

An Empirical Study on Farmer's Perception Towards the Use and Impact of Chemical Fertilizers in Sahanpur Village, Safidon In Jind District of Haryana

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ABSTRACT

Being an agro-based and growing country, India has a rise in demand for food supply. Owing to the responsibility of supplying food for the nation, farmers use chemical fertilizers in agricultural practices. A survey was conducted in Sahanpur village to find out the hazardous impact of chemical fertilizers applied in agriculture. The study reveals types of fertilizers used, knowledge of farmers on the application of fertilizers also their perceptions on the Chemical fertilizers impact on water and soil suitability and on human health. 130 farmers were surveyed and findings revealed that 8.0% believed that excessive use of fertilizers damages crop, 13.0% reduction in soil suitability, 15.3% believes it toxic, and 11.2% perceived reduction in water suitability, 17.2% believe it has short term benefits. 21.2% perceived that fertilizers harm human health and 14.4% believed that they pollute the groundwater. Farmers use fertilizers such as UREA, DAP, NPK, Zinc/ sulfur, manure, and MOP.

Key words: Agriculture, Chemical fertilizers, Farmer's perception, Environment, Water suitability, Soil suitability.

Introduction

The growing human population increased the amount of food available, which put pressure on the agriculture industry. Chemical fertilizers are used in agriculture to increase productivity and meet the growing demand for food from the population. Chemical fertilizers are used by farmers in Sahanpur village to boost yields, however the soil and water quality became less suitable for irrigation as a result of these chemicals. It simultaneously reduces soil fertility, which causes a decline in agricultural land. It negatively affects people's health as well. Despite being fully aware of the negative effects of chemical fertilizers, the residents of the

study area continue to use them in their fields in an effort to boost crop yield and raise profits. The adverse effect of these fertilizers can be only reduced or eliminated by giving a training session to the farmers and learning new agricultural technological practices such as the use of organic fertilizers like manure and bio-fertilizers which will improve the soil suitability and have no impact on water suitability for irrigation. A healthy environment will be provided for present and future generations by adopting the organic farming. Therefore, it is important to inform farmers about sustainable farming methods.

India is an agro-based country accounting for the livelihood of about 58% of the Indian population and it is estimated that directly or indirectly about

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48.9% of its population depends on agriculture to obtain their income (Economic Survey of India, 2018). In the 1960s, the green revolution was started which boosted Indian Agriculture. It was a transformed way to increase food production so that the food demands for the booming population of India could be fulfilled. By adopting modern tools, methods, and techniques of agriculture like- high-yield variety seeds, and more advanced irrigation systems this journey started strong. This resulted in the dependency of modern agriculture on fertilizers. As the population increases it is directly correlated with the increase in demand for food supply, provided by agriculture. The current situation presents a realistic example of the Malthusian Theory which states that as the population increases the demand for food supply is also increasing. In the coming years, the use of chemical fertilizers, insecticides, and pesticide is increased to fulfil the food demand. These chemical fertilizers have both negative and positive impacts on the environment and human health. Farmers use these chemical fertilizers to increase crop yield and production.

Pesticides play an important role in reducing diseases and increasing crop yields but the inappropriate use of pesticides and their mismanagement leads to harmful impacts on humans and the environment. It is necessary to control the overuse of pesticides and their negative impact on the environment, human health, and non-target organisms (Tudi *et al.*, 2021). While fertilizing soil and plants, farmers are exposed to chemical fertilizers. As a result, they may potentially experience health impacts from exposure to chemical fertilizers, such as coughing, chest tightness, skin irritation, rashes, and contact dermatitis (Pecegheiro, 1990; Pasricha and Gupta, 1983). The consumption of fertilizers increased exponentially across the world and it causes serious environmental issues. Fertilizers can enter the food chain when a plant absorbs them through the soil and fertilizers can affect heavy metal build-up in the plant and soil system. As a result, it pollutes water, soil, and air pollution. That's why in the soil before applying the fertilizers, soil analysis should be performed carefully (Savci, 2012). A general understanding of agricultural chemicals and their harmful effects on the environment was studied. The study was conducted in Nepal and it has been determined that these agrochemicals cause serious risks and that certain pesticides may harm human immune, and endocrine systems, also increase the risk of causing cancer, and

may negatively affect a child's brain development (Bhandari, 2014). Panin *et al.* (2019) worked on the impact of the overuse of fertilizers on the environment in Serbia. It was found that 79.79% of farmers use chemical fertilizers and mostly use fertilizers such as – *KAN, AN, Urea, and NPK 15:15:15* and 66.6% of farmers do not know the harmful pollution effects of nitrates on soil and water and are unaware of its harmful impact. It is important to investigate the farmer's awareness of pesticide residues and their behaviour regarding pesticide application to reduce human factors that negatively affect agricultural safety (Hou and Wu, 2010). The use of fertilizers increased by 30% per hectare from 2002-2017. The increment in the nutrient percentage was about 24% for nitrogen, 25% for P_2O_5 , and 53% for K_2O . The excessive use of chemical fertilizers has a bad impact on Soil health and Crop growth (Iqbal *et al.*, 2020). Bhat and Ramaswamy (1993) revealed that exposure to chemical fertilizers reduced lung functions. Zhang *et al.* (2002) discussed that exposure to chemical fertilizers increased the risk of respiratory symptoms. About 982 km³ of groundwater is withdrawn globally each year. Nearly 70% of this is used for irrigation. India, China, and the United States are the three main nations that rely heavily on groundwater extraction. In India, irrigation uses up to 90% of the groundwater that is extracted, or 251 km³/yr. (Margat and Gun, 2013).

Chemical Fertilizers also harm soil health. Its high content of sodium and potassium has a bad impact on soil pH, affects soil structure, and contributes to acid irrigation. If liming was not done to restore the soil pH, the application of acid-forming nitrogen fertilizers over a long period reduces the effectiveness of field crops (Luo *et al.*, 2015). Massah *et al.* (2016) investigated how fertilizers affected soil compaction and deterioration. This study was done on 12 wheat farms in the Pakdasht region, which is 35 km south-east of Tehran and has an average annual precipitation of 210 mm. The findings showed that in both lightly and heavily compacted soils, bulk density changed from 1.34 to 1.80 Mg.m⁻³ and penetrating resistance from 0.89 to 3.54 MPa. In *Ismani* which is situated in Iringa, Tanzania the production of maize diminished rapidly in the 1990s, and behind this, the major reason was the acidification of soils, increasing soil pH because of the use of chemical fertilization over a long period. The soil acidity reduced the amount of nutrients that were available to plants and increased the quantity of hazardous metals.

This problem also has an impact on the existence of microorganisms like earthworms, which produce humus needed for agricultural development (Mkonda and He, 2017). Chemical fertilizers increase and strengthen the plant growth rate but the plants grown in chemical fertilizers lack healthy plant attributes such as good root structure, shoot structure, and nutritional properties. The accumulation of these chemically produced plants in the body is hazardous (Chandini *et al.*, 2019). Urea, Diammonium Phosphate (DAP), Murate of Potash (MAP), Ammonium Sulphate (AS), Single Super Phosphate (SSP), Ammonium Phosphate Sulphur (APD), and NPK are the seven fertilizer types that are used in Nepal in large quantities. 19.65 kg/ha were consumed in 2004–2005. The result was lower-quality crops (Diwakar *et al.*, 2008).

Ellis *et al.* (1978) performed lab tests to investigate how nitrogen fertilizers changed the soil. At intervals of 14 days, fresh soil was collected from a depth of 0 to 7.5 cm. The results of the laboratory tests showed that the soil's nitrification rate was twice as fast as that of other types of soil. Lungu *et al.* (2008) determined the effects of urea use over a long period on specific soil parameters. An investigation of how urea use over an extended period affects the qualities of the soil was done in the field. This study demonstrated that yearly applications of urea over an extended time caused soil acidification and reduced the amount of exchangeable bases in the soil. Agriculture depends on the water quality of irrigation as nowadays farmers use chemical fertilizers in high quantities in their fields which degrade the water quality used for irrigation. When the water suitability for irrigation decreases it affects the production of crops and also the yield. It was estimated that about 43% of the world's irrigation water is used as compared to surface water it is considered more appropriate for irrigation purposes (Siebert *et al.*, 2010). The impact of chemical fertilizers on the water quality of the Bhopal *Hathaikheda* reservoir was investigated. There was a large concentration of nitrate and phosphate in the water samples and the availability of the higher concentration of nutrients in the low water was caused by the use of chemical fertilizers such as urea, DAP, superphosphate, and so on (Namdev *et al.*, 2011). In North 24 Parganas in West Bengal farmers were using Chemical Fertilizers in agriculture to a great extent. About 70% of people use chemical fertilizers and 30% avoid chemical fertilizers for their cultivation purposes.

Because of a lack of information such as farmers do not know the soil quality and use chemical fertilizers at a high level which spoils the soil fertility. The flora, as well as fauna of this area, have been destroyed and the ecological balance has been disturbed (Roy *et al.*, 2015).

Sahanpur is a village which is located in Safidon tehsil of Jind district in Haryana, India. It is situated 4 km away from sub-district headquarters Safidon and 40 km away from district headquarter Jind. The total geographical area of the village is 432 hectares. The total population of this village is 2,274 out of which the male population is 1,199 while the female population is 1,075. There are 496 scheduled caste persons in this village out of which 237 are females and 259 are males. Out of the total population around 21.81% were scheduled castes. There are 436 houses in Sahanpur village. Agriculture is the main profession for the residents of this village.

Materials and Methods

Both Primary and Secondary source of data were used for this research. The data was collected in the month of February 2023. Primary source data generated through the criteria of the Scheduled method and door-to-door interviews were conducted to gather information and farmers' perception of the negative impact of chemical fertilizers on soil, water, environment, health, and farming land in Sahanpur village of Safidon tehsil in Haryana. The secondary data were obtained from the relevant literature. Households served as the survey's units of analysis. The data collected via random sampling focused on the perspective of farmers towards the negative impact of chemical fertilizers used in agriculture on soil, water, human health, and the environment. One hundred and twenty farmers were surveyed and interviewed for the study. The Scheduled consists of four parts including basic farmer information, crop details, farmer's perception, and knowledge. To investigate the respondent's demographic information and the various viewpoints of the farmers, descriptive data were used.

Results

One hundred and thirty (130) interviews were filled, given a response rate of 100%, the following observations were made concerning farmer's knowledge and perceptions. The results shows that farmers

were well aware about the negative impact of using chemical fertilizers in excessive amount on water, soil and on living beings but they still using it to have high yield.

Discussion

Basic information about farmers

The results show that people in Sahanpur Village have been practicing farming for over 30 years. About 70% of the households depend on agriculture as the main source of income while 30% have also other sources of income. The Kharif crop (June to November) in the study area is Rice and the Rabi crop (December to May) is Wheat. Private tube wells were the main source of water in agriculture.

Factors that has an impact on the Crop Yield

In this area, the survey revealed (Table 1) that crop yield is affected negatively by both natural and human factors. Findings showed that (40%) of respondents believed that the crop yield was affected by diseases and resulted in lower yield. Along with diseases impacting crop yield, the respondents stated that (36%) were due to natural calamities, (25%) because of unavailability of resources while (and 20%) were due to financial problems as some farmers are economically unstable due to which they cannot provide the required resources for crop production. (10%) due to lack of knowledge results in crop damage as sometimes they applied excessive amounts of Fertilizers and did not apply organic fertilizers.

Table 1. Farmer's Responses on the Factors that affect crop yield

Factors Affecting Crop Yield Negatively	Percentage
Diseases	40%
Natural Calamities	36%
Unavailability of resources	25%
Finances	20%
Lack of knowledge	10%

Farmer's Perception on the impact of Chemical Fertilizer on Environment

The study revealed that the farmers were well aware that chemical fertilizers have an impact on human health, soil, and water negatively (Table 2). Respondents (8.0%) believed that excessive use of fertilizers damages the crop as it decreases the quality of

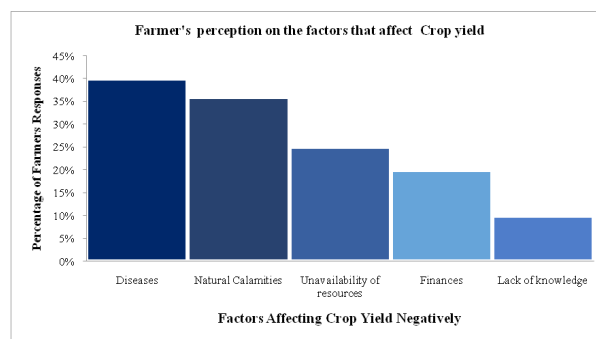


Fig. 1. Farmer's Responses to the Factors that Affect Crop Yield Negatively

crops, some (13.0%) respondents perceived a reduction in soil suitability, (15.3%) contribute to increasing toxins, and some (11.2%) perceived reduction in the water suitability, some respondents (17.2%) believed that it has short term benefits. Those (21.2%) perceived that fertilizers harm human health and (14.4%) believed that they pollute the groundwater. The soil absorbs chemical fertilizers, reducing soil suitability. The chemicals that seep in the soil pollute underground water and the soil that washes away into the village stream pollutes it. Human health is affected negatively when chemical fertilizers are used in the field and when they consume the crops grown in the soil with chemical fertilizers. This results in skin diseases, respiratory diseases, and low immunity. They believed that these fertilizers have a bad impact but by applying them they were able to have high production.

Table 2. Farmer's perception on the impact of Chemical fertilizers on the environment

Negative Impacts of Chemical Fertilizers	Percentage of Farmers Responses
Excessive use has crop Damage	8.0%
Reduction of Soil Suitability	13.0%
Increase of Toxins	15.3%
Reduction of Water Suitability	11.2%
Short Term Benefits	17.2%
Negative Impact on Human Health	21.1%
Pollute Groundwater	14.2

Farmer's knowledge of fertilizer application in Sahanpur

Farmers not received any kind of formal training (78%), and those who were trained by extension workers (22%). Compared to trained farmers, un-

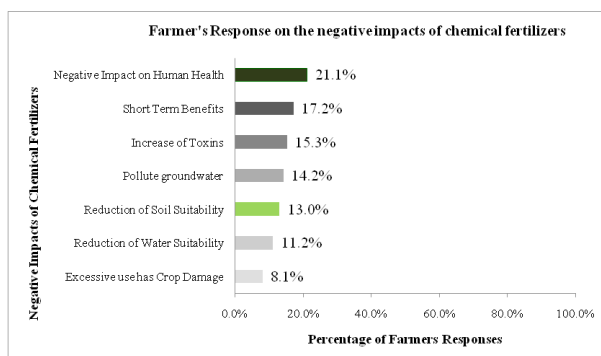


Fig. 2. Farmer's perception on the Impact of Chemical fertilizers

trained farmers were more likely to use excessive chemical fertilizers. Farmers in this village were well aware that these chemical fertilizers have short-term benefits and long-term negative impacts on the water and soil suitability.

Table 3. Types of fertilizers applied by Farmer's in study area

Types of Fertilizer	Percentage of Fertilizers Usage
MOP	2.6%
Manure	3.6%
NPK	4.4%
Zinc/Sulfur	8.2%
DAP	26.7%
UREA	54.5%

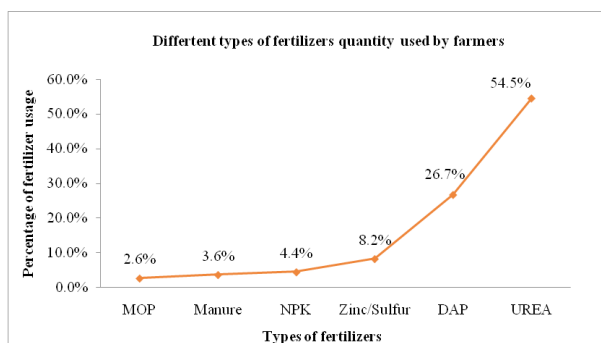


Fig. 3. Percentage of different types of fertilizer's used by Farmers

Types of Fertilizers applied in the study area

The study highlights the fact that the farmers in Sahanpur Village applied fertilizers including UREA, DAP, NPK, Zinc/sulfur, manure, and MOP (Table 3), finding revealed (26.7%) DAP (Diammonium phosphate), (8.2%) Zinc/Sulfur.

Those applied Urea fertilizer (54.5) while (4.4%) of NPK and (2.6%) MOP only (3.6%) of manure was applied in the fields to have a high yield. On an interval of 3 to 4 years, the farmers use pure organic fertilizer to restore fertility. Out of all chemical fertilizers UREA was used by all the farmers in excessive amounts as compared to other fertilizers. Besides the mentioned fertilizers, farmers use the spray in the form of pesticides to tackle crop diseases and get rid of pests. Despite being aware of the benefits of natural fertilizers, the farmers tend not to use them as they yield low amounts of crops.

Conclusion

The study concludes the awareness about the ill effects of chemical fertilizers is known to the farmers. Despite this fact, they tend to use them for higher yields and economic benefits. Alongside it leads to the tarnishing of natural resources leading to environmental degradation. Since the farmers are well aware of the harms of chemical fertilizers they hire labor to spray and apply the chemical fertilizers on the field. They do so to avoid skin and respiratory diseases. In some cases, chemical fertilizers have also become the root cause of cancer. Therefore they reduce soil and water quality and affect human health. Hence chemical fertilizers should be mixed with natural fertilizers to avoid their harmful impact. Some farmers also give their opinion that when they use organic fertilizers the crop yield was low and because of this they use chemical fertilizers. The uncontrolled application of these synthesized agricultural chemical products is affecting ecosystems and causing several health problems in both humans and other living things. Only by providing farmers with training and implementing new agricultural technological practices, such as the application of organic inputs like manure, bio-fertilizers, and slow-release fertilizers, which will improve the soil suitability and have no impact on water suitability for irrigation, can the adverse effects of these fertilizers be reduced or eliminated.

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Declaration of interest statement

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