5 Structure of the Dissertation

The following chapter consists of literature review, main books and articles based on the use of agrochemicals in agriculture are reviewed in this chapter. Rachel Carson's 'Silent Spring' published in 1961, Vandana Shiva's 'Violence of Green Revolution' are some of the books that were taken into account in the literature review along with some articles on the endosulfan issue in Kerala. By this literature review, the research gives a primary outlook into the harmful effects in the use of agrochemicals.

After the literature review chapter, this paper moves on to the methodology and data collection section. In this chapter, the methodology used in the research is explained in the first subtopic and then it delves into the data collection, mentioning the questions formulated for the farmers, scientists and other actors, for having a better look into the issue and the summary of their responses to the questions and

discussions. In this subsection, it also explains why these questions are necessary to be in the discussion and also the relevance of these questions in the research.

The fourth chapter consists of the analysis, the data collected from the farmers, scientists and other actors were analysed in this chapter along with the information taken from the literature review. Ethical theories that were used to analyse the issue were briefly mentioned and then analysed on the ethical basis considering the various viewpoints of the same issues were done in this chapter. The ethical dilemma in agriculture is shown and this chapter acts as the core of the research. Theories which are related to these issues were qualitatively analysed and stated the ethical dilemma clearly in this chapter. Finally in conclusion it serves as the last chapter and it mainly consists of summary of the research, main limitation and future scope of the research.

CHAPTER II : UNDERSTANDING THE PROBLEM THROUGH LITERATURE AND OTHER VARIOUS APPROACHES

Agriculture has undergone drastic changes in the past few decades to meet the demands of the growing Global population. New ways and techniques have emerged to satisfy this need of Global Hunger and yet it is to be fulfilled. For increasing the yield, agrochemicals have played a pivotal role, but it costs a high price. The heavy use of agrochemicals brings a complex ethical social and environmental injustice. In this chapter we are going to understand the hazardous effects with the use of Agrochemicals through different approaches. The use of agrochemicals began in the 1940s and one or two decades after people started to notice its harmful effects on the environment and to the living beings. The book 'Silent springs' written by the American Marine Biologist Rachel Carson in 1962, stated the detrimental effects of these Agrochemicals to the environment and to the living beings made a revolutionary Movement in America, by numerous Laws which bans the harmful chemicals to the living beings. But later in 1972-2011 another dangerous chemical was used throughout India, Endosulfan, a poison which spoiled numerous lives including children with its use in agriculture. We will be discussing all these in this chapter.

2.1 Wide Awake with Silent Spring

Rachel Carson's "Silent Spring" published in 1962 was an enlightenment to the need of environmental conservation with respect to the agricultural sector. She critically analyses the problem, which arises with the use of agrochemicals in the environment, with respect to everything which is connected to it. She examines the effects of these synthetic chemicals in the soil, water bodies, humans and other living

bodies. She supports her arguments with necessary case studies and examples where we can see the direct violations of human rights and unethical instances. Her book starts with this paragraph, about a town and its situation before the use of chemicals in agriculture and after the use of chemicals for increasing production. She raises a major of ethical issues related to the use of Agrochemicals:

There was once a town within the heart of America where all life appeared to live in concordance with its surroundings. The town lay within the middle of a checkerboard of affluent ranches, with areas of grain and slopes of plantations where, in spring, white clouds of blossom floated over the green areas. In harvest time, oak and maple and birch set up a blast of colour that blazed and flashed across a scenery of pines. At that point foxes tapped within the slopes and deer quietly crossed the areas, half covered up within the fogs of the drop mornings……Then an interesting curse crawled over the region and everything started to alter. A few fiendish spells had settled on the community: secretive diseases cleared the herds of chickens; the cattle and sheep sickened and died. Everywhere was a shadow of passing. The farmers spoke of much sickness among their families. Within the town the specialists had gotten to be increasingly confused by unused sorts of ailment showing up among their patients. There had been a few sudden and unexplained deaths, not as it were among grown-ups but indeed among children, who would be stricken abruptly while at play and kick the bucket inside some hours .(Carson, 1962).

It talks about the horrible effects of DDT[1] and other agrochemicals, how it destroyed the environment and the living being in the countryside of America.

[1] Dichlorodiphenyltrichloroethane (DDT) was the first modern synthetic insecticide produced in the 1940s.

Carson's book is not only stating about the environmental issues brought by the agrochemicals in America, but also the present reality in most of the countries, which doesn't have any other option left other than using the agrochemicals for better productivity to satisfy and to sustain the hunger of their increasing population. This book played a pivotal role in enhancing awareness for global environmental protection and developing environmental ethics in modern society.

2.1.1 A Small Town

In this section, we will be doing a detailed analysis of this book. Carson explores the ethical dilemma of destroying the natural harmony of the environment by chemical intervention, by giving a vivid picture of a town. She makes her concern about safeguarding nature and the consequences of the long term exposure of these chemicals in nature. She questions the human nature of giving importance to the short term gains and not caring about the long term sustainability. The wide acceptance gained by the pesticides for better productivity is a plus for the chemical interventions but the harmful effects of it to the non-targeted organisms and the natural enemies of the pests raises deep concerns about the sustainable environment. She challenges technological development without environmental sustainability, and highlights the need of Moral Imperative[2] to consider the environment and the future generations with respect to present human actions.

Carson states that from the 1940s, more than 200 pesticides and other agrochemicals were introduced to the agricultural sector for controlling the pest, they were applied through different mediums like aerial spraying and other means to farm

[2] Moral imperative: It is a strongly held concept that drives that person to behave. It is a categorical imperative, as Immanuel Kant described it.

land with different geological landscapes. This application of the agrochemicals which are non selective kills the insects and the natural enemies of the pests, non selectively which brings the death of the beings which the destories the crops and also the beings farmers need:

These spray, slaughter each creepy crawly, the 'good' and the 'bad', to still the tune of winged creatures and the jumping of angle within the streams, to coat the clears out with a dangerous film, and to wait on in soil all this in spite of the fact that the planning target may be as it were some weeds or creepy crawlies. (Carson).

Carson uses the word ‘biocide’ for the insecticide because it kills living beings not only insects and destroys the harmony of nature. And the harmony of nature with the living being is a fundamental relationship that is necessary for life to exist in the world, the moment we break it we will be having problems and existence of our life will be a question. It is not only the case of polluting the land water with the use of agrochemicals, but also with global warming which is an after effects of the growing industries and carbon emission, we are destroying the harmony in nature.

2.1.2 The Poison to Human

The Third chapter of Carson's ‘Silent Spring’ - Elixirs of Death, examines the scientific evidence linking the chemicals to the environmental harms and the human risks. She mentions the discovery of the residues of these agrochemicals in the rivers, groundwater which was applied a long time ago. The chain of consumption of these agrochemicals, the different ways in which it reaches the human body, from the vegetables and crops that they apply, to the living organisms like animals, fishes and birds, which made their home in the fields. Regardless of the age group from an old

person to the newborn baby, there is the presence of these synthetic chemicals. To illustrate this presence, she gives an example of the child who faced a harmful after effects of these chemicals. ‘There was a little baby in America, her parents had troubles with cockroaches, so they applied some insecticides to kill the cockroaches, when the baby was not in the house. After the application they washed the floor well and the baby was taken into the house, after sometime the baby started showing symptoms of vomiting and poisoning and the baby lost consciousness and was taken to the hospital. She lost her ability to hear and she was having frequent muscle cramps, the doctors lost their hope to cure her’. Here we can see that the presence of these synthetic chemicals will always be there even after the wash, it pollutes everything whatever it comes in contact with. It is just one case of accident that she mentions here, all over the world there are thousands of cases reported in a year which come under agrochemical accident, it shows how poisonous it is, and arise the question if these synthetic chemicals is residing in the land, plants, or even fruits in which it is applied, even after washing, it is a concern that it will be residing in the vegetables, fruits or other crops that we eat in a certain percentage.

Most of these synthetic chemicals were there from a long time but it’s property to kill insects and pests was noticed in the late 1930s and taken as insecticides and pesticides in the agriculture sector from then onwards. These chemicals attack the nervous system of the being and most of these are non targeted chemicals in which both the cold-blooded and warm-blooded animals are affected in the same way, damaging the nervous system.

This chapter, 'Elixirs of Death' of Silent Spring, examines the ways in which pesticides can accumulate in the environment, contaminating soil, water, and air. She explains how pesticides can persist in the environment for long periods, leading to widespread contamination and harming non-target organisms. It is the responsibility of humans to consider the broader impacts of their actions on the environment and future generations. Carson argues that the use of pesticides is not only a short-sighted approach to agriculture but also a potentially dangerous one, with far-reaching consequences for ecosystems and human health.

2.1.3 Water to Poison

In the next chapter of the book she explores the impact of the agrochemicals in Surface Waters and Underground Seas. She highlights the importance of water as a vital resource for all life forms and the fundamental role it plays in maintaining ecological balance, But with the use of agrochemicals we destroy the water system and the ecosystem which is interconnected to it. She put light into the problem where the synthetic chemicals used in agriculture are washed off by rain and other means into the river, lakes, oceans and even to the underground water system, contaminating the water source and posing threat to the aquatic lives, animals and also to the humans.

She raises questions about the ethical responsibility of industries and governments to protect water resources from chemical pollution and the need for precautionary measures in pesticide regulation. Carson advocates for a holistic approach to water management that considers the ecological impacts of pesticide use and prioritises the protection of water quality for future generations. Furthermore she

advocates for a solution to the Ethical dilemmas which emerge regarding the equitable distribution of environmental risks and the disproportionate burden borne by vulnerable communities. Carson emphasises the ethical imperative of taking preventive measures and prioritising ecosystem resilience in pesticide regulations and management.

2.1.4 Toxic Land and Soil

Carson delves into the complex interactions between pesticides and soil organisms, underscoring the critical role of soil health in sustaining life on Earth, in the fifth chapter of the book, ‘Realms of Soil’. She critically examines the impact of pesticides on soil health and the ethical implications of chemical intensive agriculture, and also highlights the vital role of soil in sustaining life on Earth and emphasises the interconnectedness of soil ecosystems with human well-being and the environment. She states that it is our moral responsibility to conserve and to protect the biodiversity, ecosystem and the land fertility from these chemicals to the future generation. Nature has an intrinsic value in itselves and it needs to be conserved.

The life in the soil is not only what we see, there are also microorganisms which are beneficial for the soil fertility and for the harmony of nature. But with the use of these chemicals we destroy these microorganisms and other living beings which are essential for the harmony of the ecosystem and which maintain the soil fertility. She states how it disrupts the balance of nature and the overall negative impact of this in a long term period.

She readdress the key ethical issue of the concerning unintended consequences of pesticide use on soil, how it can accumulate in the soil, leading to long-term environmental contamination and ecological disruption. She argues that the indiscriminate use of pesticides reflects a shortsighted approach to agriculture that prioritises immediate gains over long-term sustainability, raising ethical questions about intergenerational equity and the moral obligation to future generations. Carson advocates for the organic farming practices that prioritise soil conservation, such as crop rotation[3], cover cropping[4], and composting[5]. She focuses on the point that these practices not only protect soil health but also reduce the need for pesticides and chemical fertilisers, aligning with ethical principles of environmental sustainability and ecological integrity. But the question, 'Can organic farming be able to satisfy the hunger of this increasing population?' remains unanswered, she mostly debates on the debates on sustainable agriculture and environmental ethics, highlighting the need for a paradigm shift towards more holistic and ecologically sound approaches to food production.

2.1.5 Destroying the Harmony

Carson addresses the concept of ecological integrity in her book in the sixth chapter, where she explores the ethical implications in pesticide use on non-target organisms and ecosystems.

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[3] Crop rotation is the process of growing different crops on the same piece of land in sequence to improve soil health, optimise nutrients in the soil, and combat pest and weed pressure.

[4] A cover crop is a plant cultivated primarily to reduce erosion, enhance soil health, improve water retention, suppress weeds, manage pests and diseases, boost biodiversity, and provide various other advantages to a farm.

[5] Composting is a natural process in which organic matter is "rotted down" or broken down by microorganisms under controlled conditions.

She says that:-

'Earth's vegetation is a portion of the internet of life in which there are hints and fundamental relations between plants and the soil, between plants and other plants, between plants and creatures. Some of the time we have no choice but to irritate these connections, but we ought to do so astutely, with full mindfulness that what we do may have results inaccessible in time and put. But no such lowliness marks the booming 'weed killer' trade of the display day, in which taking off deals and extending employment check the generation of plant-killing chemicals' (Carson, 1961).

She talks about the relations between the lives and the dependency of lives to each other, she argues that by disrupting natural ecosystems through the indiscriminate use of pesticides, humans are not only harming wildlife but also threatens the very systems that support life on Earth. Humans believe that we can manipulate nature in the way we want without thinking about the consequences and the imbalance that it creates in nature. Carson argues strongly against this; she warns against the arrogance of the human being, that they don't think about the consequence of their action, she emphasises on the ethical responsibility to respect the intrinsic value of nature.

She states the need to shift away from the exploitative mindset that views nature as a resource to be exploited for short-term gain, towards a more sustainable approach that values the long-term health and well-being of the planet. To make a stewardship[6], of caring for and protecting the environment for future generations, with sustainable environmental practices.

[6] The responsible use and protection of the natural environment through conservation and sustainable practices to enhance ecosystem resilience and human well-being.

2.1.6 Need for Environmental Ethics

Carson discusses the moral need to reevaluate humanity's relationship with the environment and address the unexpected effects of technological hubris in the last chapter, ‘Needless Havoc’, of her book. She makes a strong conclusion about the ethical implication on the use of pesticides and other synthetic chemicals used in the agriculture sector. She reflects the need for sustainable environments, the change in our attitudes and practices toward nature, and broadening the ethical dimensions to connect more the relation between human and the environment. She argues that the indiscriminate and unnecessary use of pesticides leads to environmental crises. The mindset of people that nature is to be conquered and to be controlled, destroys nature's harmony and we as a human being need to do actions to make a sustainable environment.

Carson talks about biotic ethics, in which we should respect nature and all living things. She restates that we're connected to nature and it is our duty to protect it and to conserve it. This ethical standpoint is different from the utilitarian values and idea that pesticides are okay if they help us make money, that the actions are right if it is giving pleasure to a number of people. She thinks we should think about the long-term effects on the environment, not just short-term gains. Carson also says we should use science to help us make ethical decisions about the environment. She criticises the idea of only caring about making money now, instead of thinking about how our actions will affect the environment in the future. She wants us to take a more careful and thoughtful approach to taking care of the environment.

From an ethical standpoint, Carson challenges the idea that the benefits of pesticides outweigh their risks. She argues that the use of these chemicals is often driven by profit and convenience, rather than a genuine concern for the well-being of the planet. Carson calls for a reevaluation of our relationship with nature, urging us to consider the ethical implications of our actions on future generations.

2.1.7 Wave created by Silent Spring

Rachel Carson's "Silent Spring" played a crucial role in shaping environmental ethics by raising awareness about the impact of human activities on the environment and advocating for a more ethical and sustainable approach to environmental management. It highlights the harmful effects of the pesticides and other synthetic chemicals in the land, wildlifes, water bodies, to the ecosystem and to human health. She mentions the challenges in the conservation of environment and ecosystem with respect to technological advancement and economic growth.

One of the key contributions of "Silent Spring" to environmental ethics was its emphasis on the interconnectedness of all living things and the intrinsic value of nature. Her argument that humans are not separate from nature but are part of a complex web of life, and therefore have a moral obligation to protect and preserve the environment for future generations, established a lot of environmental organisations for the protection of nature and it became an important topic to discuss.

The book also raised important questions about the ethical responsibilities of individuals, corporations, and governments in addressing environmental issues. Now at present this book is widely regarded as a landmark work that helped catalyse the

modern environmental movement and led to increased public awareness about environmental issues and paved the way for the establishment of environmental protection agencies and the enactment of environmental laws and regulations.

Today, the principles and ideas put forth in "Silent Spring" continue to influence environmental ethics and policy-making around the world. The book's call for a more sustainable and ethical approach to environmental management remains relevant in the face of ongoing environmental challenges such as climate change, pollution, and biodiversity loss.

2.2 The Tragedy of Endosulfan

Endosulfan is a hazardous agrichemical chemical which has been used to control the pest, in most of the countries. It is currently banned in various countries including India due to its harmful effects on human beings and to the environment. From 1978 to a period of 20 years, it has been widely used in the cashew nut plantations in Kerala, but its invention dates back to 1950. This synthetic chemical got approval to use in the agriculture field as pesticides in 1954 in America, later with the Green revolution, where India adopted the American model of agriculture, Endosulfan became widely used in the Indian agricultural market. We will be analysing the Endosulfan case, its impact to nature and to humans, with reference to the articles and other trustworthy data.

Several scholarly articles have examined the ethical dimensions of the endosulfan episode, focusing on issues such as regulatory failures, scientific evidence, and ethical decision-making. I will be presenting a comparative analysis that

examines three key articles on the endosulfan issue:- "Invisible Disaster Endosulfan" by Mohammed Irshad and Jacquleen Joseph, "Endosulfan Issue: Science versus Conscience" by G K Mahapatro and Madhumita Panigrahi

2.2.1 An Unseen Holocaust

The work of Irshad and Joseph, 'Invisible Disaster Endosulfan' focuses on the comprehensive exploration of the environmental and health impacts of endosulfan exposure in the Kasaragod district of Kerala, India. The article begins by providing a history and the background in the use of endosulfan in the estates of Kasargod district. They analyse the social, economic and the ethical aspects in the use of endosulfan in the communities of the plantations and highlight the negative impact with the use of endosulfan in cashew plantations, that its subsequent use contaminates air, water, and soil. This article also emphasises the disproportionate impact of endosulfan on marginalised communities, particularly women, children, and domestic animals who are most vulnerable to its toxic effects.

The aerial spraying of the endosulfan was done by the Plantation Corporation of Kerala (POK)[7], started the spraying in 1978 as a trail. According to the data from 1981 onwards the corporation started aerial spraying regularly twice a year, around this time of period the people in the area also started reporting the various disabilities in domestic animals. With supporting graphs and data they tried to uncover the ethical and human rights violations which happened in the estates of Kasargod. One of the key strengths of the literature is its focus on the human dimensions of the endosulfan tragedy. Irshad and Joseph provide firsthand accounts of the health problems faced by

[7] POK is a public owned company in the Indian state of Kerala that is involved in the cultivation and processing of various plantation crops. Established in 1962, its primary mandate is to promote the cultivation of crops such as tea, rubber, coffee, and spices in Kerala.

individuals exposed to endosulfan, including neurological disorders, reproductive health issues, and birth defects. The authors highlight the emotional and psychological toll of the endosulfan crisis on affected communities, painting a vivid picture of the human suffering caused by pesticide contamination.

Chapter by chapter they critically analysed the economy and political ideologies that played a role in the scenario, which caused the loss of livelihoods and the breakdown of traditional agricultural practices in Kasaragod. At that time endosulfan was considered to be the cheapest pesticides that can give a positive impact in pest control. People are ignorant about the chemical's dangerous side effects, the appropriate safety precautions to take when using it, how much is needed, and other information. As marginalised populations suffer the most from environmental degradation and government negligence, the authors contend that the endosulfan incident is a reflection of larger problems with social and economic inequality in India.

With regard to ethical analysis, the article brings up significant issues such as environmental justice and the duties of business and government in preserving the environment and public health. Irshad and Joseph criticise the regulatory authorities for not doing enough to control the use of endosulfan and for not holding pesticide manufacturers responsible for the harms caused by their products. According to the authors, the endosulfan tragedy exemplifies environmental injustice, as disadvantaged people are disproportionately affected by pollution and toxic exposure. It also played an instrumental role in creating awareness about the human cost of endosulfan

exposure and advocating for greater accountability and redress for affected communities.

This similar way of thinking and addressing the issues can also be seen in the work of ‘Endosulfan Issue: Science versus Conscience’ by G K Mahapatro and Madhumita Panigrahi. This article provides a critical examination of the controversy surrounding the use of endosulfan in India, focusing on the conflicting narratives and interpretations of scientific evidence.

2.2.2 Unravelling a Mystery

G.K. Mahapatro and Madhumita Panigrahi's article named Endosulfan Issue: Science versus Conscience, is an excellent work which highlights the endosulfan issue is not simply a matter of scientific debate but also involves ethical considerations related to human health and environmental protection. Also like the previous article, ‘Invisible Disaster of Endosulfan’ Mahapatro and Panigrahi, begins by showing the social and economic background in the use of Endosulfan. The authors inquire into the ecological consequences of endosulfan contamination, highlighting its impact on wildlife and ecosystems, and also underline the complex scientific evidence regarding the health effects of endosulfan exposure. This article comes in a contradiction to the work of K. M. Sreekumar and KD Prathapan's article, ‘An Endosulfan Episode’ we can see a lot of arguments against their articles throughout this work.

Mahapatro and Panigrahi examine the role of science in shaping public perception and policy responses to the endosulfan issue. They discuss the limitations of scientific research on endosulfan, including challenges related to sample size,

methodology, and confounding variables. They argue that while scientific evidence is important, it is not the only factor that should be considered in decision-making in a complex situation of need for increasing production and human health. The authors emphasise the need for ethical reasoning and moral judgement in complex environmental decision-making, particularly in cases where scientific evidence is inconclusive or contested. With the use of graphs showing the decline of cashew nut production and the images of the ant's nests, they represent the crisis phase of the endosulfan tragedy.

The article focuses on the importance of considering the broader social and ethical implications of pesticide use, including issues of environmental justice, intergenerational equity, and the rights of future generations. The authors insist that scientists have a responsibility to be transparent about the limitations of their knowledge and to engage in meaningful dialogue with stakeholders about the risks and benefits of pesticides like endosulfan.

Overall this article analyses the endosulfan controversy, highlighting the complexities of balancing scientific evidence with ethical considerations in environmental decision-making. Comprehensive. Also it underlines the importance of incorporating ethical reasoning and moral judgement into discussions about pesticides and other environmental issues, ultimately calling for a more comprehensive and inclusive approach to environmental policy.

But the main challenge to this article is the arguments by K. M Sreekumar and K.D Prathapan, two professors, working in Kerala Agriculture University. They argue

that political and economic interests have often overridden scientific evidence and ethical considerations in the regulation of pesticides, particularly in the case of endosulfan. They criticise the lack of transparency and accountability in the regulatory process, and emphasise the importance of prioritising public health and environmental protection over profit-driven motives.

But in general there can be some synthetic chemicals which are bad for human health and the environment. We can't be sure about that. The main problem of the synthetic chemical is that short term exposure may not show the harmful effects. After a long period we will be realising the damage that it did to us and to our living environment. That's why, the United nations and other national and international organisations formed an list of Persistent Organic Pollutants[8], where they can have a list of highly toxic chemicals, and researches are going on the side effects of agrochemicals.

2.3 Genotoxic Damage in Punjab

Punjab Poisoning is an environmental and human health issue that arose in Punjab due to the excessive use of agrochemicals in the agriculture sector. Punjab is considered as the grainary of India, because of its high production of wheat and rice, and other food crops. When we look into the past after the independence of India, it needed a boost in the agriculture sector, with respect to the increasing population. Punjab is especially a focal point of this green revolution because of its fertile soil, favourable climate and well irrigation facility. It was a huge success that it was able to

[8] Persistent Organic Pollutants (POPs) are a group of toxic chemicals that persist in the environment, bioaccumulate in living organisms, and pose risks to human health and the environment. These chemicals include pesticides, industrial chemicals, and unintentional by-products of industrial processes, such as dioxins and furans.

satisfy the hunger of millions of starving people, and resulted in economic and social well being. But the question of long term sustainability and environmental sustainability remained as a question. With the use of agrochemicals it polluted the water, soil, it destroyed the fertility and caused health problems in humans and livestocks animals.

2.3.1 The Down side of Green Revolution

The Green Revolution was needed for India, as a solution to food insecurity. The main aim was to increase food productivity by the use of high yield crop varieties, machines and the intensive application of agrochemicals to boost up the yield. While the Green Revolution succeeded in boosting food production and alleviating hunger of millions, it also had negative consequences, particularly in terms of human health and the environment.

One of the most significant concerns associated with the use of agrochemicals in Indian agriculture is their adverse effects on human health. Pesticides, in particular, have been linked to a range of health problems, including respiratory illnesses, skin disorders, reproductive issues, and neurological disorders. Studies have found that the use of agrochemicals like organophosphate pesticides, which has been commonly used during the Green Revolution, have been associated with acute poisoning incidents and long-term health effects among agricultural workers and rural communities[9].

[9] John Victor Peter, Thomas Isiah Sudarsan, and John L. Moran "Clinical features of organophosphate poisoning: A review of different classification systems and approaches"*Indian Journal of Critical Care Medicine,* 2014 Nov

Moreover, studies have found higher incidences of cancer, birth defects, and other chronic diseases in areas with heavy pesticide use, raising serious concerns about the long-term health impacts on farming communities and vulnerable populations. The indiscriminate use of agrochemicals has also led to pesticide residues contaminating food and water sources, further exacerbating health risks for consumers, Endosulfan Tragedy in Kerala and pesticide poisoning incidents among cotton farmers have been reported in the village of Padre, Andhra Pradesh, due to the use of hazardous pesticides without adequate safety precautions with the lack of protective gear and training, coupled with poor regulatory oversight, has resulted in acute pesticide poisoning cases and long-term health effects among agricultural workers in the region were an example to it.

In addition to human health concerns, the use of agrochemicals especially synthetic fertilisers has profound ecological consequences, threatening soil fertility, water quality, biodiversity, and ecosystem integrity. Synthetic fertilisers, such as urea and phosphate, are known to degrade soil structure with the profounded use; it can disrupt the natural balance of nutrients in the soil, leading to nutrient imbalances and soil degradation. Also it deplete essential nutrients, leading to soil erosion, salinization[10], and desertification[11] over time. Not only fertiliser, but also pesticides are bad for the environment, if applied to agricultural fields can leach into groundwater or runoff into nearby water bodies, contaminating aquatic ecosystems and posing risks to aquatic organisms and human populations reliant on these water

[10] Excessive application of artificial fertilisers may also result in salinization of the soil, a condition where the concentration of salts in the soil increases. This could happen when salts from synthetic fertilisers build up in the soil over time and are not absorbed by plants. This might lower the soil's capacity to support plant growth and have a detrimental effect on crop yields.

[11] Desertification is a process where fertile land becomes increasingly arid and degraded, eventually turning into desert-like conditions. The use of synthetic fertilisers can contribute to desertification by depleting soil nutrients and disrupting the soil's natural ecosystem.

sources. Some studies have detected pesticide residues in rivers, lakes, and groundwater supplies, with potential implications for drinking water safety and ecosystem health.

Another major environmental impact of chemical-intensive agriculture is biodiversity loss. The Green Revolution favoured monoculture farming techniques, which resulted in the spread of a few high-yielding crop types at the expense of conventional agricultural diversity. The loss of genetic variety not only impairs the agricultural system's resilience, but it also jeopardises food security and livelihoods, particularly for small-scale farmers and indigenous people.

Furthermore, increased pesticide use has resulted in the growth of pesticide-resistant pests as well as a drop in beneficial insects such as pollinators and natural predators, undermining ecological balance and agricultural viability. The adverse effects of agrochemicals on human health and the environment in India are evident, with far-reaching ramifications for farming communities, ecosystems, and future generations. The Green Revolution's legacy of chemical-intensive agriculture emphasises the critical need for a transition to sustainable and agroecological agricultural techniques that prioritise human well-being, environmental stewardship, and social fairness.

2.3.2 Poisoning Punjab

From the previous subchapter we can understand the violation of human and environmental values, by the application of Agrochemicals in various parts of India. In this subchapter we will directly focus on the issue in Punjab. The book “Violation

in the Green revolution" by Vandana Shiva portrays a critical analysis of the social, ecological, and human rights implications of the Green Revolution in the context of third-world agriculture which happened in Punjab, in the Green revolution period. With the help of relevant data she shows how the land and the human health has been affected by the synthetic chemicals which have been widely used there.

She gives focus on the health issues, the rights of workers, indigenous rights of human beings and also the ecological impacts like, soil degradation, biodiversity loss and water pollution. She certifies that the agrochemicals brings a rise in production of crops, but also it poisons the land and water. The indiscriminate use of synthetic chemicals leading to acute and chronic health problems among agricultural workers and consumers, and also causes health impacts on women and children, who are vulnerable because most of the people are in contact with this harmful synthetic chemicals with their involvement in activities such as weeding and pesticide application, which makes them at greater risk of exposure.

According to the census of 1981, Even though Punjab's population was comparatively less compared to the national average, the production of the food was really higher compared to other states. For this the average Punjab's farmer uses three times the agrochemicals per hectare than the national average. All this was in the Green revolution, She states that :

The Green revolution was based on the assumption that technology is a superior substitute for nature, and hence a means of producing growth, unconstrained by nature's limits….the reduction in the availability of fertile land and genetic

diversity of crops as a result of green revolution practices indicate that at the ecological level, the green revolution produced scarcity not abundance. (shiva)

Her idea is really clear from this statement that, with green revolution it benefited a lot to the development of economy and productivity, but when we look into the nature, it's not the productivity or the growth that we can see, we see only the damages that we did to the environment with the intensive use of chemical fertilisers, like soil degradation, including loss of soil fertility and increased soil erosion. And Water Pollution, the contamination of water sources due to the runoff of agrochemicals from agricultural fields. She underlines that pesticide residues and fertilisers can pollute groundwater and surface water, leading to water scarcity and ecosystem degradation.

She argues that pesticide residues and fertilisers can pollute groundwater and surface water, leading to water scarcity and ecosystem degradation. Which can disrupt natural ecosystems, leading to imbalances in predator-prey relationships and the proliferation of pest species. She suggests that the Green Revolution's reliance on chemical pesticides has created a cycle of dependency on these inputs, further exacerbating ecological problems.

Shiva also points out the link between pesticide exposure and the incidence of cancer and other genetic damages and diseases. She cites studies showing higher rates of cancer and other health problems in areas with intensive pesticide use and also pesticides and other chemicals used in agriculture can disrupt genetic material, leading to long-term health effects for exposed populations, suggesting a causal

relationship between pesticide exposure and health outcomes. This is an important point that she mentions because we can see that in the case study of endosulfan in Kerala, people exposed to these chemicals show infertility and genetic damage during birth.

In conclusion, Vandana Shiva's article "The Violence of Green Revolution" provides a compelling critique of the human health issues and ecological impacts associated with the use of agrochemicals in intensive agriculture. She examines the socio-economic, environmental, and political dimensions of the Green Revolution, and highlights the need for a paradigm shift towards more sustainable and equitable agricultural practices that prioritise human health, ecological integrity, and social justice.

2.4 Pesticide a Poison or a Remedy?

The use of pesticides has both good aspects and bad aspects. On the positive side, pesticides help control pests and diseases that can damage crops, resulting in higher yields and increased food production. This is especially important in a region like Punjab where agriculture is a major industry and food security is a major concern in a place which has a high population. It also protects public health by controlling disease-carrying insects such as mosquitoes, DDT is an example to this, because in India DDT is banned for the agricultural uses because of it harmful side to the human and to the environment but it is used in the health sector to control the mosquitoes to prevent large number cases of malaria. still, the downside of pesticides is also important. They can have negative effects on human health, wildlife, and the environment. Pesticide residues can contaminate soil, water, and food and pose a

threat to human health. Additionally, pesticides can harm beneficial insects, birds, and other wildlife and disrupt ecosystems. Overuse or misuse of pesticides can lead to the development of pesticide-resistant pests, posing long-term pest control challenges.

We can determine the right and wrongness in the use of pesticides, sometimes it is necessary for the present society, it is a protagonist and also an antagonist in the same way at the same time. In this subchapter we will be discussing the detrimental effects of pesticides. The article “Impact of Pesticides Use in Agriculture: Their Benefits and Hazards" by Wasim Aktar, Dwaipayan Sengupta, and Ashim Chowdhury provides a comprehensive overview of the benefits and hazards associated with the use of pesticides in agriculture. They point out the various aspects of pesticide use, including its historical context, modes of action, environmental impacts, and human health effects.

The article starts with showing the historical background of pesticide production and usage in India and later moves on to the benefits in highlighting improvement of production with its use. They argue that pesticide, especially insecticide, is really necessary to control the vectors of malaria and other deadly diseases. Not only in India most of the developing and underdeveloped countries face the problem of controlling the vectors without the means of these synthetic chemicals.

Later in the article they write about the hazardous effects of these chemicals in human health, by showing the studies conducted on various kinds of people, the authors portray the damage that these chemicals are doing to human health. Pesticide exposure causes a range of health problems, including cancer, reproductive disorders,

and neurological effects. Agricultural workers, who are most frequently exposed to pesticides, are at particularly high risk. in spite of that, pesticide residues can also find their way into the food chain, exposing consumers to potential health risks.

In India, the first incidence of pesticide poisoning came from Kerala in 1958, when over 100 people died after eating parathion-contaminated wheat flour. After a multicentric study was conducted to analyse pesticide residues in selected food commodities gathered from various states of the country by Surveillance of Food Contaminants in India, DDT traces were discovered in around 82% of the 2205 samples of bovine milk collected from 12 states. Around 37% of the samples revealed DDT residues that were above the tolerance limit of 0.05 mg/kg. This is a huge ratio of residue in food that can cause a lot of damage to human health and genetics.

One of the key environmental impacts of pesticides that is mentioned in the article is pollution. It can leach into the soil and contaminate groundwater, also by leaking into the ground water sources it can also be able to spread to surface water sources. This contamination can have detrimental effects on aquatic life, as pesticides can be toxic to fish and other aquatic organisms, which is necessary for the sustainability of aquatic life. Additionally, pesticides can also impact non-target organisms, such as beneficial insects, birds, and mammals, leading to disruptions in ecosystems. For example bees which are really needed for pollination purposes and also for the apiculture, but the use of pesticide can really cause harm to bees and other needful insects.

Another environmental concern that the authors state is the development of pesticide resistance in pest populations. Over time, pests can develop resistance to pesticides, rendering them ineffective. This can lead to a cycle of increasing pesticide use or the invention of more poisonous synthetic chemicals, which can further exacerbate environmental pollution and harm non-target organisms.

Overall, the article gives a thorough examination of the benefits and drawbacks of pesticide use in agriculture. It emphasises the need of using sustainable pest management strategies to reduce pesticides' negative impacts on the environment and human health. The authors call for ongoing research and innovation to produce safer and more sustainable pest management approaches that lessen dependency on chemical pesticides.

CHAPTER III : QUALITATIVE ANALYSIS AND COLLECTED DATA

With the above literature review, which postulates the key issues stated by scientists, professors and other environmental activists on the issue of the use of pesticides and other chemicals in agriculture, gives an understanding on the effects it leads in the land, water and to the living beings, how it is destroying the sustainability of the environment. This research will also be looking into the perspective of farmers and scientists in the present, as most of the books that we referred to are a bit old, it is crucial to look into the present scenario of the agrochemicals and its related issues. For having this perspective and their point of view about the issues, various methods will be used such as; conducting Interviews and Questionnaires with the farmers, scientists and other non governmental organisations who work in this field of research.

The research will be qualitative, for a comprehensive analysis of the issue related to the agrochemicals. To have a view from an ethical perspective, it is necessary to analyse the data collected from the farmers, scientists and other actors through interviews, questionnaires and the reviewed articles, books in the second chapter, also with the data collected from other trustworthy sources. The research takes a Qualitative Approach, the main aim was to analyse the data collected from farmers and other stakeholders, to understand their perspectives on the ethical implications of agrochemical use. Also the data collected, will be analysed through the ethical frameworks related to it such as environmental ethics, utilitarianism, deontology, value of justice and virtue ethics. Furthermore, it is also important to

analyse the ethical implications of agrochemical use, considering factors such as human health, environmental sustainability, and social justice so it will also be carried out in the research.

3.1 Qualitative approach.

Qualitative approaches are essential to capture the fine distinction in ethical considerations and diverse perspectives of people involved in agriculture. This approach delves into the perspectives of farmers and other stakeholders regarding the ethical implications of agrochemical use. The qualitative data collected from farmers and stakeholders will be analysed to gain a deeper understanding of the ethical dilemmas, considerations, and decision-making processes involved in the use of agrochemicals.

Furthermore, the data collected through qualitative research will be analysed through the lens of various ethical frameworks, including environmental ethics, utilitarianism, deontology, justice theory, and virtue ethics. Each of these frameworks offers unique insights into the ethical dimensions of agrochemical use, allowing for a comprehensive exploration of its impact on human health, environmental sustainability, and social justice. By this there can be a clear understanding of the right and wrong in the use of agrochemicals in agriculture. Also from the ethical perspective of the environment, environmental ethics provides a philosophical foundation for understanding the intrinsic value of the environment and the moral obligations humans have towards it. Through this lens, we can assess the environmental consequences of agrochemical use and evaluate its compatibility with

principles of environmental stewardship and conservation. The view that if nature extinct then the humans will also die but if the human becomes extinct then it won't create any damage to the environment so the point is that the environment is superior and it needs to be conserved no matter what the state of human being is supported.

The other concepts like Utilitarianism in ethics which offers a consequentialist perspective, focusing on the maximisation of overall happiness or utility. By applying this framework, we can examine the balance between the benefits of increased agricultural productivity from agrochemicals and the potential harms to human health and the environment. Deontology, which emphasises on the importance of moral duties and principles in guiding ethical decision-making. Through this concept analysis, were done on the ethical obligations of farmers and other stakeholders in minimising harm, respecting human rights, and upholding ethical norms in agricultural practices. And other theories which consider the fair distribution of benefits and burdens in society such as principles of distributive justice, procedural justice, and social justice, by applying these theories it was possible to evaluate the equity and fairness of agrochemical use, particularly in terms of its impact on marginalised communities and future generations.

Overall, Analysing data through an ethical framework allows for a deeper understanding of the ethical implications of pesticide use, considering factors such as human health, environmental sustainability, and social justice. This holistic approach allows us to identify key ethical issues, challenges and opportunities for promoting sustainable and ethical agricultural practices. This qualitative research approach was

invaluable in its ability to capture the complex and context-dependent nature of ethical decision-making in agriculture.

3.2 Discussions and Results

The interviews and questionnaires were designed to target different segments, including scientists, organic farmers and non-organic farmers. By targeting different groups it was possible to have the perspective and point of view of a larger audience with different ideologies, which were really helpful to analyse and to arrive at a conclusion.

3.2.1 Responses from the Scientists and NGOs

The questions delve into various aspects of agrochemical research, including the reasons for their widespread use, ethical dilemmas, safety measures, regional variations, and the intersection with sustainable agriculture. Each question highlights a critical aspect that contributes to a comprehensive understanding of the impact of agrochemicals on agriculture and the environment. It is crucial to understand the reasons behind the widespread use of agrochemicals for identifying the drivers that influence agricultural practices. This knowledge is needed to make policy decisions, agricultural strategies, and public awareness campaigns aimed at promoting sustainable alternatives.

The questions are also postulated in a way to investigate the differences in the effectiveness of agrochemicals and shed light on their varied impacts on agricultural practices and environmental outcomes. By highlighting the case study of Punjab poisoning with agrochemicals and Endosulfan tragedy in Kerala, which are some

instances of human rights violations associated with agrochemical use underscores the ethical considerations and social justice implications of agricultural practices. These incidents provide valuable lessons on the ethical complexities and human consequences of agrochemical use.

These interrogations addressed the impacts of agrochemicals on human health and the ecosystem, and the need for an understanding of the complex interactions between agricultural practices, environmental dynamics, and socio-economic factors. These questions explored the relevance to agrochemical research, and the need to work towards promoting sustainable and ethical agricultural practices that ensure food security, protect human well-being, and safeguard the environment for future generations.

The first question tries to understand the specific areas of agrochemical research that have been the focus of the scientist's or expert’s career. It is crucial for establishing their expertise and contextualising their responses that provides insight into the individual's background and the depth of their knowledge in the field. Later moving on to the next question which gives key reasons for the widespread use of agrochemicals in agriculture is essential for addressing the challenges associated with their use. This question gives insights into the factors driving their use, we can better understand the implications of these chemicals on agricultural practices and the environment.

It is also really important to understand the variations in the effectiveness of agrochemicals, which can significantly impact agricultural practices. By exploring the

professor's observations regarding the effectiveness of different agrochemicals, we can have a better understanding of their implications for agricultural productivity and sustainability. Also, uncovering the direct violations or ethical concerns related to the use of agrochemicals, I can understand the ethical implications of their use, which is crucial for my research. This knowledge can be used for developing the ethical guidelines and policies to mitigate these concerns. Case studies such as the endosulfan issue in Kerala or the Punjab poisoning incidents provide valuable insights into the ethical aspects of agrochemical use. Examining these cases can give a deeper understanding of the ethical dilemmas associated with agrochemical use and their implications.

Exploring safety measures and precautions taken to mitigate the risks of the farmers in the use of agrochemicals and understanding variations in the use of agrochemicals across different regions globally can provide valuable insights into research so these questions will be covered in the interviews. To have a proper conclusion to the research it is important to have some knowledge on how sustainable agricultural practices intersect with the use of agrochemicals and identifying areas within agrochemical research that require further investigation or attention. Also, exploring the benefits of collaboration between scientists, policymakers, and ethicists in the context of agrochemical research is essential for promoting informed decision-making. By understanding the benefits of such collaboration, can better promote interdisciplinary approaches to addressing agrochemical-related challenges.

Finally, by examining the feasibility of meeting the food demands of the increasing population without the use of agrochemicals, understanding the professor's

perspective on traditional farming methods in providing insights into the potential of these methods to meet food demands and uncovering the reasons behind the use of harmful pesticides or chemicals that are banned or not used in other countries is crucial for understanding regulatory practices and safety standards. By exploring these reasons, we can better address the challenges associated with the use and impacts of agrochemical use on ecosystems and their implications. Gaining insights into these impacts can help us better address the challenges associated with agrochemical use and promote more sustainable agricultural practices. These are the main areas or questions that we are going to look up to in this section of interviews with professors and scientists.

In response to the first question regarding specific areas of agrochemical research, individuals made their focus on different distinct paths. One individual has dedicated their career to the management of chemicals in mice during their master's studies, while the other has specialised in researching insecticides and their residues on agricultural products. These areas of expertise encompass a range of topics within agrochemical research, including toxicity management, pesticide application practices, and the impact of insecticide residues on food safety and agricultural sustainability. By incorporating insights from these individuals, the data collection process will benefit from a diverse array of perspectives and expertise in addressing the multifaceted challenges associated with agrochemical use in agriculture.

For the second question about their perspective or the view of agrochemical usage in agriculture, they state that efficiency and productivity emerge as key drivers for their widespread adoption of agrochemicals in agriculture. Countries like China,

the US, and India exhibit varying levels of agrochemical consumption per hectare, with China leading, followed by the US, and India only uses approximately half a kilogram. This disparity in usage rates may be attributed by factors such as historical contexts, economic development, and agricultural practices. When we take India, where there has been a significant shift from extreme poverty to a focus on food security for a billion population, agrochemicals played an essential tool to enhance agricultural productivity and ensure food sufficiency. The immediate impact of agrochemicals on crop yields makes them a preferred choice for farmers seeking to meet the growing demands for food production. Thus, the widespread use of agrochemicals in agriculture can be attributed to their perceived efficacy in pest control and their role in improving agricultural productivity, particularly in regions striving to overcome food insecurity and poverty. The main focus was to eradicate poverty rather than to think about the other harmful effects it does to the environment or to human health.

The third question addresses the effectiveness of various agrochemicals in agricultural practices. From their observance, there are some significant disparities in the effectiveness of various types of agrochemicals, particularly between organic biopesticides and chemical pesticides, also the same in case of fertilisers. While chemical pesticides and fertilisers are favoured by most farmers for their superior efficacy in pest control and productivity enhancement, organic biopesticides and biofertilizers are perceived to be less efficient. The preference for chemical pesticides is because of their quick response to pests and their ability to deliver immediate results. In contrast, biopesticides, which are often neem-based and eco-friendly, are primarily used for household purposes to minimise exposure to harmful chemicals,

especially among children and adults, these biopesticides are the slower action and have reduced efficacy compared to chemical pesticides, which pose challenges in pest management for agricultural practices. Despite their eco-friendly nature and minimal environmental impact, biopesticides may not provide the rapid pest control required in commercial farming settings. Thus, while biopesticides are valued for their safety and environmental benefits, their limited effectiveness in comparison to chemical pesticides impacts agricultural practices, influencing farmers' decisions regarding pest management strategies.

For the fourth question regarding direct violations of human rights associated with the use of agrochemicals in agricultural practices, the scientists state that they have witnessed numerous instances of direct violations of human rights associated with the use of agrochemicals in agricultural practices. According to their view, despites of the regulations put forward in plant protection acts mandating safety measures during agrochemical application, such as the use of protective clothing, masks, and gloves, there is not that much caring or attention given among farmers on these regulations. Many individuals apply agrochemicals without adhering to proper safety precautions, leading to increased risks of skin diseases and exposure to carcinogenic properties present in certain chemicals, potentially resulting in organ-related diseases and various forms of cancer. Most of the scientists agree that lack of awareness regarding the harmful effects of agrochemicals contributes significantly to this issue. Many farmers are unaware of the potential health hazards posed by these chemicals and they fail to take necessary precautions. Also, the extension efforts undertaken by governments and NGOs to disseminate information

on safety practices often do not reach all communities, exacerbating the problem of inadequate awareness.

Moreover, even among farmers who are aware of safety precautions, there is often a reluctance to implement them in practice. This may be due to factors such as inconvenience, lack of access to proper safety equipment, or a perceived prioritisation of productivity over personal safety. The respondents believe that it is not only enough to address these violations of human rights, it also requires concerted efforts to increase awareness among farmers about the dangers of agrochemical exposure and the importance of adhering to safety protocols. Agricultural instructors and knowledgeable individuals within communities play a vital role in spreading and teaching this information and encouraging adoption of safe practices. According to the scientists, by prioritising education and enforcement of safety measures, we can work towards mitigating the adverse impacts of agrochemical use on human health and upholding the fundamental right to a safe and healthy working environment in agriculture.

The respondents are familiar with notable case studies related to agrochemical use, including the Endosulfan Tragedy in Kerala and the Punjab poisoning incidents. These incidents highlight the toxic consequences of inadequate safety measures and regulatory oversight in the use of agrochemicals. They provide insights into the ethical aspects of these cases, the importance of prioritising human health and environmental well being over short term gains in agricultural productivity. They add to the point that Endosulfan Tragedy and Punjab poisoning incidents serve as reminders of the ethical imperative to regulate agrochemical use rigorously, enforce

safety standards, and prioritise sustainable agricultural practices that minimise harm to both people and the environment.

Agrochemicals carry inherent risks, as indicated by warning labels and safety instructions provided on product packaging, but the responsibility for ensuring the safe use of these chemicals ultimately falls on the users, who must diligently follow recommended safety precautions. Despite these precautions, instances of adverse health effects caused by agrochemical exposure, albeit minor, still occur, underscoring the need for heightened awareness and vigilance in agricultural practices.

According to the professors and scientists, the primary ethical dilemmas associated with the use of agrochemicals in modern agriculture revolve around the trade off between economic profit and human health. It is a significant dilemma which arises from the pressure on farmers to prioritise crop yield and market value over consumer safety. By this compulsion, farmers are mentally forced to use pesticides and chemicals to mitigate pest damage and ensure marketable produce, often without adequate consideration of the health risks posed by chemical residues. The waiting period specified on agrochemical packaging is crucial in preventing harmful residue accumulation, yet many farmers may overlook this in their pursuit of economic gain, leading to potential health hazards for consumers and agricultural workers alike. Also there is a growing consumer awareness of the risks associated with chemical residues in agricultural products, leading to increased demand for organic alternatives. although, the ethical dilemma arises from the challenge of meeting the escalating food demands of a growing population while preserving food quality and safety. As agricultural land diminishes due to urbanisation and development, the pressure to

maximise production using agrochemicals intensifies, despite concerns about the purity and safety of the food produced. While organic farming offers a potential solution, its scalability to meet global food needs remains uncertain, prompting ethical debates about the balance between food security and agricultural sustainability.

Regarding mammalian safety and the safety measures implemented by the government, the scientist states that, most agrochemicals undergo rigorous mammalian safety tests before being approved for market availability and precautions are taken to ensure that these chemicals pose minimal harm to mammals when used according to prescribed guidelines. but also, there are some drawbacks like, failure to adhere to recommended usage practices, such as using agrochemicals beyond their expiration date or in excessive quantities, can lead to adverse effects on mammalian health. Despite regulatory measures in place, compliance with safety protocols remains a challenge, with instances of non-compliance reported in agricultural practices.

Furthermore, while some agrochemicals are specifically designed to be safe for mammals, others may still pose risks to both mammals and the environment if misused or improperly handled. They also add that, prioritising mammalian safety and enforcing adherence to safety regulations, governments can help minimise the risks associated with agrochemical use and promote responsible agricultural practices that safeguard both human and animal health and thereby the ecosystem.

For the question regarding the variation in agrochemical use across different regions globally the respondents affirm positively and provide insights into the

factors such as the market availability of agrochemicals, with certain chemicals being more readily available in some regions than others. This variation is often influenced by factors such as land type and agricultural practices specific to each region. Additionally, the role of consultants and agrochemical dealers is significant, as they play a crucial role in promoting and selling agrochemical products to farmers. Their influence can contribute to variations in agrochemical use patterns, as their recommendations and marketing strategies may differ across regions.

From the experience of scientists, they have encountered several challenges related to agrochemical use that are unique to specific geographic areas such as the development of pest resistance to pesticides, known as cross resistance. Continuous use of a particular pesticide can render it ineffective against pests, necessitating the use of stronger chemicals, also there are instances where pests become resistant to all available pesticides in the market, posing significant challenges for farmers in pest management.

Another challenge that they highlight is the presence of chemical residues in food products, which can have detrimental effects on both health and the economy. High levels of agrochemical residues can lead to restrictions on exports, impacting the agricultural economy of the country and the use of these agrochemicals can disrupt natural ecosystems by killing natural enemies of pests and beneficial organisms such as earthworms, which play a crucial role in maintaining soil fertility and ecosystem balance.

Additionally, the application of agrochemicals can vary depending on the proximity to protected areas such as forests. In areas near protected areas, the use of agrochemicals is often limited to minimise environmental impact. These challenges underscore the importance of region-specific approaches to agrochemical use and the need for sustainable and environmentally conscious agricultural practices.

From the perspectives of scientists, sustainable agricultural practices intersect with the use of agrochemicals in nuanced ways, Firstly, sustainable agriculture prioritises the adoption of organic and environmentally friendly pest management strategies, reserving agrochemicals as a last resort when alternative methods, such as biopesticides, prove ineffective. Integrated pest management (IPM) is emphasised, highlighting the importance of holistic approaches to pest control that minimise reliance on chemicals and prioritise ecosystem health.

Moreover, sustaining farmers is identified as a primary concern in promoting sustainable agriculture. Without viable livelihoods for farmers, the future of agriculture and food security is jeopardised. Economic challenges, including declining market values for agricultural products, compel farmers to seek cost-effective solutions for maximising productivity. While agrochemicals may offer immediate benefits in terms of pest control and yield enhancement, the long-term sustainability of agricultural systems hinges on addressing economic disparities and ensuring equitable access to resources.

The scientists underscore the pivotal role of sustainable agricultural practices in addressing environmental and ethical concerns. By minimising reliance on

agrochemicals and promoting holistic approaches to farming, such as IPM and organic farming, sustainable agriculture mitigates environmental pollution and preserves biodiversity. Additionally, prioritising the well being and livelihoods of farmers aligns with ethical imperatives to uphold human rights and social justice within agricultural systems. Overall, sustainable agricultural practices serve as a pathway towards achieving food security, environmental stewardship, and ethical resilience in the face of evolving agricultural challenges.

From the interview, they give insight to the collaboration between scientists, policymakers, and ethicists that holds immense potential for advancing agrochemical research towards the goal of achieving sustainable agriculture and a healthier environment. According to their view, working together can enhance awareness programs about the harmful effects of agrochemicals and implement stricter control measures on their use. They add that scientists can develop environmentally friendly products for pest management and productivity enhancement, but their successful implementation in agricultural practices requires the support of policymakers and ethicists.

Furthermore, promoting the availability of genetically modified plants and RNA pesticides in the market offers a promising avenue for reducing environmental impacts associated with agrochemical use. Advances in technology have enabled the modification of plant genetics to enhance resistance to pests and diseases, thereby reducing the need for chemical interventions, so there need to have more collaborative efforts to promote the adoption of genetically modified crops and innovative pest

management strategies contribute to the overarching goal of sustainable agriculture and environmental stewardship.

Overall, collaboration between scientists, policymakers, and ethicists facilitates the integration of scientific knowledge, ethical considerations, and policy frameworks to address the complex challenges posed by agrochemical use. By leveraging the expertise and perspectives of diverse stakeholders, collaborative initiatives can foster innovation, promote responsible decision-making, and pave the way towards a future where agriculture is both productive and environmentally sustainable.

In response to the question of whether traditional farming methods, without the use of agrochemicals, can satisfy the hunger of the increasing population, the respondents state that such methods alone are insufficient. The prevalence of pests, coupled with their increasing resistance to pesticides, poses significant challenges to traditional farming practices. Additionally, the rise of invasive pests from external sources further complicates pest control efforts. These factors underscore the necessity of agrochemical use in modern agriculture to effectively manage pest populations and ensure sufficient food production to meet the demands of a growing population.

In response to the question regarding the use of harmful pesticides or chemicals still in use in India despite being banned or restricted in other countries, it is noted that certain agrochemicals, such as abamectin, continue to be utilised despite their restricted status in many nations. This discrepancy can be attributed to several

factors, including concerns over mammalian safety and environmental harm posed by these chemicals. While economic considerations may play a role, it is also recognized that India lacks robust systems for testing and regulating the safety of agrochemicals, contributing to their continued use despite international restrictions.

Also in addressing the impact of agrochemical use on the ecosystem and human health, it is evident that these chemicals have deleterious effects on both. Agrochemicals disrupt the delicate balance of the ecosystem, harming microorganisms, mammals, and other beneficial organisms, thereby disturbing the natural harmony and equilibrium of nature. Furthermore, the adverse health effects of agrochemical exposure on humans are significant, as highlighted in Rachel Carson's seminal work, "Silent Spring." The overuse of chemicals exacerbates these impacts, posing a grave threat to environmental sustainability and human well-being

3.2.2 Discussions and the Responses from Farmers who use agrochemicals

By engaging with non-organic farmers about their experiences and practices regarding agrochemical use provides insights into the realities and challenges of agricultural production. Questions that are prepared about the extent and types of agrochemicals used, changes in soil fertility and crop yields, safety measures, health effects, and environmental concerns can help to understand the on-the-ground impacts of agrochemicals and the motivations behind their use. By understanding farmer’s perspectives on agrochemical use we can make efforts to promote alternative farming practices and sustainable agriculture. The questions also underline their experiences and challenges and highlight the need for support and resources to transition towards safer and more sustainable agricultural practices.

Moreover, exploring farmer's perceptions of the risks and benefits of agrochemical use can help to understand the complex decision making processes involved in agricultural practices, the situation they face which force them to use the agrochemicals. By engaging with farmers in dialogue about these issues, develops more nuanced and context-specific approaches to promoting sustainable agriculture and mitigating the adverse effects of agrochemicals on human health and the environment. In general, engaging with farmers in discussions about agrochemical use has an impact on research on agricultural sustainability and it can contribute to the development of strategies and to understand the dilemma that they face because of the economic and other social factors.

The main questions that were asked were about their experiences with agrochemicals, this can provide valuable insights into the extent of their use and the associated challenges. Also discussions to understand the quantity and limits of agrochemical use in agriculture, which is crucial for ensuring safe and sustainable farming practices were done with the farmers. In addition, it is also important to inquire about the main types of agrochemicals that are used and their purposes because different chemicals may have varying impacts on soil fertility, crop yields, and overall agricultural productivity were also discussed with the farmers.

It is also important to discuss the safety measures that they have taken care of when handling or applying agrochemicals, as well as any specific challenges or risks associated with their use. Inquiring about any adverse effects on health or the health of family members due to agrochemical exposure can help assess the health risks

associated with these chemicals. Also, interrogating concerns of farmers about water contamination, soil degradation, and biodiversity loss are also important to explore, as these issues are often linked to the widespread use of agrochemicals. Also, understanding the primary reasons for farmers to rely on agrochemicals in India is necessary to provide insights into the drivers of their use and potential barriers to adopting alternative farming practices or organic methods.

Finally, inquiring about farmer's experiences with alternative farming practices or organic methods or their consideration to practise other alternative methods can help assess the feasibility of transitioning away from conventional agrochemical use. In addition to this, asking about the support or resources farmers believe would be most helpful in transitioning towards safer and more sustainable agricultural practices can inform efforts to promote sustainable farming practices in India.

In response to the question about their experiences with the use of agrochemicals in farming practices, two distinct perspectives were shared. The first perspective highlighted the extensive use of agrochemicals in agriculture, aimed at increasing productivity and controlling pests quickly. The farmers in Kerala that I interviewed noted that approximately 10,000 rupees worth of agrochemicals are used per acre annually. While organic components such as vermicompost, cow dung, and seaweed extract are also utilised, they are not sufficient for achieving optimal productivity. The main challenge faced is to achieve a high yield within a short cultivation period, leading to the use of around 2 kilograms of fertiliser per acre.

On the other hand, the second perspective emphasised the long-term use of chemical fertilisers and pesticides over the past 30 years. The farmers acknowledged the harmful effects of chemical farming on both human health and soil quality. though, they also noted that without the use of chemical fertilisers and pesticides, the crop yield is significantly lower. They mentioned that the government now advises the use of manual or composted fertilisers to improve soil fertility, leading to a reduction in the use of agrochemicals.

In response to the question regarding the main types of agrochemicals used and their purposes, the farmers highlighted a range of fertilisers and pesticides utilised in agricultural practices. The primary fertilisers mentioned by them include NPK[12] fertilisers, which are essential for promoting plant growth, along with Boron, Calcium Nitrate, Potassium Nitrate, Urea, and Diamonic Phosphate. They say that these fertilisers play a crucial role in providing essential nutrients to crops and optimising yield. Additionally, participants mentioned the use of various pesticides such as Asetaf, Indofil, Manik, Coragen, Fame, and Roger for disease and pest control. These pesticides are employed to manage pests and diseases effectively, thereby safeguarding crop health and maximising agricultural productivity. Overall, the participants emphasised the importance of utilising a combination of fertilisers and pesticides to address the diverse needs of crop management and ensure optimal agricultural outcomes

To the question regarding changes in soil fertility, crop yields, or overall agricultural productivity, since the introduction of agrochemicals, the farmers express

[12] NPK stands for "nitrogen, phosphorus, and potassium," the three nutrients that compose complete fertilisers.

mixed observations and concerns. While some farmers acknowledge a perceived decline in soil fertility, about a potential of 50% reduction, they underscore the importance of balancing chemical usage with organic matter to mitigate soil damage, this can be because of the awareness classes that they have from the agriculture institute. They emphasise the detrimental effects of overusing agrochemicals, which can disrupt soil ecosystems and diminish soil fertility. But the lack of accessibility and affordability of organic fertilisers, such as compost, and the need for higher productivity drives farmers to prioritise chemical fertilisers, despite their potential long-term consequences. As agriculture remains their primary source of income, farmers prioritise maximising production and cultivating crops, even if it means compromising soil health in the short term. Additionally, farmers in Goa echo similar arguments, affirming that agrochemical use correlates with a decline in soil capacity from their experience. These responses highlight the complex interplay between agrochemical usage, soil health, and agricultural productivity.

When it comes to handling or applying agrochemicals on their farms, most farmers prioritise safety measures such as using gloves and masks to minimise direct exposure. Despite these precautions, farmers acknowledge the potential risks associated with agrochemical use, including vomiting tendencies, skin irritations, and other minor health issues. Also with the awareness classes they recognize that inadequate precautionary measures could lead to more serious health consequences, such as genetic diseases and various types of cancer, highlighting the importance of proper handling and application of agrochemicals. These responses underscore the challenges and risks associated with agrochemical use, emphasising the need for stringent safety protocols to safeguard both farmers and the environment.

The responses from farmers regarding adverse health effects resulting from exposure to agrochemicals reveal a cautious approach towards their application. While most farmers in the area of Palakkad adhere to proper safety measures during agrochemical application and prioritise organic materials, they have not experienced significant adverse health effects aside from occasional skin irritation and temporary vomiting tendencies immediately after application. In spite of these, they emphasise the importance of maintaining a balanced approach between agrochemicals and organic materials to ensure both agricultural productivity and human health. They caution against over reliance on agrochemicals, warning of potential long-term soil degradation and associated health risks. On the other hand, some farmers in Goa report witnessing health issues in their communities linked to agrochemical usage, underscoring the need for greater awareness and precautionary measures in agricultural practices. They report that farmers in Goa indicate more severe health problems associated with agrochemical use, with one individual specifically mentioning brain-related health issues. But, when asked about the primary reasons for the widespread reliance on agrochemicals among farmers even with these problems, the reason for most farmers is rooted in economic necessity.

They assert that their economic stability hinges on the use of agrochemicals, a sentiment echoed by many in the farming community. They express frustration with social media campaigns and interviews advocating for a shift towards organic farming, emphasising that their challenges as farmers differ from what they narrate. As sole providers for their families, farmers rely solely on income from farming to cover household expenses and repay loans, making profit is their primary concern.

With the short timeframe between planting and cultivation, farmers feel compelled to prioritise agrochemical use to achieve high production levels and maintain profitability. They highlight the lack of viable alternatives for pest and disease management using organic materials, further reinforcing their reliance on agrochemicals to sustain their livelihoods. These responses underscore the complex economic realities faced by farmers and the significant role that financial pressures play in shaping agricultural practices.

With the above scenario for having economic stability I asked about considering or adopting alternative farming practices or organic methods as an alternative to conventional agrochemical use. For this the farmers have varied responses. While some farmers have not adopted any alternative practices, others have embraced a mixed method approach combining traditional and modern techniques. Those utilising the mixed method have incorporated seaweed extract and other organic materials instead of conventional nutrients like calcium nitrate. But, a major challenge cited by these farmers is the limited availability of organic materials.

Also, all farmers disagree with the possibility of completely stopping the use of agrochemicals and achieving better crop harvests with completely organic farming. According to them, it is not feasible, especially given the current agricultural situation. They emphasise that without the use of pesticides and fertilisers, achieving expected yields is nearly impossible, particularly due to the high prevalence of pests and the low market value of agricultural products. While farmers acknowledge the potential for reducing agrochemical usage to a certain extent, they highlight that doing so may introduce income instability. They note that while organic farming is more

suitable for long-term production of cash crops like rubber and certain spices, which do not require immediate action, food crop farmers need quick responses to address pests and diseases. Thus, the use of chemicals that provide rapid solutions is deemed necessary for food crop farmers to ensure crop protection and maintain income stability.

3.2.3 For the Farmers using organic pesticides

It is also important to understand the perception of the farmers who use more organic ways in farming, so that we can have a whole picture or the idea of the agricultural and Agrochemical system. The main questions which arise after the interviews with farmers who use the agrochemicals for better productivity, can be rectified with the interview of the people who use organic pesticides and bio fertilisers. The main aim of this questionnaire will be to understand the question, Is bio farming an answer to sustainable agriculture? The outline of questions are given in the paragraph below.

Firstly, the question deals with the experiences of farmers with organic materials that can provide valuable insights into the advantages of organic farming. Secondly, it is also important to understand whether they have ever tried synthetic chemicals for increasing productivity or pest control can shed light on the perceived benefits and drawbacks of synthetic chemicals compared to biopesticides and biofertilizers. These two areas of discussion give an expertise of farmers, then further inquiring about the main reasons for being an organic farmer can help understand the motivations behind choosing organic farming practices. Also, asking about the main

organic materials, biofertilizers, and biopesticides used on their farm can provide insights into the specific practices and inputs used in organic farming.

It is also important to assess a farmer's satisfaction with the production level on their farm. Organic farming can help gauge the effectiveness of organic practices in meeting their production goals. Inquiring about the main challenges experienced in organic farming can provide insights into the barriers to adopt or maintain organic practices. Exploring farmer’s beliefs about the potential of traditional organic farming to satisfy the hunger of the increasing population can help understand their perspectives on the scalability and feasibility of organic farming. Asking about the support and help needed from policymakers and other organisations to increase productivity using organic materials in agriculture can inform efforts to promote sustainable farming practices.

Lastly, inquiring about any economic problems experienced in agriculture by using only biological materials can help assess the economic viability of organic farming practices and identify areas where support may be needed.

As a response to the enquiry, when discussing the advantages experienced in the use of organic materials for farming, organic farmers highlighted several key benefits. Most of them emphasised the adage "health is wealth," indicating a broader perspective on the health benefits associated with organic farming practices. Also, some of the farmers also noted significant advantages in soil conservation, sustainability, and fertility preservation with organic farming compared to synthetic chemicals. These farmers stated that they have observed that with organic farming,

plants exhibit longer growth periods and develop broader, greener leaves, indicating healthier and more robust plant growth. These responses underscore the multifaceted advantages of organic farming practices in promoting environmental sustainability and soil health.

Besides these, when asked about their use of synthetic chemicals for increasing productivity or pest control, one farmer admitted to using pesticides on the farm for controlling the pest as there wasn't any other way to control the pest, while another stated that they had only used organic materials. The farmer who used synthetic pesticides noted that they were only used sparingly. Moreover, the person who used synthetic chemicals noted that synthetic chemicals had a quick and effective impact on pest control, but they were also aware of the potential negative effects on soil health and biodiversity. On the other hand, the farmer who only used organic materials did not face any negative impacts and emphasised the benefits of organic farming for soil health and biodiversity.

Further, when delving into the main reasons for choosing organic farming, both farmers emphasised the value of life and the satisfaction they derived from sustainable farming practices. They highlighted the challenges and dedication required and also mentioned the health benefits most of the farmers expressed their satisfaction in knowing that they were not relying on external inputs. Additionally, in terms of the organic materials, biofertilizers, and biopesticides used on their farms, most of the farmers mentioned using vermicompost, while some farmers stated that they only used compost as fertilisers.

Most of the farmers expressed their satisfaction with the production level on their farm with organic farming. But some farmers add the point that it requires initial work, there won't be enough production in the beginning, but the production level eventually stabilises. Plus, regarding the main challenges experienced in organic farming, one farmer mentioned that the crops may be less compared to the agrochemical farmers but, he did not face significant challenges apart from the presence of weeds, which is a common issue in organic farming due to the absence of chemical weed control.

While interrogating about the potential of traditional organic farming to satisfy the hunger of the increasing population, farmers highlighted the need for widespread adoption of kitchen gardens in every home and utilising all vacant land for agriculture. They emphasised the importance of conducting experiments to boost up the productivity of organic farming practices on a larger scale, suggesting that such measures could potentially address the food demands of the growing population.

Finally asked about the support and help needed from policymakers and other organisations to increase productivity using organic materials in agriculture, responses varied. Some farmers expressed satisfaction with the government's support for organic farming, while others felt that support was lacking in certain areas. Overall, farmers emphasised the need for increased support and assistance from policymakers and organisations to further promote organic farming practices and increase productivity.

CHAPTER IV : ETHICAL DILEMMA

This chapter deals with the analysis of discussions and Interview with the farmers, Scientists and other Environmental activists along with the literature review and Data collected from the trustworthy sources, with a philosophical and ethical framework. The main reason for analysing the ethical view was it will help us to understand the relation between humans and the environment, the intrinsic value of the environment and the need to protect nature can be acquired from the philosophical understanding. By analysing environmental issues from an ethical perspective, we can assess the moral implications of our actions and decisions, leading to more responsible and sustainable environmental practices. Also with the philosophical view or standpoint, we can look more into the sustainable future than the short term goals. The main ethical theories used were mentioned below.

4.1 Ethical Theories that can be Portrayed on the use of Agrochemicals

Ethical theories play a crucial role in shaping our understanding of human rights and can provide valuable frameworks for analysing and addressing ethical dilemmas in this context. There are different key perspectives that can be used in the analysis of this current issue of agrochemicals. Theories like Utilitarianism, Deontology Justice and value theories can give different opinions or different points of view about the use of agrochemicals. All these theories are explained in this chapter.

4.1.1 Utilitarianism

To briefly introduce utilitarianism, it is one of the most powerful and convincing approaches to normative ethics in the history of philosophy. Although many different views are discussed, utilitarianism is generally considered the view that the morally right action is the action that produces the most good. There are many ways to express this general statement. It should be noted that this theory is a form of consequentialism: right action is understood entirely in terms of the consequences produced. What distinguishes utilitarianism from egocentricity has to do with the severity of its consequences. From a utilitarian perspective, one must maximise overall benefit, which means considering the interests of others as well as one's own (Mill, 1998).

In other words what utilitarianism aims is the happiness of the people, it's an ethical theory giving importance to happiness of the being as a whole. There are mainly two thinkers who mainly state the Utilitarian theory, J.S. Mill and Jeremy Bentham. According to their view, Mill believes that the quality of pleasure is also important in deciding what is moral. Mill's most important thought was to move away from Bentham's view. Instead, Bentham's utilitarianism was quantitative in the sense that all he focused was on maximising the amount of overall pleasure calculated hedonically. To him all that mattered was the creation of pleasure, and the way this was achieved was not important.

According to Mill, higher pleasures are more valuable than lower pleasures. The higher pleasures are intellectual pleasures produced by activities such as poetry, reading, or going to the theatre. To him, What one should seek to maximise pleasures

of higher quality, even if the resulting overall pleasure turns out to be quantitatively lower (Crisp,2021).

Justifying this distinction between higher and lower pleasures as non-arbitrary and not simply an expression of one's preferences, Mill says that competent judges who have experienced both two kinds of pleasure, it is best for him to choose which pleasures are superior and which are inferior.

When we analyse the Harvesting Dilemma in the use of agrochemicals on the Utilitarian framework, we can take account of both the Quantitative Utilitarianism of Bentham and Qualitative Utilitarianism of Mill. Trying to understand this issue is so complex that it involves different actors and different sections of which need to be taken into account when it comes to the happiness of the people. All these are further discussed later in the chapter.

4.1.2 Deontology

Deontology is a moral theory which uses rules to distinguish right from wrong. This ethical theory is often associated with philosopher Immanuel Kant. He believed that moral actions follow universal moral laws, such as “Don`t lie. Don't steal. Don't lie”. To him these are bad actions regardless of the situations. In contemporary moral philosophy, deontology is one type of normative theory concerned with which choices are morally obligatory, forbidden, or permissible. They argue that some choices cannot be justified by their effects, that no matter how morally good their consequences, some choices are morally unacceptable, where what makes a choice right is its conformity to moral standards. Consider an example, one

person lies about something, and that lie has a good consequence. He lied because the truth gives bad consequences, but according to this theory, what is morally wrong is always wrong.

In this sense, for these deontologists, the Law is considered to take precedence over the Good. If an action is not in accordance with the Law then it cannot be performed, no matter what benefit it may bring.

This theory has its own weakness and the strong aspects, mainly deontologists criticise the consequentialist theories, and the relative ethics that the right and wrong can vary according to situations are not taken into account into the deontology. This theory plays an important role in making a standpoint of right and wrong in the use of agrochemicals.

4.1.3 Justice theory and Value Theory

Justice theory has been developed over a long period of time, many philosophers made their view on this topic from time to time. At its core, the theory of justice seeks to address issues of fairness, equality, and resource allocation in society. Philosophically speaking, justice is often considered a fundamental moral principle that guides our actions and interactions with others without the violation of morality. From an ethical perspective, theories of justice consider how we should treat others and what makes for a just or equal society.

When it comes to the modern era, justice theory is the idea of distributive justice, which concerns the equitable distribution of resources, opportunities, and

advantages in society. This concept is often associated with philosopher John Rawls, who argued that justice requires that everyone have an equal opportunity to succeed and that economic and social inequalities are only permissible if they bring benefits to the most disadvantaged members of society. Rawls's theory of justice as fairness has had a major influence on contemporary political and moral discourse, shaping discussions of issues such as social welfare, health care, and education. By this theory, he proposes an alternative ethical theory to utilitarianism that addresses the problem of distributive justice, and it uses an updated form of Kantian philosophy and a variation of conventional social contract theory.

To sum up, applying justice theory in the harvesting dilemma gives the focus on fairness, equality, and the distribution of benefits and burdens in society. Which raises an important question about who bears the costs and benefits of agricultural practices with the agrochemicals. This issue is analysed in the upcoming section.

4.2 Aspects of Environmental Consideration

Environment is something that needs to be conserved and to be protected, regardless of the existence of human beings. Humans and all the other beings are dependent on nature and we are using nature and the environment for their existence. But, most of the time and most of the places humans over exploit nature, because of the never ending greed which is rooted in their mind. In the name of development we are taking all the resources from nature and this has gone too far, making it a challenge to the sustainable future. Some thinkers and activists started to advocate for the need for environmental consideration.

According to Barry from his book “The Closing Circle” Published in 1971 states that “everything is connected to everything else” which made the slogan that “Humans are part of Nature” (Jamieson,2008). This book is considered as the First law of Ecology, this book underlines that human actions are leading to the destruction of the environment and this is separating us from nature. Nowadays, nobody cares about the Environment even their own. Everyone knows that the plastic and all other chemicals that we use are harmful to nature. Still, we are using these and still we are dumping them in the surroundings, creating destruction.

The focus of environmental ethics, it was important to recognise the intrinsic value of nature. Nature has inherent value regardless of its usefulness to humans, challenging anthropocentric thinking that puts human interests above all else. Achieving this perspective requires a fundamental shift in the way we perceive and interact with the natural world, away from exploitation and toward respect and responsibility. Recognising the intrinsic value of nature requires us to reevaluate our relationship with the environment and develop a deeper sense of responsibility and respect for all living things and ecosystems.

It is also important to take into account Environmental Justice while analysing the issue, it is an important aspect of environmental protection that addresses the disproportionate impact of environmental degradation on marginalised communities and future generations. Achieving environmental justice requires considering the distribution of environmental benefits and burdens and advocating for justice and

fairness in decision-making processes. This gives valuable guidance in assessing the detrimental effects in agriculture with the use of agrochemicals.

Also, in the book of Jamieson (2008) mentions the Conservation ethics, which includes various approaches in conserving biodiversity and ecosystems, balancing the needs of human society with the needs of protecting and conserving natural habitats. Ethical considerations are at the heart of conservation work and guide decisions about land use, resource extraction and biodiversity conservation. This aspect aims to overcome tensions between conservation goals and human development aspirations and foster dialogue and cooperation to find sustainable solutions to environmental problems. Ethical considerations and considerations are essential to maintaining.

Most of all, it is important to underline Sustainability, which acts as a core ethical obligation in environmental protection, emphasising our moral obligation to future generations and the long-term health of the planet. Unsustainable practices such as overconsumption, pollution and habitat destruction threaten the well-being of future generations by depleting natural resources and damaging ecosystems. Prioritising environmental protection and intergenerational equity is important to ensure that future generations inherit a healthy and sustainable planet. Ethical principles that promote sustainability guide our actions with the aim of treating the environment responsibly and conserving biodiversity for future generations.

The use of agrochemicals in agriculture raises important ethical considerations from an environmental perspective, especially given the interconnectedness of all living things and the intrinsic value of nature. Although agrochemicals are

instrumental in increasing agricultural productivity and combating food insecurity, their widespread and indiscriminate use has led to environmental degradation and posed environmental challenges.

Lack of Sustainability is one of the main ethical issues related to the use of agricultural chemicals. Agricultural chemicals, such as pesticides and fertilisers, are often used in excessive quantities, leading to soil and water pollution, loss of biodiversity and ecosystem disruption. This over-exploitation is driven by human greed and the relentless pursuit of development, leading to environmental degradation.

From an environmental perspective, the rightness of using agrochemicals in agriculture is called into question due to their adverse impacts on nature and ecosystems. This ethical perspective emphasises the intrinsic value of nature, regardless of its usefulness to humans. This challenges anthropocentric thinking and calls for a shift towards a more respectful and responsible relationship with the natural world. Recognizing the intrinsic value of nature requires us to reevaluate our actions and prioritise environmental protection and conservation over short-term gains. These environmental impacts highlight the ethical concerns associated with the indiscriminate use of agrochemicals, as they undermine the intrinsic value of nature and contribute to the deterioration of ecosystems.

Furthermore, the overexploitation of natural resources for the production of agrochemicals exacerbates environmental degradation and threatens the sustainability of future generations. The extraction of raw materials for agrochemical production,

such as fossil fuels for synthetic pesticides and mining for mineral fertilisers, depletes finite resources and contributes to habitat destruction and greenhouse gas emissions. This unsustainable use of natural resources conflicts with the principle of sustainability, which emphasises our moral obligation to preserve the environment for future generations.

Not only with the environmental aspects, this issue can be analysed with various other ethical theories that are mentioned below.

4.3 Analysing the Harvesting Dilemma on the Ethical Framework

4.3.1 Qualitative Analysis on the basis of Utilitarianism

The use of agrochemicals in agriculture presents a complex ethical dilemma, balancing the need for increased productivity and food security against the potential harms to farmers and consumers. From a utilitarian perspective, which seeks to maximise overall happiness or utility, the ethical implications of agrochemical use can be analysed by considering the benefits and harms to actors involved. This section examines the ethical dimensions of agrochemical use, focusing on its effects on farmers, consumers, and overall food security, through the lens of utilitarian theory.

Speaking about agrochemicals, it came as a cure for lack of productivity. So one portion of the people believe that it is a necessity to use the agrochemicals in agriculture to increase yields and to decrease global hunger. With the world's population steadily increasing, there is a growing demand for food production to meet the nutritional needs of billions of people. Agrochemicals, including fertilisers, pesticides, and herbicides, are essential tools for boosting crop yields and protecting

plants from pests and diseases. By increasing agricultural productivity, agrochemicals contribute to greater food availability, reducing hunger, and improving overall welfare for many people, particularly those in developing countries who depend on agriculture for their livelihoods.

The utilitarianism theory can also be viewed in agrochemical use, by considering the harmful effects it causes on farmers, particularly in developing countries where safety regulations may be lax or poorly enforced. From the interviews and the data collected it shows that prolonged exposure to agrochemicals, such as pesticides and herbicides, give rise to significant health risks to farmers, including acute poisoning, chronic illnesses, and reproductive problems. Also, it is noted from the discussions with the scientists about the potential harms caused to consumers associated with agrochemical residues in food. The indiscriminate use of pesticides and herbicides can result in the presence of harmful residues on fruits, vegetables, and grains consumed by humans, some farmers are not aware of the waiting period of the agrochemicals. Long-term exposure to these chemical residues has been linked to various health problems, including cancer, neurological disorders, and reproductive issues. Thus, from a utilitarian standpoint, the negative impact of agrochemical residues on consumer health must and the negative consequences experienced by farmers must be weighed against the potential benefits of increased productivity and food security to determine the overall utility of agrochemical use.

Also promoting sustainable agricultural practices that minimise reliance on agrochemicals can offer a more ethical approach to food production. New methods, such as integrated pest management, organic farming, and conservation agriculture,

prioritise ecological balance, biodiversity conservation, and soil health while maintaining or even enhancing agricultural productivity. By reducing the use of synthetic pesticides and fertilisers, these approaches mitigate environmental pollution, protect human health, and promote social justice by empowering farmers to adopt more resilient and equitable farming systems. From a utilitarian standpoint, investing in sustainable agriculture offers a pathway to maximise overall utility by optimising productivity while minimising negative externalities and promoting long-term well-being for farmers, consumers, and the planet.

It is also worth mentioning that the use of utilitarianism framework provides for weighing the competing interests involved in the use of agrochemicals, considering the benefits to food production and security against the harms to farmers and consumers. While agrochemicals may contribute to increased productivity and food availability, their use also carries significant risks to human health and the environment. Ethical decision-making within a utilitarian framework requires a careful consideration of these competing interests, seeking to maximise overall utility by minimising harm and promoting the greatest good for the greatest number of people.

When it comes to the ethical dilemma of agrochemical use, it underscores the complex interplay between the need for increased agricultural productivity and the potential harms to farmers and consumers. The utilitarian perspective, the decision to use agrochemicals must be based on an assessment of their overall impact on human welfare and well-being. While agrochemicals may offer benefits in terms of increased food production and security, their use also carries significant risks to human health

and the environment. Ethical decision-making requires a careful balancing of these competing interests, seeking to maximise overall utility by promoting sustainable agricultural practices that minimise harm to both people and the planet. The integrity of the environment and promoting conservation practices that respect the essential values of nature.

Qualitative and quantitative utilitarianism, as proposed by Jeremy Bentham and John Stuart Mill, respectively, provide contrasting perspectives on the use of agrochemicals in agriculture. In qualitative utilitarianism, the focus is on the quality of the outcomes. This means that the ethicality of using agrochemicals would depend on whether the overall quality of life is improved or not. For example, if the use of agrochemicals leads to increased crop yields and improved food security for a population, qualitative utilitarianism would argue that this outcome is morally right, despite potential negative impacts on the environment and human health.

On the other hand, quantitative utilitarianism, as advocated by Mill, focuses on the quantity of outcomes. According to this view, the ethics of agricultural chemical use would depend on increasing well-being or overall well-being. For example, if the use of agricultural chemicals leads to a net increase in the overall happiness of society, even if some individuals experience negative effects, quantitative utilitarianism would consider this is morally right.

In the context of India and other parts of the world, the use of agrochemicals can be viewed from both utilitarian perspectives. For example, the Green Revolution in India, which involved widespread use of agricultural chemicals, led to a dramatic

increase in food production and helped reduce hunger for millions of people. From a quantitative utilitarian perspective, this outcome would be considered morally right, since it would lead to a net increase in overall welfare.

However, from a qualitative and pragmatic perspective, the use of agrochemicals during the Green Revolution also caused negative consequences such as soil degradation, water pollution and health problems for farmers and consumers, common people. These negative effects would be considered morally wrong because they reduce the overall quality of life, despite increased food production.

4.3.2 Analysing with respect to Deontology Theory.

From the perspective of deontological ethics, which emphasises the adherence to moral principles and duties, this issue raises questions about the inherent rights and responsibilities associated with agricultural practice. We can also take this theory in different perspectives which contradict the others, just like utilitarianism, some of the arguments are based on duty to increase productivity, duty to protect humans health and environment.

When speaking about the duty to increase productivity, on the deontology theory of ethics, the issue can be seen in this way that farmers have a moral duty to maximise yields to meet the growing demands of a rapidly expanding global population. Agrochemicals, such as fertilisers and pesticides, are instrumental in achieving this goal by enhancing crop yields and protecting plants from pests and diseases. From a deontological perspective, fulfilling the duty to increase productivity

is paramount, as it aligns with the moral imperative to ensure access to an adequate and nutritious food supply for all individuals.

Even the Green revolution's main objective was driven by the recognition of the growing global population and the need to meet the escalating demands for food. At the heart of this aim lies the moral imperative to fulfil the basic human right to food. At that time that was the primary, satisfying hunger is the main focus even today around the globe people are facing food insecurity. The only way to eradicate food insecurity is by increasing the production from the grass root level.

In this context, the role of agrochemicals in increasing agricultural productivity is pivotal. Fertilisers provide essential nutrients to crops, improving soil fertility and enhancing yields, while pesticides protect crops from pests and diseases, reducing yield losses and ensuring a more reliable food supply. The use of agrochemicals has been instrumental in boosting crop yields and improving food production efficiency, contributing to the overall goal of achieving food security. Viewing this from a deontological point, there is a moral duty to maximise agricultural productivity to meet the basic needs of the growing global population. Ensuring access to an adequate and nutritious food supply is not only a moral imperative but also a fundamental human right and agrochemicals play a crucial role in fulfilling this duty by enhancing crop yields and safeguarding food production against various threats. Therefore, the use of agrochemicals to increase agricultural productivity aligns with the deontological principle of fulfilling one's moral duty to ensure access to food for all.

Coming to the next view, the reliance on agrochemicals also raises ethical dilemmas and concerns. The indiscriminate use of fertilisers and pesticides can have adverse effects on human health, as well as the environment. From this research with literature review and from various discussions with farmers and scientists, it has unfolded that pesticides and herbicides have been linked to various health problems, including respiratory issues, neurological disorders, and certain types of cancer. Farmers, especially those in developing countries with limited access to protective equipment and training, bear the brunt of these health risks. Additionally, consumers may unknowingly ingest pesticide residues present in fruits, vegetables, and other food products, jeopardising their well-being.

As the indiscriminate use of agricultural chemicals are leading to adverse effects on human health and the environment it is considered as a mistake. Deontological ethics focuses on the inherent rightness or wrongness of actions, regardless of their consequences. So from the case studies and discussions with the actors related to this issue it is clear that use of agricultural chemicals are harmful to human health and the environment. Therefore from another perspective of deontology which emphasises the importance of respecting human health and the environment as intrinsic values that should not be compromised in the name of increasing agricultural productivity. The use of agrochemicals that harm human health and the environment would be deemed wrong because it violates the principle of not causing harm to others.

The Endosulfan issue in Kerala stands as a stark reminder of the ethical dilemmas inherent in the use of agrochemicals, the consequences of its usage were

severe, leading to detrimental health effects on both human beings and the environment. The harmful impacts of Endosulfan, ranging from neurological disorders to reproductive issues and cancer, represent a blatant violation of this duty. From a deontological standpoint, this action is unequivocally wrong, as it disregards the moral imperative to protect human health and uphold fundamental human rights. The case of Endosulfan in Kerala underscores the ethical responsibility to prioritise human well-being over economic considerations in agricultural practices.

The widespread use of pesticides, as depicted in "Silent Spring," represents a clear violation of this duty. By prioritising short-term gains in agricultural productivity over long-term sustainability and human well-being, policymakers and chemical companies engaged in actions that were ethically wrong. The failure to consider the potential harms of pesticides on human health and the environment demonstrates a disregard for moral responsibilities and principles. Carson's work serves as a powerful reminder of the ethical imperative to prioritise human health and environmental stewardship in agricultural practices.

Also while taking the perspective of farmers, the pressure to maximise yields and economic returns may lead some farmers to prioritise short-term gains over long-term sustainability and ethical considerations. In some cases, this may involve the indiscriminate use of agrochemicals without proper safety measures or consideration of potential health and environmental impacts. From a deontological standpoint, such actions are ethically wrong, as they violate the duty to protect human health and the environment. To sum up a deontological perspective, there is a clear duty to prioritise human health and environmental stewardship in agricultural

practices, which necessitates careful consideration of the potential risks and consequences associated with agrochemical use. Upholding ethical responsibilities and principles is essential for promoting sustainable and socially responsible agricultural practices that prioritise human well-being and environmental integrity.

4.3.3 Analysing with respect to Justice Theory and Value Theory

Justice theory underscores the importance of fairness and equity in the distribution of benefits and burdens within society. In the context of agriculture, this entails ensuring that the benefits of increased productivity resulting from agrochemical use are equitably distributed among farmers, particularly smallholders and marginalised communities. The use of agrochemicals can have significant impacts on farmers' livelihoods, particularly in developing countries where small-scale agriculture is prevalent, it is necessary for the living.

John Rawls' theory of justice provides a compelling framework for examining the rightness and wrongness of using agrochemicals in agriculture, particularly in the context of human health, the need for food, and environmental considerations. According to his theory of justice's view, the use of agrochemicals can be considered only if it brings the greatest benefit to the most disadvantaged members of society, such as those who are food insecure. Agrochemicals have the potential to increase agricultural productivity, leading to higher food yields and potentially reducing hunger and malnutrition. In this sense, the use of agrochemicals can be seen as a means of promoting social justice by meeting the basic needs of the most vulnerable members of society.

But, the use of agrochemicals also raises concerns that indiscriminate use of agricultural chemicals can lead to environmental degradation, harming both the environment and future generations. This raises questions about intergenerational equity, as the benefits of increased food production may come at the expense of environmental sustainability for future generations. Additionally, the health impact of agricultural chemicals on agricultural workers and surrounding communities must be considered, as exposure to these chemicals can lead to serious health problems.

Value theory, including ethical frameworks like environmental ethics, emphasises the intrinsic value of human health and the environment. It questions the trade-off between short-term gains in productivity and long-term sustainability. While agrochemicals may boost crop yields, their prolonged use can lead to soil degradation, water contamination, and biodiversity loss, posing serious threats to the environment and human health. This raises ethical concerns about the value we place on these aspects of life and the need to consider their long-term consequences.

Despite their potential benefits in increasing crop yields and ensuring food security, agrochemicals can have detrimental effects on the environment and human health. The positive impacts must be carefully evaluated against these negative consequences. For example, while agrochemicals may temporarily increase productivity, the long-term effects of soil depletion and water pollution can undermine agricultural sustainability. Additionally, the health risks associated with exposure to agrochemical residues raise ethical questions about the prioritisation of short-term gains over the long-term well-being of both people and the environment.

CHAPTER V : CONCLUSION

From the extensive research conducted on the ethical implications of agrochemical use in agriculture in this research, it becomes evident that discerning the rightness and wrongness of their application is a multifaceted and subtle attempt, fraught with various perspectives and ethical considerations. The main factor which lies in the use of agrochemicals is human food insecurity, where agrochemicals emerge as indispensable tools in boosting agricultural productivity and ensuring the availability of food for billions of people worldwide. Indeed, in the face of widespread hunger and malnutrition, the ethical obligation to prevent starvation and provide adequate nutrition takes precedence, making the use of agrochemicals seemingly imperative.

But, delving deeper into the issue unveils a complex landscape riddled with ethical dilemmas. Concerns regarding the adverse effects of agrochemicals on the health of farmers and consumers, coupled with the overarching imperative of environmental conservation, cast a shadow of doubt on the righteousness of their continued use. Despite their short-term benefits, the long-term consequences of agrochemicals paint a grim picture of environmental degradation and unsustainable agricultural practices, posing existential threats to future generations and the planet as a whole. Thus, while agrochemicals may serve as a temporary solution to immediate food insecurity concerns, their ethical legitimacy is called into question when viewed through the lens of long-term sustainability and the broader implications for human health and environmental well-being.

5.1 Summary

The use of agrochemicals in agriculture poses a complex ethical issue, balancing the need to increase productivity and food safety with the potential harms to farmers, consumers and consumers. From a utilitarian perspective, which seeks to maximise overall happiness or utility, the use of agrochemicals can be analysed by considering its advantages and disadvantages for all parties. Utilitarianism considers the consequences of using agricultural chemicals, weighing the benefits of increased productivity against the harm to human health and the environment. Although agricultural chemicals can contribute to increased food supplies and short-term economic prosperity, their negative impacts on human health and the environment must be carefully assessed.

Prolonged exposure to agricultural chemicals has been linked to a variety of health problems, including acute poisoning and chronic diseases, especially among farmers in developing countries. Additionally, the presence of pesticide residues in food products raises concerns about consumer safety and their long-term health effects. From a utilitarian perspective, the negative consequences of using agrochemicals must be weighed against the potential benefits to determine the overall benefits of their use in agriculture.

Deontological ethics also provides insight into the rights and wrongs of using agrochemicals in agriculture. By this view farmers have a moral obligation to maximise yields to meet the nutritional needs of a growing global population. Agrochemicals play a vital role in achieving this goal by improving agricultural productivity and protecting food production from various threats. However,

indiscriminate use of agricultural chemicals without appropriate safety measures or consideration of potential health and environmental impacts is a violation of the obligation to protect human health and the environment.

Justice theory, proposed by John Rawls, emphasises fairness and justice in the distribution of benefits and burdens in society. Agrochemicals have the potential to increase agricultural productivity and reduce hunger, thereby promoting social equity by ensuring food access for vulnerable populations. However, concerns about environmental degradation and health risks associated with agrochemical use have raised questions about intergenerational equity and the distribution of benefits and burdens.

Overall, the rightness and wrongness of agrochemical use in agriculture depend on a careful consideration of its consequences and adherence to moral principles and duties. Utilitarianism provides a framework for evaluating the overall utility of agrochemical use, weighing its benefits against its harms to determine its ethical implications. Deontological ethics emphasise the inherent rightness or wrongness of actions, highlighting the importance of upholding moral responsibilities and principles in agricultural practices. Justice theory underscores the importance of fairness and equity in the distribution of benefits and burdens within society.

All these theories emphasise the need to consider the interests of all stakeholders, particularly the most vulnerable members of society. By considering these ethical perspectives, policymakers, farmers, and consumers can make informed

decisions about the use of agrochemicals in agriculture, promoting sustainability, social justice, and human well-being.

Also the probable solution to this issue is by promoting sustainable agricultural practices that reduce dependence on agrochemicals can lead to a more ethical approach to food production. Integrated pest management, organic farming and conservation agriculture prioritise ecological balance, preserving biodiversity and soil health while maintaining or even improving agricultural productivity. By reducing the use of pesticides and synthetic fertilisers, these methods reduce environmental pollution, protect human health, and promote social equity by allowing farmers to adopt better agricultural systems.

5.2 Limitation and Future Scopes

One significant challenge lies in the difficulty of measuring and predicting the long-term effects of these chemicals. Many studies focus on short-term outcomes such as immediate health effects or crop yields; they often lack data on the long-term impacts on soil health, biodiversity, and ecosystem resilience. Understanding these long-term effects is crucial for comprehensively assessing the ethical implications of agrochemical use, as some effects may only become apparent years or even decades after initial application. By this if any problems which can be caused by the newly came agrochemicals, won't be seen in the present.

Another limitation is the absence of universal ethical principles or frameworks that definitively determine the rightness or wrongness of agrochemical use. While

ethical theories provide theoretical foundations for analysis, their application can vary depending on specific circumstances and contexts. This lack of consensus on ethical standards can lead to ambiguity and uncertainty when evaluating the ethical implications of agrochemical use, as different ethical perspectives may lead to conflicting conclusions.

Ethical analysis often involves balancing competing interests and values, such as the need for increased food production against potential harms to human health and the environment. Different ethical theories may prioritise these interests differently, resulting in divergent ethical conclusions. For instance, utilitarian perspective justifies agrochemical use if it leads to increased food production and reduced hunger, prioritising the greatest good for the greatest number. Conversely, deontological perspectives mainly disagree in agrochemical use as it causes harm to human health and the environment, prioritising the intrinsic value of these entities.

Finally, the complexity of the issue itself poses a challenge to research. The use of agrochemicals in agriculture is a multifaceted issue with numerous interconnected factors, including economic, social, and environmental considerations. It was difficult to capture and analyse all these complexities within the scope of a single research study This limitation limits the generalizability of research findings and highlights the need for comprehensive, interdisciplinary approaches to studying the ethical aspects of agrochemical use in agriculture.

One key area for future research is the development of more comprehensive and subtle ethical frameworks for evaluating agrochemical use. This includes

integrating diverse perspectives such as environmental ethics, to provide a more holistic understanding of the ethical implications of agrochemical use. By incorporating these perspectives, future research can better make a stand on the future surrounding agrochemical use and provide more guidance for policymakers, farmers, and other stakeholders.

Another important scope is that, future research on the ethics of agrochemical use can be done in an interdisciplinary approach, involving agricultural, philosophical, ethical, and environmental scholars and approach would enable a more holistic understanding of the ethical implications of agrochemical use by integrating insights from diverse fields. This collaborative research involving scholars from these disciplines can lead to the development of comprehensive ethical frameworks that consider the complex interactions between agriculture, ethics, and the environment.

Also, this interdisciplinary research can give insight into the development of sustainable agricultural practices that reduce reliance on agrochemicals, including exploring alternative methods such as organic farming, integrated pest management, and agroecology that prioritise environmental sustainability, human health, and social justice. By promoting these practices, interdisciplinary research can contribute to more ethical and sustainable agricultural systems that minimise harm to the environment and human health.

Future research on this topic can explore the social and economic impacts of agrochemical use, particularly on marginalised communities and future generations by having more interviews and discussions with farmers and various other actors. Mainly

examining the distribution of benefits and burdens of agrochemical use, the impacts on food security and livelihoods, and the implications for intergenerational equity. By addressing these social and economic dimensions, future research can contribute to more equitable and sustainable agricultural systems that prioritise human well being and environmental integrity.

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APPENDIX I : INTERVIEW QUESTIONS

NGOs and Professionals Working Related to Agrochemicals

1. Are there any specific areas of agrochemical research that have you focused on throughout your career?
2. From your perspective, what are the key reasons for the widespread use of agrochemicals in agriculture?
3. In your research, have you observed any significant differences in the effectiveness of various agrochemicals, and how do these differences impact agricultural practices?
4. Have you seen any direct violation of human rights, with the use of agrochemicals in your career?
5. Are you familiar with any notable case studies related to agrochemical use, such as the endosulfan issue in Kerala or the Punjab poisoning incidents? What insights can you provide regarding the ethical aspects of these cases?
6. In your opinion, what are the primary ethical dilemmas associated with the use of agrochemicals in modern agriculture?
7. What are the precautions or safety measures that the government takes for the mammalian safety and also the safety of farmers who use it? Are there any agro chemicals which are still in use, which have harmful effects on mammals and to the environment?
8. Do you think that the use of agrochemicals varies across different regions globally, if what factors contribute to these variations?
9. Does the economy of a country have an influence on the agrochemicals that the country uses?

10. Are there particular challenges or opportunities related to agrochemical use that you believe are unique to specific geographic areas?
11. How do sustainable agricultural practices intersect with the use of agrochemicals, and what role do they play in addressing environmental and ethical concerns?
12. Are there specific areas within agrochemical research that you believe require further investigation or attention?
13. From your experience, what benefits can arise from collaboration between scientists, policymakers, and ethicists in the context of agrochemical research?
14. Do you think that with the traditional farming method, (without the agrochemicals) we can satisfy the hunger of the increasing population?
15. Are there any harmful pesticides or other chemicals which are still in use in our country, but banned or not been used in other countries? What are the major reasons behind the use of these chemicals in our country?
16. Studies have found that with the use of agrochemicals in the agriculture sector it is not only harmful to humans but also to the ecosystem. Do you think it destroys the equilibrium of the ecosystem and how bad is its impact?

For the Farmers Using Agrochemicals

1. Can you share your experiences with the use of agrochemicals in your farming practices? How extensively are they used on your farm? Are you aware of the quantity or the limits of agrochemicals that you can use in Agriculture?
2. What are the main types of agrochemicals you use, and for what purposes?

3. Have you noticed any changes or effects on soil fertility, crop yields, or overall agricultural productivity since you started using agrochemicals?
4. What safety measures do you take when handling or applying agrochemicals on your farm? Are there any specific challenges or risks associated with their use?
5. Have you experienced any adverse effects on your health or the health of your family members as a result of exposure to agrochemicals? If yes, what are the effects ?
6. Are there any concerns about water contamination, soil degradation, or biodiversity loss?
7. In your opinion, what are the primary reasons for the widespread reliance on agrochemicals among farmers in India?
8. Have you considered or adopted any alternative farming practices or organic methods as an alternative to conventional agrochemical use?
9. Do you think you can stop using the agrochemicals and have a better crop harvesting?
10. What support or resources do you believe would be most helpful in transitioning towards safer and more sustainable agricultural practices?

For the Organic Farmers

1. What are the advantages that you experience in the use of organic materials for farming?
2. Have you ever tried any synthetic chemical for increasing productivity or for pest control?

3. If yes for the above question, what are the main positive and negative impacts in the production that you feel, with the use of synthetic chemicals compared to biopesticides and biofertilizers on your farm?
4. What are the main reasons for you to be an organic farmer?
5. What are the main organic materials/ biofertilizer and biopesticides that you use in your farm?
6. Are you satisfied with the production level on your farm with organic farming?
7. What are the main challenges that you experience in organic farming?
8. Do you believe that we can have enough productivity to satisfy the hunger of this increasing population with the use of traditional organic farming?
9. From your perspective, what are the support and help that you need from the policy makers and other organisations to increase the productivity, by using the organic materials in agriculture?
10. Have you experienced any economic problems in agriculture by using only biological materials in farming?

HARVESTING DILEMMA: ETHICAL CONSIDERATION IN THE USE OF AGROCHEMICALS

A Dissertation Report for

PHI - 651 Dissertation

16 Credits

Submitted in partial fulfilment of Master's Degree

MASTER OF ARTS IN PHILOSOPHY

by

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2024

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DECLARATION BY STUDENT

I hereby declare that the data presented in this Dissertation report entitled **Harvesting Dilemma: Ethical Consideration in the Use of Agrochemicals** is based on the results of investigations carried out by me in the Discipline of Philosophy at the School of Sanskrit Philosophy and Indic Studies, Goa University under the Supervision of Ms. Rajavi Damodar Naik, Assistant Professor, and the same has not been submitted elsewhere for the award of a degree or diploma by me. Further, I understand that Goa University or its authorities will not be responsible for the correctness of observations / experimental or other findings given the dissertation.

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COMPLETION CERTIFICATE

This is to certify that the dissertation report Harvesting Dilemma: Ethical Consideration In The Use Of Agrochemicals is a bonafide work carried out by Binesh A R under my supervision in partial fulfilment of the requirements for the award of the degree of Master of Arts in Philosophy in the Discipline of Philosophy at the School of Sanskrit Philosophy and Indic Studies, Goa University.

Ms. Rajavi Naik

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Signature of Dean of the School

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