UNIVERSITY OF AGRICULTURAL SCIENCES COLLEGE OF AGRICULTURE, GKVK, BENGALURU-560065 DEPARTMENT OF AGRICULTURAL EXTENSION

SEMINAR REPORT ON

Pesticides and fertilizers pollution in Agriculture

Submitted to:

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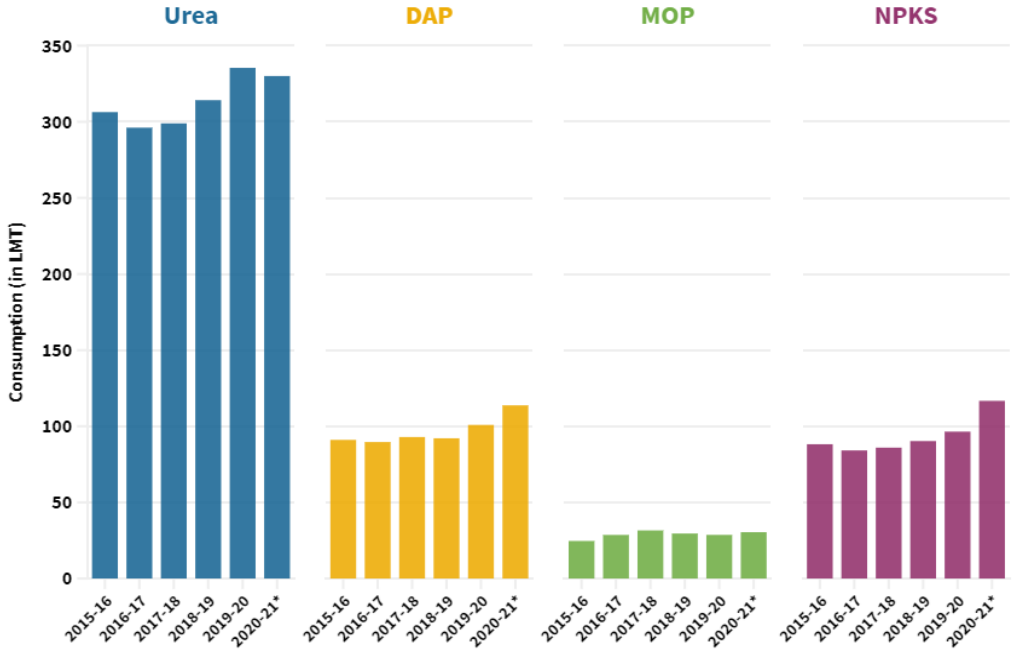
Introduction

- Agriculture is an important practice to sustain the life-support systems of human civilizations since ancient times.
- Modern agriculture has included several innovative ideas to enhance crop production and productivity, such as application of chemical fertilizers and pesticides etc., in farming sector.
- Addition of chemical fertilizer and pesticides has become the fundamental part of today's agricultural systems to fulfill the huge demand of food grains of the whole world.
- However, excessive application of agro-chemicals (fertilizers and plant protection chemicals) is deteriorating the quality of soil as well as the groundwater due to the addition of nitrogen, phosphorous, and persistent pesticides.
- Recent data indicates that the consumption of chemical fertilizers in the country has increased by around 16 per cent from 2015-2016 (510LMT) to 2020-2021 (590MLT) (Anonymous 2021)
- There is also an increase in the consumption of the pesticides by 8.78 per cent from 2015-16 (56,720 Mt) to 2019-2020 (61,702 MT) (https://news.agropages.com).

Trend in Consumption of Chemical Fertilizers in India

(2015-16 to 2020-21*)



Source: Rajya Sabha
*2020-21 is up to February 2021

FACTLY

The sector –wise production urea, dap and complex fertilizer during 2020-2021 and estimated production during 2021-22

S. No	Sector	2020-21			2021-22 (Estimated)		
		Urea	DAP	Complex fertilizers	Urea	DAP	Complex fertilizers
1.	Public Sector	66.63		14.54	64.88		14.37
2.	Cooperative Sector	69.98	19.24	23.48	67.62	22.87	20.95
3.	Private Sector	109.42	18.50	55.19	131.24	16.81	58.42
Total		246.03	37.74	93.21	263.74	39.68	93.74

- Haryana, Punjab, Uttar Pradesh, Uttarakhand, Andhra Pradesh and Tamil Nadu are the major fertilizer consuming states in India.
- Punjab alone consumes about 9 % of total fertilizers in India.
- Comparing the per hectare consumption Punjab (184 kg), Haryana (167 kg), Andhra Pradesh (138 kg), Uttarakhand (127 kg) and west Bengal (122 kg).

Source: Anonymous 2021

Consumption trend in chemical pesticides

(Quantity in tonnes, technical grade)

States	2015-16	2016-17	2017-18	2018-19	2019-20
Maharashtra	11,655	13,496	15,568	11,746	12,783
Uttar Pradesh	10,457	10,614	10,824	11,049	12,345
Punjab	5,743	5,843	5,835	5,543	4,930
Telangana	993	3,436	4,866	4,894	4,915
Haryana	4,100	4,050	4,025	4,015	4,200
West Bengal	3,712	2,624	2,982	3,190	3,630
Rajasthan	2,475	2,269	2,307	2,290	2,095
Tamil Nadu	2,096	2,092	1,929	1,901	1,895
Gujarat	1,980	1,713	1,692	1,608	1,784
Karnataka	1,434	1,288	1,502	1,524	1,608
Andhra Pradesh	2,713	2,015	1,738	1,689	1,579
Chhattisgarh	1,625	1,660	1,685	1,770	1,488
Bihar	831	790	840	850	995
Madhya Pradesh	732	694	502	540	563
Kerala	1,123	895	1067	995	459
North Eastern States	544	684	617	657	819
All India*	**56,720**	**58,634**	**63,406**	**59,670**	**60,599**

*Includes other States, UTs

Source: Agri Ministry

- Maharashtra tops the list in the consumption of pesticides.
- When we see through per hectare consumption Punjab (0.74 kg) is in first place followed by Haryana (0.62 kg) and Maharashtra (0.57 kg).

Source: Ministry of Agriculture and Farmers welfare

In this backdrop, the present study has been conceptualized with the following objectives:

1. To understand the concept of pollution, pesticides and fertilizers pollution
2. To know the effects of pesticides and fertilizers pollution
3. To review the related research studies

Concept of pollution, and pesticides and fertilizers pollution

POLLUTION

Pollution is the introduction of contaminants into the natural environment that cause adverse change. (https://www.nationalgeographic.org).

Types of pollution

- Air pollution
- Water pollution
- Land pollution
- Noise pollution

DEFINITION

- Air pollution: Air pollution is the contamination of air due to the presence of substances in the atmosphere that are harmful to the health of humans and other living beings, or cause damage to the climate or to materials.
- Water pollution: Water pollution is the contamination of water sources by substances which make the water unusable for drinking, cooking, cleaning, swimming, and other activities.
- Land pollution: Land pollution is the degradation of land surfaces often caused by human activities and their misuse of land resources.
- Noise pollution: Noise pollution is considered to be any unwanted or disturbing sound that affects the health and well-being of humans and other organisms.

PESTICIDE POLLUTION

- Pesticide pollution refers to the pollution due to the usage of pesticide on human health and environment
- Pesticides are organic and inorganic chemicals originally invented and first used to better the human environment by controlling undesirable life forms such as bacteria, pest and foraging insects
- They are normally applied to private gardens, agricultural land, and other public areas to kill undesirable organisms.

FERTILIZER POLLUTION

Fertilizer pollution refers to the contamination by excessive inputs of nutrients. (https://en.wikipedia.org)

It is a primary cause of eutrophication of surface waters (lakes, rivers and coastal waters), in which excess nutrients, usually nitrogen or phosphorus, stimulate algal growth.

High application rates of nitrogen-containing fertilizers combined with the high water-solubility of nitrate leads to increased runoff into surface water as well as leaching into groundwater, thereby causing groundwater pollution.

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FERTILIZER

- A fertilizer is any material of natural or synthetic origin that is applied to soil or to plant tissues to supply one or more plant nutrients essential to the growth of plants. (https://en.wikipedia.org).

Types of fertilizer

- Natural fertilizers
- Artificial or chemical fertilizers

Effects of fertilizers and pesticides

Decrease in crop yields

The positive effect of these substances only lasts for a certain time since the soil is likely to suffer from an excessive use of these chemical fertilizers resulting in low crop yield.

Soil pollution

- Amendment of soil with fertilizers and pesticides strongly influences a range of soil functions and properties like soil organic carbon, pH, moisture, activities of soil enzymes and many others.
- The over-use of chemical fertilizers can lead to soil acidification and soil crust thereby reducing organic matter content, humus content, beneficial organisms, stunting plant growth, can change the soil pH, increase pests, and even contribute to the release of greenhouse gases
- Nitrogen applied to fields in large amounts destroys the balance between the three macronutrients, N, P and K over time which would result in lack of micronutrients; it also damages topsoil, resulting in reduced crop yields. Sandy soils are much more prone to soil acidification than are clay soils.

- Repeated applications of chemical fertilizer may result in a toxic buildup of heavy metals such as arsenic, cadmium, and uranium in the soil. These toxic heavy metals not only pollute the soil but also get accumulated in food grains, fruits and vegetables.
- Fertilizer application without the using soil testing recommendation can lead to implications such as soil degradation, nutrient imbalance, destruction of soil structure, increasing bulk density.

- Fertilizers, more than the recommended amounts causes formation, accumulation and concentration of mineral salts of fertilizers which leads to compaction layer and soil degradation in the long-term.

Effect on soil fertility

- Heavy treatment of soil with pesticides can cause populations of beneficial soil microorganisms to decline.
- According to the soil scientist Dr. Elaine Ingham, “If we lose both bacteria and fungi, then the soil degrades.
- Overuse of chemical fertilizers and pesticides have effects on the soil organisms that are similar to human overuse of antibiotics.
- Indiscriminate use of chemicals might work for a few years, but after awhile, there aren't enough beneficial soil organisms to hold onto the nutrients” (Savonen, 1997).

Destruction of biodiversity

- Excessive use of agro chemicals lead to habitat loss and climate change.
- They can have short-term toxic effects on directly exposed organisms, and long-term effects could result from changes to habitats and the food chain.

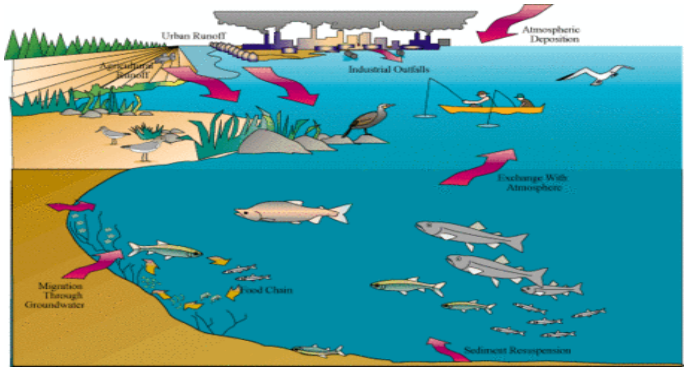
Air Pollution

- High application rates of chemical fertilizer and pesticides for enhancing crop production is generating numerous harmful greenhouse gases, depleting the protective ozone layer hence exposing the humans to harmful ultraviolet rays.
- Nitrogen fertilizer whose excess use results in an emission of nitrogen oxides (NO, N2O, NO2) is responsible for severe air pollution [24] . Other gases also responsible for the ozone depletion are water vapour, carbon dioxide, methane, hydrogen sulphide and chloro-fluoro hydrocarbons.

Water pollution

- Pesticides can reach surface water through runoff from treated plants and soil. Contamination of water by pesticides is widespread.
- The results of a comprehensive set of studies done by the U.S. Geological Survey (USGS) on major river basins across the country in the early to mid- 90s yielded startling results.
- More than 90 percent of water and fish samples from all streams contained one, or more often, several pesticides (Kole *et al*; 2001).
- Pesticides were found in all samples from major rivers with mixed agricultural and urban land use influences and 99 percent of samples of urban streams (Bortleson and Davis, 1987-1995).

- Nitrogen-based fertilizers produce potent greenhouse gases and can overload waterways with dangerous pollutants.
- Chemical pesticides with varying toxicological effects can contaminate the air and water or reside directly on food.
- As the nutrient use efficiency of the chemical fertilizer is very less hence these are applied in quantities much more actually required and when these are applied in unfavorable environmental condition then these get lost in the environment by different ways.
- These can be leaching, drainage or surface flow, for example, in most cultivated upland soils, mineral N is likely to be oxidized to nitrate due to microbial activity.
- As a result, relatively high fractions of the applied N may potentially be leached or removed from the root zone into the surface and groundwater.

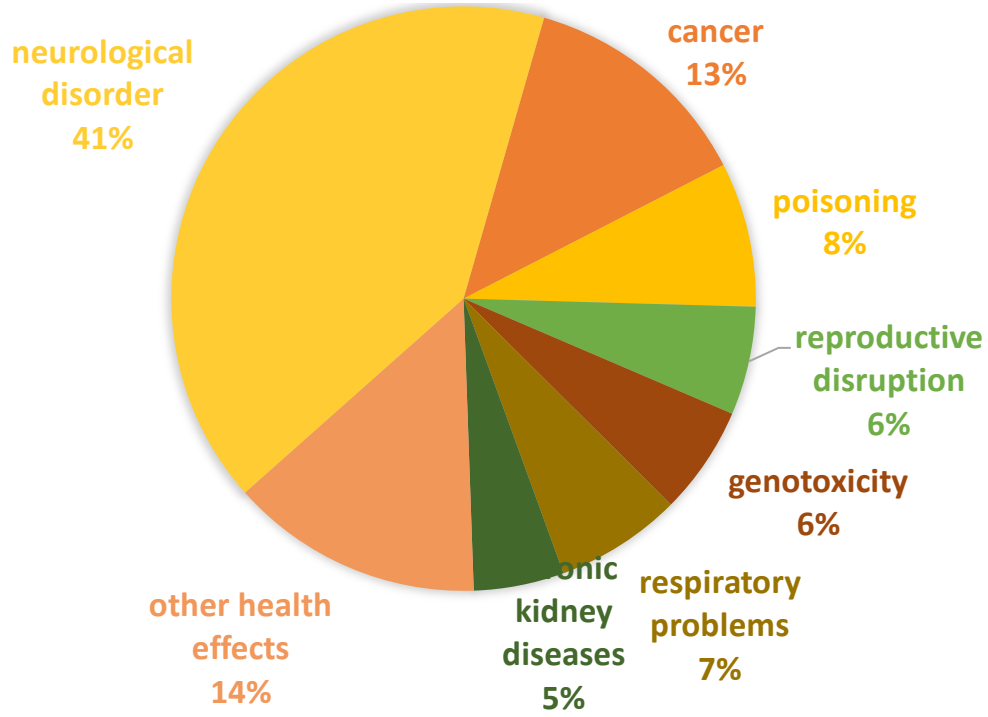


- Even when these chemicals are applied in ideal conditions, plants use only up to 50% of the N fertilizer applied, 2-20% gets volatilized, 15-25% reacts with organic compounds in the clay soil and the remaining 2-10% interfere surface and groundwater.

- One of the most important parameters of the pollution of water is nitrate which is the basic component of fertilizer.
- Nitrate is the most common form of dissolved nitrogen present in groundwater or other water bodies.

Human health

- Pesticides poisoning is directly responsible for the death of at least 10,000 people every year in India.
- There is higher incidence of breast cancer among women residing in the Gangetic plain. Exposure of children to toxins will lead to various developmental problems including impaired cognitive functions.
- In October 2017, about 40 farmers died and more than 700 were hospitalized in Maharashtra due to pesticide poisoning.
- This is the same pesticides (Monocrotophos) chemical that was responsible for the death of 23 children who consumed the toxic mid-day meal in Bihar during 2013.



Source: https://byjus.com

Impact on environment

- Pesticides can contaminate soil, water, turf, and other vegetation.
- In addition to killing insects or weeds, pesticides can be toxic to a host of other organisms including birds, fish, beneficial insects, and non-target plants.
- Insecticides are generally the most acutely toxic class of pesticides, but herbicides can also pose risks to non-target organisms.

Effects on animals

- The chemicals not only can kill wild animals, but can also disrupt hormones in animals, affecting behavior and the ability to reproduce.
- Some persistent pesticides can build up in the bodies of animals, including humans.
- The natural enemies of pest insects can also be killed by pesticides.

Other Alternatives Besides Using the Chemical Fertilizers

- Excessive use of the chemical fertilizer for a long time on the same soil may lead to soil degradation and loss of beneficial soil microorganisms.
- Therefore, to ensure both the enhanced and sustainable agricultural production and to safeguard the environment integrated use of different types of nutrient suppliant such as organic manures, biofertilizers and other slow released or controlled released chemical fertilizers should optimum.

- The use of organic fertilizers together with chemical fertilizers, compared to the addition of organic fertilizers alone, had a higher positive effect on microbial biomass and hence soil health.

Biofertilizer

- Biofertilizer is defined as a substance which contains living micro-organisms and is known to help with the expansion of the root system and better seed germination. A healthy plant usually has a healthy rhizosphere which should be dominated by beneficial microbes.
- Biofertilizers differ from chemical and organic fertilizers in the sense that they do not directly supply any nutrients to crops and are cultures of special bacteria and fungi.
- The production technology for biofertilizers is relatively simple and installation cost is very low compared to chemical fertilizer plants.

Slow-Release Fertilizers

- Slow release fertilizers involves the release of the nutrient in a slower manner than common fertilizers. However, the rate, pattern, and duration of release are well controlled.
- Different types of slow or controlled release fertilizers are:

1. Organic-N Low-Solubility Compounds for e.g. Urea-formaldehyde

2. Fertilizers in Which a Physical Barrier Controls the Release for e.g., the coated fertilizers coated with organic polymer coatings that are either thermoplastic or resins and fertilizers coated with inorganic materials such as sulfur- or mineral-based coatings etc.
3. Inorganic Low-Solubility Compounds: Fertilizers such as metal ammonium phosphates and partially acidulated phosphates rock.

Nano fertilizers

- Nano fertilizers are synthesized or modified form of traditional fertilizers, fertilizers bulk materials or extracted from different vegetative or reproductive parts of the plant by different chemical, physical, mechanical or biological methods with the help of nanotechnology used to improve soil fertility, productivity and quality of agricultural produce.
- Nanoparticles can be made from fully bulk materials.

Application Efficiency

Application of any fertilizer should be done at an economic rate other than optimum rate. Also application from right source, rate, placement & time will reduce the adverse effect on both the crop and the environment.

Various techniques that maintain and enrich the soil fertility & the soil humus content should be used like using compost, manure, agro-forestry, green manure, mulch manure etc.

Other Alternatives Besides Using the pesticides

Cultural Control

- Cultural control is the deliberate alteration of the production system by targeting the pest itself through agronomic practices to avoid or reduce pest injuries to crops.
- These methods are utilized most frequently to control pest related issues.
- Crop rotation, intercropping, sanitation, trap crops and pest resistant crop plants are few examples of cultural control.
- These individual tactics of cultural control tend to be pest and crop specific.

Physical and Mechanical Control

Physical and mechanical controls either kill insects and small rodents, or make the environment unsuitable for them by attacking, or setting up barriers. These methods are used for crop growing and household pest management.

The Biological Alternatives

Biological alternatives can be used as a replacement of chemical pesticides to leave the ecosystem undisturbed. Biological alternative options can be broadly classified as: (a) Biological Control, (b) Biopesticides, (c) Semi chemicals, and (d) Transgenic Organisms.

Biological control, also known as biocontrol, is the use of natural enemies (predators, parasitoids, insects or other arthropod species) to reduce the damage caused by pests.

Biopesticides, also known as biological control, are based on pathogenic microorganisms or natural products which usually kill pests.

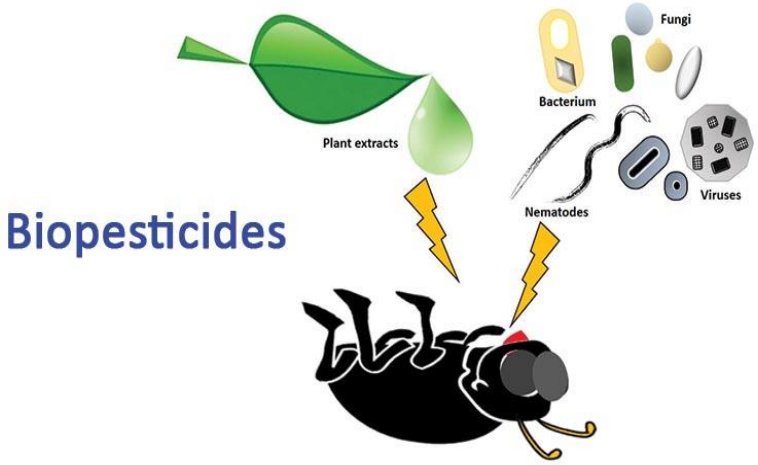
- The term biopesticide may also be used, more widely, to describe the application of biological agents, pathogens, predators, or parasitoids. In addition, botanicals, semi chemicals and transgenic plants sometimes be described as biopesticides.

- Biological Control

Biological control involves the suppression of reproductive organisms through the actions of parasites, predators, or pathogens to restrict pest population at a lower average density.

- Biopesticides

Biopesticides are certain types of pesticides derived from natural materials such as animals, plants, bacteria, and certain minerals. For example, canola oil and baking soda have pesticidal applications and are considered as biopesticides.



- Transgenic Organisms

Genes of one species can be modified or can be transplanted to another species. Organisms that have altered genomes are known as transgenic. Genetic modification with recombinant DNA techniques is the newest way of generating pest resistant plants.

The most successful commercial transgenic crops resistant to insects include cotton, maize and potato.

The most successful commercial transgenic crops resistant to insects include cotton, maize and potato.

These crops possess transgenes from the insecticidal bacterium Bacillus thuringiensis (Bt) and herbicide-resistant soybea

Case study/research study

1.Overdose of fertilisers threat to soil health- Article in Hindusthan Times

Ranbir Singh Brar (2013)

Report says that most farmers apply fertilizers on their own without getting their soil tested to compete with other farmers or on the advice of input dealers, who have vested interests.

Instead of going by expert recommendation, they increase the dosage of these fertilizers to get more yield and allegedly apply unnecessary supplements on the advice of shopkeepers.

The excessive dosage of fertilizers is a threat to soil health and environment, says Charanjeet Singh Pooni, a farmer from Chaina village of Joura district in Madhya Pradesh, who practice natural farming.

- Against an application of 110 kg of urea, many farmers apply up to 150 kg of urea to paddy. As far as the phosphorus fertilizer is concerned, the farmers have been ignoring the recommendations of Punjab Agricultural University.
- According to the recommendations, if the DAP fertilizer has been applied to rabi crops before the sowing of wheat, it is not required for the paddy and cotton crops. But farmers can be seen applying up to two bags of the fertilizer to BT cotton, says Pooni.
- "It is spoiling the soil health as well as environment. Private companies have been running a campaign to sell their products.
- The farmers are not educated to understand them and such companies succeed in selling their products to the farmers. Instead of selling recommended fertilisers, selling sub-standard supplements is a profitable business for sellers too,"

2. The Impact of Pesticides on Farmer's Health: A Case Study of Fruit Bowl of Himachal Pradesh

Shanta Kumari *et al.*, (2014)

Methodology

- The study was based on the primary survey of farmers of Kullu and Theog districts of Himachal Pradesh.
- One hundred farmers were interviewed in each district, using pretested questionnaire.
- Total sample consisted of 200 farmers.

Table 1: Pesticide poisoning: symptoms of pesticides

Symptoms	Per cent of respondents (n=200)	
	Kullu district	Theog district
Eye irritation	86.00	77.50
Headache	59.00	77.00
Dizziness	22.00	9.00
Vomit	56.00	41.00
Back pain	59.00	77.50
Skin irritation	66.00	41.00
Eye flu	1.00	31.00
Fatigue	81.00	77.30

3. Effects of Chemical Fertilizers and Pesticides on Human Health and Environment: A Review

Sharma *et al.*, (2017)

Effects of Chemical Fertilizers and Pesticides on Human Health

- The study was conducted in Bhopal, Madhya Pradesh
- Sixty farmers who sprayed pesticides to the crop were interviewed
- The farmers reported maximum acute signs and symptoms like burning/stinging of eyes (18.42%), blurred vision (23.68%), skin redness/itching (50%), excessive

sweating/shortness of breath (34.2%), dry sore throat (21.05%) and burning of nose (28.90%).

- There is need for creating more awareness among the farmers regarding the handling of pesticides.

4. The Impact of Chemical Fertilizers on Our Environment and Ecosystem

Chandini et al., (2019)

Impact of Chemical Fertilizers on Natural Resources

Chemical fertilizers leads to several problems like:

- Environment pollution (soil, water, air pollution),
- Reduced input efficiency,
- Decreased food quality,
- Resistance development in different weeds, diseases, insects, soil degradation, micronutrient deficiency in soil, toxicity to different beneficial living organism present above and below the soil surface, less income from the production, etc.
- Despite these many problems, there is also a challenge to meet the food demands of the world's growing population.

5. An Agricultural Pollutant: Chemical Fertilizer

Serpil Savci (2019)

EFFECTS OF CHEMICAL FERTILIZERS ON WATER POLLUTION

- Even in ideal conditions, Plants use 50% of nitrogenous fertilizers applied to soil, 2-20% is lost through evaporation, 15-25% reacts to organic compounds in the clay soil and the remaining 2- 10% leeches into surface and ground water

- Majority of nitrogenous fertilizers aren't absorbed products and they interfere with both underground and surface water. Groundwater nitrate problem should be considered in a global context.

6. Fertilizers and Pesticides: Their Impact on Soil Health and Environment

Impacts of Chemical Fertilizers and Pesticides

- The over usage of fertilizers and pesticides is imposing possible risks and adverse effects on the soil health, crop productivity, environment, and human health.

- The chemical fertilizers are rich in N, P, K which are highly water soluble and change biochemical properties including organic carbon content, nitrogen content, pH, moisture etc
- The disproportionate use of fertilizers causes chemical burns to crops.
- The use of synthetic chemical fertilizers leads to imperfectly synthesized protein in leaves, which is responsible for poor crops and in turn for pathological conditions in humans and animals fed with such deficient food.

7.Global pesticide consumption and pollution: with China as a focus

Zhang *et al.*, (2021)

Table 2: Age distribution and causes of human pesticide poisonings during 1997 and 2003

Age	Total		
	Cases	Deaths	%
0-15	6291	244	3.88
15-35	47447	2641	5.57
35-60	43710	2823	6.46
60-65	3951	435	11.01
65-70	2633	435	14.81
70-100	4322	903	20.89
Unknown	18	01	5.56
Total	108372	7437	6.86

CONCLUSION

- Greater use of modern inputs like chemical fertilizers and plant protection chemicals does not necessarily result in increased soil fertility and crop productivity.
- The adverse effects of the synthetic chemicals on human health and the environment can be reduced or eliminated by adopting agricultural practices such as use of organic inputs (manure, bio-fertilizers, bio-pesticides, slow-release fertilizers and nano fertilizers etc.) and moving away from chemical intensive cultivation.
- Therefore, the extension agency should motivate the farmers to adopt the integrated pest and nutrient management practices in agriculture to avoid the ill effects of fertilizers and pesticides on soil and human health.

Discussion

1Q. What are the other alternatives besides using chemical fertilizer and pesticides?

Ans: Biofertilizer, biochemical and biopesticides

2Q. How can help KVK to farmers besides using chemical fertilizer and pesticides?

Ans: training provided by DESI programme

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Name	:	Shivanandagowda G R	Venue	:	Dwarakinath Hall
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Seminar-II

Pesticides and fertilizers pollution in Agriculture

Synopsis

Modern agriculture has included several innovative ideas to enhance the crop production and productivity in the farming sector. Of which, application of chemical fertilizer and pesticides has become the integral part of today's agricultural systems to fulfill the huge demand of food grains of the whole world. However, excessive application of agro-chemicals (fertilizers and plant protection chemicals) is deteriorating the quality of soil as well as groundwater due to the addition of nitrogen, phosphorous, persistent pesticides, *etc*.

Recent data indicates that the application of chemical fertilizers in the country has increased by around 16 per cent from 2015-2016 (510LMT) to 2020-2021 (590MLT) (Anonymous 2021) and also there is an increase in the application of the pesticides by 8.78 per cent from 2015-16 (56,720 Mt) to 2019-2020 (61,702 MT) (https://news.agropages.com). There is a need for balanced use of fertilizers and minimising the usage of pesticide for

restoring and improving the environmental situations. In this backdrop, the present study has been conceptualized with the following objectives:

1. To understand the concept of pollution, and pesticides and fertilizers pollution
2. To know the effects of pesticides and fertilizers pollution
3. To review the related research studies

Concept of pollution, and pesticides and fertilizers pollution

Pollution is the introduction of contaminants into the natural environment that causes adverse physical, chemical and biological changes (https://www.nationalgeographic.org).

Pesticide pollution refers to the pollution due to the usage of pesticide on human health and environment. Where as, fertilizer pollution refers to the contamination by excessive inputs of nutrients (https://www.environmentalpollutioncenters.org).

Effects of fertilizers and pesticides

The major effects of fertilizers and pesticides includes: (1) decrease in crop yields, (2) soil pollution, (3) destruction of biodiversity, (4) water pollution, and (5) effects on human and animal health.

Reviews related to research studies:

Ragbir Singh Brar (2013) reported that most farmers apply fertilizers on their own without getting their soil tested to compete with other farmers or on the advice of input dealers, who have vested interests. Instead of going by expert recommendation, they increase the dosage of these fertilizers to get more yield and allegedly apply unnecessary supplements on the advice of shopkeepers. The excessive dosage of fertilizers is a threat to soil health and environment, says Charanjeet Singh Pooni, a farmer from Chaina village of Joura district in Madhya Pradesh, who practice natural farming.

Shanta Kumari *et al., (*2014) revealed that in Kullu district of Himanchal Pradesh, most of farmers revealed that they had experienced eye irritation (86.00%) followed by 81.00 per cent, who reportedly experienced fatigue, 66.00 per cent skin irritation, 59.00 per cent head ache and back pain, 56.00 per cent vomiting, 22.00 per cent dizziness and one per cent eye discharge caused by pesticide exposure. In Theog district, 77.50 per cent of the respondents reported eye irritation and back pain, 77.30 per cent fatigue, 77.00 per cent headache, 41.00 per cent vomiting and skin irritation, 31.00 per cent eye flu and nine per cent dizziness.

Chandini *et al.,* (2019) reported that the World agricultural systems is using excessive chemicals, such a fertilizers and pesticides to achieve more production per unit area, but using more doses than optimum or recommended dose of these chemicals and fertilizers leads to several problems like environment pollution (soil, water and air pollution), reduced input efficiency, decreased food quality, resistance development in different weeds, diseases, insects, soil degradation, micronutrient deficiency in soil, toxicity to different beneficial living organism present above and below the soil surface, less income from the production, etc.

Pooja Baweja *et al.,* (2020) reported that chemical fertilizers and pesticides are used to improve the growth of plants and increase the yields of fruits and vegetables in relatively

shorter period. The over usage of fertilizers and pesticides is imposing possible risks and adverse effects on the soil health, crop productivity, environment, and human health.

Conclusion

Greater use of modern inputs like chemical fertilizers and plant protection chemicals does not necessarily result in increased soil fertility and crop productivity. The adverse effects of the synthetic chemicals on human health and the environment can be reduced or eliminated by adopting agricultural practices such as use of organic inputs (manure, bio-fertilizers, bio-pesticides, slow-release fertilizers, nano fertilizers etc.) and moving away from chemical intensive cultivation. Therefore, the extension agency should motivate the farmers to adopt the integrated pest and nutrient management practices in agriculture to avoid the ill effects of fertilizers and pesticides on soil and human health.

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