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Examining the alarming increase in fertilizer and pesticide consumption in Punjab's agriculture

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Abstract

This study examines the use of fertilizers and pesticides in Punjab's agriculture, a state in northern India. Agriculture is an important sector of the state's economy in terms of employment and it contributes about 22 percent of the gross state domestic product (2010-11). Punjab has made significant advancements in agriculture since the introduction of modern technology in the late 1960s, becoming the nation's food basket and a major contributor to its Gross State Domestic Product. The State has about 4.2 million hectares of cultivable area. As per agricultural data of 2011-12, Punjab has the largest proportion of irrigated area (98 percent), highest cropping intensity (about 200 percent) as compared to other states of the country. However, the overreliance on chemical fertilizers and pesticides has raised serious environmental, health, and socioeconomic concerns.The state has maximum use of chemical fertilizers (246 kg/ha) than other states. Because of large-scale adoption of high-yielding and fertilizer-responsive crops the state of Punjab has increased the consumption of inputs of fertilizers and pesticides over the period of time. The study utilizes data from various statistical abstracts, Punjab Agricultural University, and the Department of Agriculture as primary sources. The analysis reveals a steady increase in the consumption of fertilizers and pesticides in Punjab. Nitrogen consumption alone witnessed significant growth, increasing from 5 kg/ha in 1960-61 to a peak of 1436 kg/ha in 2012-13. Phosphorus and potash consumption also showed an upward trend. In terms of pesticides, cereal crops had the highest consumption of both chemical and bio-pesticides, followed by vegetable crops.The findings underscore the urgent need for sustainable and responsible agricultural practices in Punjab. It is crucial to promote balanced approaches that minimize the reliance on chemical inputs and encourage the adoption of organic and environmentally friendly alternatives.

Keywords

Punjab,
Agriculture,
Fertilizers,
Pesticides

Introduction

Agriculture in the state of Punjab has advanced significantly. Since the advent of modern technology in the late 1960s, Punjab's agriculture has made impressive strides. The state's agricultural and rural economy were revolutionised by technological advancement, turning Punjab into the nation's food basket. Regarding employment and its contribution to the state's Gross State Domestic Product (2010–11), agriculture remains a significant economic sector.

The State has 4.2 million hectares of cultivable land, or 3% of the total area planted in the nation. With 12.4 percent and 6.7 percent of the total area planted with rice

and wheat, respectively, it generates around 11 percent of the country's wheat. Over the past forty years, it has provided 25–50% of the country's rice and 38–75% of the country's wheat. The state's agricultural growth has advanced significantly. According to 2011–12 agricultural data, Punjab has the highest cropping intensity (around 200 percent) and the highest percentage of irrigated land (98 percent).

Over the years, Punjab's agriculture has witnessed a significant increase in the application of fertilizers and pesticides, driven by the desire to maximize crop yields and meet the growing food demands of a rapidly expanding population. While these inputs initially offered promising results, the overreliance on chemical fertilizers and pesticides has raised serious environmental, health, and socioeconomic challenges. The state has maximum use of chemical fertilizers (246 kg/ha) than other states/UTs. But the production of food crops by maximum use of chemical fertilizers has raised many questions for natural resources especially health of the soil and nutritional value. One of the primary issues associated with the overuse of fertilizers and pesticides is the degradation of soil and water quality. Continuous and excessive application of fertilizers, especially nitrogen-based compounds, has led to soil acidification, reduced soil fertility, and imbalances in nutrient ratios. This, in turn, has adversely affected the long-term sustainability of agricultural productivity. Pesticides, when applied without adequate knowledge and precautions, contaminate soil, water bodies, and the food chain. They not only harm beneficial organisms like pollinators and natural predators but also pose health risks to farmers, farmworkers, and consumers. The high incidence of pesticide-related illnesses in agricultural communities is a grim reminder of the urgent need for change.

Study area:

Punjab is in the country of India's northwest. Geographically, the state extends between 73.55° East longitudes to 76.50° East longitudes and from 29.30° North latitudes to 32.32° North latitudes. Punjab covers a total area of 50,362 km2. The states of Jammu & Kashmir and Himachal Pradesh border the state of Punjab to the north and northeast, respectively. Rajasthan and Haryana border it on the south. The Punjab share nation's western border with Pakistan.

Objective:

To understand the use of fertilizers and pesticides in the agriculture of Punjab

Data base and methodology:

The secondary sources of data used for the proposed study were collected from several statistics abstracts of Punjab. A small number of previously completed research on this topic were evaluated in order to substantiate the facts and data. The study's primary source of data was the Punjab Agricultural University and the Department of Agriculture. The data is represented using a variety of statistical diagrams.

Results and Discussion

The agricultural sector plays a vital role in the economy of Punjab, a state in northern India known as the "Granary of India." Punjab has long been recognized as a major contributor to the country's food production, particularly in the cultivation of wheat and rice. However, this agricultural success has come at a cost, as the excessive and indiscriminate use of fertilizers and pesticides has become a pressing concern. In India, the use of pesticides and fertilisers in agriculture is highly common. To increase agricultural output, fertilizers and insecticides must be timely and readily available. The use of fertilisers and pesticides further accelerated the green revolution's surge in food crop output. The state of Punjab has gradually expanded its usage of fertiliser and pesticide inputs due to the widespread adoption of high-yielding and fertilizer-responsive crops. Fertiliser usage in the state of Punjab increased from 37.50 (kg/ha) in 1970–1971 to 239 (kg/ha) in 2012–2013 (provisional).The state's net planted area was enlarged to support agriculture output, and farm chemicals were used extensively to support the development of food crops. The extensive use of pesticides to control pests, diseases, and weeds has had unintended consequences. Addressing the issue of overuse of fertilizers and pesticides in Punjab's agriculture is crucial not only for the long-term viability of the state's farming sector but also for the overall environmental and human well-being.

Table-1 Punjab: Use of Fertilizers, 1960-61 to2011-2012

Year	Nitrogen N	Phosphorus P	Potash K	Total	Consumption (kg/ha)
1960-61	5	…	…	5	…
1970-71	175	31	7	213	37.50
1980-81	526	207	29	762	112.50
1990-91	877	328	15	1220	162.60
1995-96	1020	227	16	1263	166.31
2000-01	1008	282	23	1313	168.33
2005-06	1255	369	63	1687	214
2006-07	1299	354	38	1691	215
2007-08	1317	341	37	1695	213
2008-09	1332	379	55	1766	223
2009-10	1348	383	56	1787	226
2010-11	1403	435	73	1911	243
2011-12	1416	449	53	1918	243

Nutrient (000’ Tonnes)

*Provisional

Source: Department of Agriculture, Government of Punjab

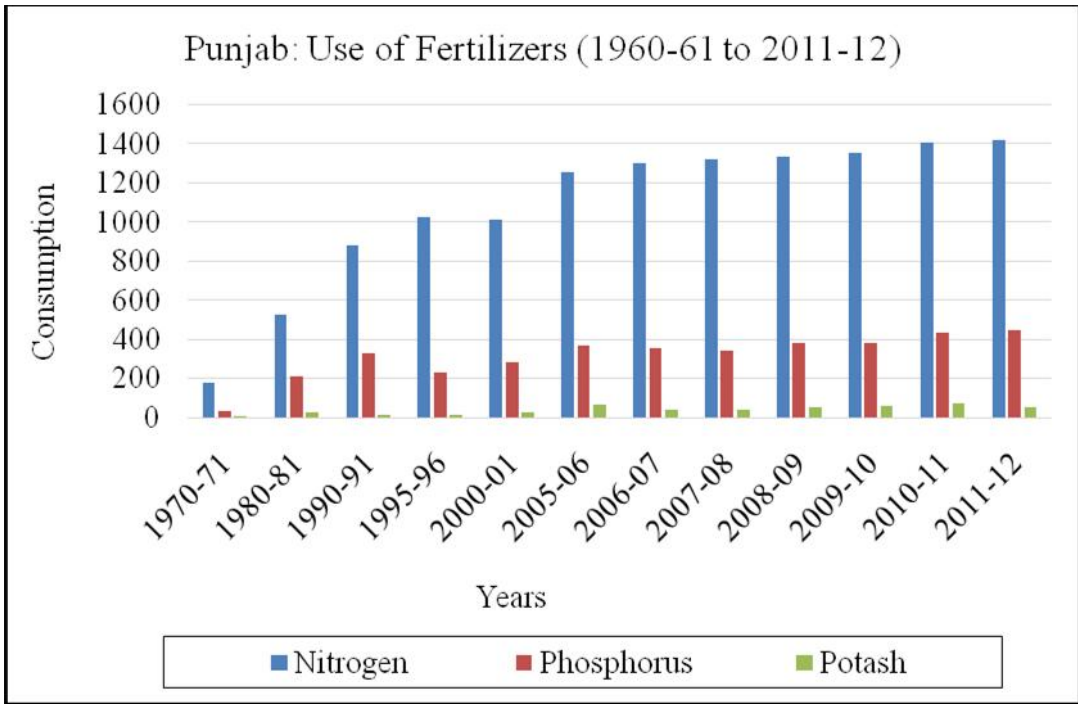

Fig.-1

Nitrogen (N) Consumption: The consumption of nitrogen increased consistently over the years, with some fluctuations. It rose from 5 kg/ha in 1960-61 to a peak of 1436 kg/ha in 2012-13 and then slightly declined to 1425 kg/ha in 2013-14.From 1960-61 to 2013-14, nitrogen consumption witnessed a significant growth of approximately 285 times.

Phosphorus (P) Consumption: Phosphorus consumption shows an upward trend with variations. It increased from 31 kg/ha in 1970-71 to 469 kg/ha in 2013-14.The growth in phosphorus consumption from 1970-71 to 2013-14 is about 15 times.

Potash (K) Consumption: Potash consumption exhibits fluctuations, but the overall trend remains relatively stable. It ranged from 7 kg/ha in 1970-71 to 83 kg/ha in 2013-14.The growth in potash consumption during the analyzed period is approximately 11.9 times.

Total Nutrient Consumption: The total consumption of nitrogen, phosphorus, and potash combined reflects an overall intensification of agricultural practices. The total consumption increased from 213 kg/ha in 1970-71 to 1977 kg/ha in 2013-14, indicating a substantial growth of about 9.3 times over the analyzed period. The average annual growth rate for total nutrient consumption during this period is approximately 4.6%.

Trends and Observations: Nitrogen consumption generally dominates the total nutrient consumption, followed by phosphorus and potash. The growth in nutrient consumption suggests an increasing reliance on fertilizers to meet agricultural demands and improve crop yields. Fluctuations in phosphorus and potash consumption may be influenced by factors such as availability, pricing, and crop-specific requirements. It's important to consider the environmental and sustainability implication.

Table-2 Punjab: Commodity and crop wise consumption of indigenous pesticides (Chemical, bio-pesticides): kharif, 2015

Name of the commodity	Chemical Pesticides	Bio-pesticides	Total
	(Qty. in MT)		
Cereal Crops	2735	95.1	2830.1
Vegetable Crops	599	9.86	618.86
Pulse Crops	112	4.06	116.06
Oilseed Crops	39.5	1.02	40.52
Fruit Crops	112	3.36	115.36
Plantation Crops	46.5	1.06	47.56
Cash Crops	207	7.16	214.16
Total	3851	131.62	3982.62

Source: Department of Agriculture, Punjab

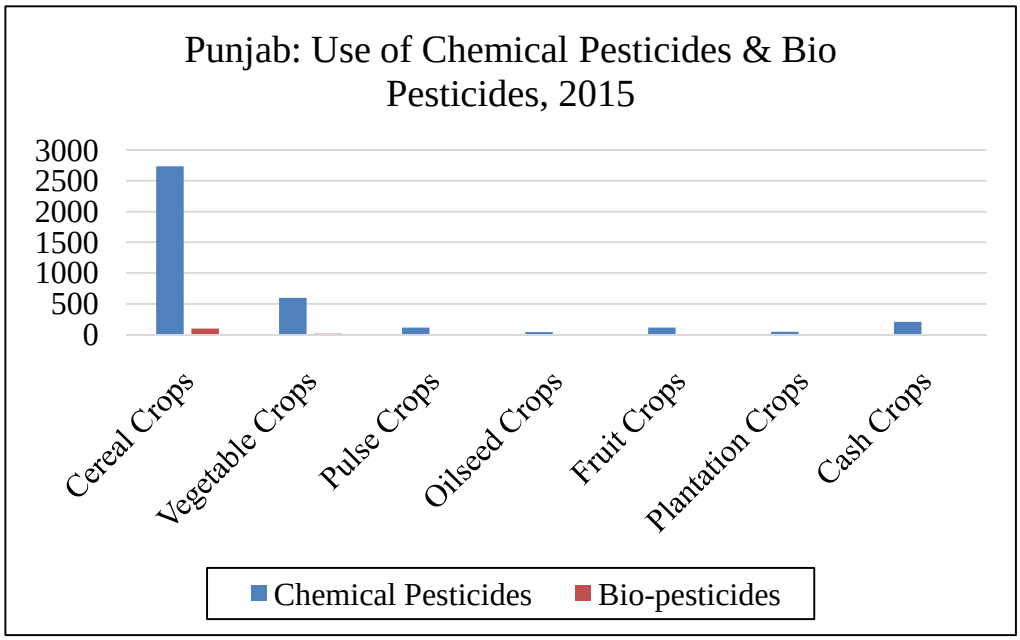

Fig.-2

Commodity-wise Chemical Pesticides Consumption: Cereal crops have the highest consumption of chemical pesticides, with 2735 MT used during the Kharif season of 2015.Vegetable crops have the second-highest consumption of chemical pesticides, with 599 MT. Cash crops and fruit crops also show significant consumption, with 207 MT and 112 MT, respectively. Pulse crops, oilseed crops, and plantation crops have comparatively lower consumption of chemical pesticides.

Commodity-wise Bio-pesticides Consumption: Cereal crops again have the highest consumption of bio-pesticides, with 95.1 MT used during the Kharif season of 2015.Vegetable crops have the second-highest consumption of bio-pesticides, with 9.86 MT. Cash crops and fruit crops also show notable consumption, with 7.16 MT and 3.36 MT, respectively. Pulse crops, oilseed crops, and plantation crops have relatively lower consumption of bio-pesticides.

Total Consumption: The total consumption of both chemical and bio-pesticides in Punjab during the Kharif season of 2015 was 3982.62 MT. Chemical pesticides accounted for the majority of the total consumption, with 3851 MT, while bio-pesticides contributed 131.62 MT.

Conclusion

In conclusion, the state of Punjab has experienced significant agricultural growth over the years, becoming a major contributor to India's food production. However, this success has come at a cost, as the excessive and indiscriminate use of fertilizers and pesticides has become a pressing concern. The data analysis reveals a steady increase in the consumption of fertilizers and pesticides in Punjab's agriculture. The consumption of chemical fertilizers, particularly nitrogen, phosphorus, and potash, has witnessed significant growth over the years. Nitrogen consumption alone increased from 5 kg/ha in 1960-61 to a peak of 1436 kg/ha in 2012-13, indicating a reliance on fertilizers to boost crop yields. The consumption of phosphorus and potash also showed an upward trend, though with some fluctuations.Furthermore, the analysis of pesticide consumption during the Kharif season of 2015 highlights that cereal crops and vegetable crops have the highest usage of both chemical and bio-pesticides. Cereal crops, in particular, had the highest consumption of chemical pesticides, while bio-pesticides were primarily used on cereal and vegetable crops. The total consumption of pesticides in Punjab during that season reached 3982.62 MT, with chemical pesticides accounting for the majority. The overuse of fertilizers and pesticides in Punjab's agriculture has raised serious concerns about environmental degradation, soil and water quality, and the health and well-being of farmers, farmworkers, and consumers. The high dependency on chemical inputs poses risks to beneficial organisms and contributes to pesticide-related illnesses in agricultural communities. It is essential to address the issue of overuse and promote sustainable agricultural practices in Punjab. The long-term viability of the farming sector and the overall well-being of the environment and society depend on adopting balanced approaches that minimize the reliance on chemical inputs and promote organic and environmentally friendly alternatives. The data analyzed provides valuable insights into the current state of fertilizers and pesticides consumption in Punjab's agriculture, shedding light on the urgent need for sustainable and responsible agricultural practices in the region.

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