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# Unveiling the Silent Threat; Pesticide Pollution in Pakistan's Agricultural Soils

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#### ABSTRACT

In Pakistan, a nation whose economy and food security are largely reliant on agriculture, pesticide contamination of agricultural soils is becoming an increasingly serious environmental issue. Pesticides improve the crop production and keep the pests under control but the cost our agricultural lands pay is very high yet unnoticed. In Pakistan, farmers frequently use chemical pesticides as their main method of controlling pests. The overuse of pesticides is partly caused by a lack of knowledge about sustainable alternatives and integrated pest management (IPM) techniques. Excessive use of pesticides ultimately leads to soil quality deterioration and barren lands which are no longer convenient for agriculture. Unmonitored pesticide application is not just contributing to land pollution, but water and air pollution are also taking a rise. Pesticide usage is also increasing because of the growing demand of the country. More food is required to cater for a greater population and to support the urbanization infrastructure effectively. In-depth investigation of the origins, kinds, distribution, and possible effects on soil quality are provided by this study of pesticide contamination in Pakistani agricultural soils across the region of Jalalpur Nangyana located in the tehsil of Sargodha.

KEY WORDS: Pesticide, Agriculture, Soil quality, Pesticide use, Pakistan.

#### **1 INTRODUCTION**

#### 1.1 Background

Pesticides are chemical compounds or biological agents that are applied to crops, livestock, or humans in order to control, repel, or eradicate pests that pose a threat to them. These include insecticides, fungicides, microbes, nematicides, herbicides, molluscicides, piscicides, avicides, rodenticides, bactericides, insect repellents, animal repellents, and lampricides (Yusuf Abubakar, 2020). When it comes to Agriculture of Pakistan, the province of Punjab cannot go unnoticed. The Punjab province, which accounts for nearly 60% of Pakistan's total agricultural output, is crucial to the country's economy. Finding the variables influencing the province's agricultural output will help to strengthen this contribution even more. To increase agricultural output in the province, these factors should be given prime importance by the provincial government. Jalalpur Nangyana located in a district of Punjab is famous for its agricultural produce. The agricultural practices in this region focus on the use of pesticides for a more fruitful yield of various crops.



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### **1.2 Objective of the Study:**

- Analyze the production of wheat, potato, and sugarcane under different pesticides.
- Study different pesticides and investigate their impacts on crop production and soil quality.
- Educate farmers, consumers, and the public about the safe and responsible use of pesticides, as well as the potential risks associated with exposure.

### 2 LITERATURE REVIEW

A large part of Pakistan's economy depends on its agricultural produce. With millions of people relying on crop production as their major source of nutrition, agriculture is the most important sector of development in Pakistan (Imtiaz Khan, 2022). Major crops like wheat, rice, sugarcane, cotton, and maize are the foundation of Pakistani agriculture and account for 4.67% of the country's GDP and nearly 24% of the value added in all of agriculture. Bajra, Jowar, mash, gram, and other minor crops make up 11.36% of the value added in agriculture overall and 2.25% of GDP. 11.61% of GDP and 58.55% of agricultural value addition are derived from livestock. The value addition of agriculture is 2.06% and the GDP is 0.41%, respectively, from forestry. Agriculture gains 2.17% and the GDP gains 0.43% from fishing (Shafique, 2017).

The land space of the country is decreasing but the demand does not seem to pitch down anytime soon (Arshad, Arfan, et al., 2019). Keeping in view the needs of the country, all the available land that can be irrigated for agriculture is being utilized to maximum levels (Arshad, 2019). For reliable produce, farmers are captivated towards using pesticides. Pesticides are chemicals designed to keep pests under control. These include insecticides, fungicides, microbes, nematicides, herbicides, molluscicides, piscicides, avicides, rodenticides, bactericides, insect repellents, animal repellents, and lampricides (Yusuf Abubakar, 2020). Additionally, pesticides are employed in public health while many others use insecticides in their lawns and gardens around their residences (AL-Zaidi, Abdullah A., et al., 2019). DDT and pyrethroids have been detected in drinking water and soil, with concentrations peaking in winter and significantly impacting food safety in brownfield areas (Abubakar, Yusuf, et al., 2020).

Pakistan is a major global buyer of pesticides, with Punjab province being the largest consumer at 88.3% due to significant urban and agricultural development, followed by Sindh (8.2%), Khyber Pakhtunkhwa (2.8%), and Baluchistan (0.76%). (Rashid, Sajid, et al., 2022).

The main chemicals used in agriculture to eradicate insecticides and pesticides are called organophosphorus pesticides, or OPPs. Regretfully, prolonged exposure to OPPs in humans may result in metabolic disorders such as dyslipidemia, hyperglycemia, hypertension, and obesity (Leonel Javeres, Mbah Ntepe, et al., 2021). Synthetic chemical pesticides are also being used to deal with the destruction and increase crop yield but unfortunately, they also have undesirable effects. Alternative "botanical insecticides" might potentially affect pollinators and biocontrol services in unintended ways (Shah, 2019). China, the US, Australia, and many other nations are effectively using microbial biopesticides on a large scale to undermine the credibility of synthetic pesticides in agriculture. However, there has been no attempt to increase their use in agriculture in Pakistan (Inam-ul-Haq, M., et al., 2019).



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# 3 METHODOLOGY

The methodology utilizes both, a qualitative and quantitative approach.

### 3.1 Study Area

This research was conducted in the remote village of **Jalalpur Nangyana in Sargodha (central Punjab)**. Crop production expanding on several acres was observed and the changes in the yield due to pesticide consumption was also noted.

### 3.2 Target Pesticides under observation

Various pesticides were used for the detailed examination of soil health as well as rapid crop production across the region of Jalalpur Nangyana.

### 3.2.1 Pesticides for Wheat

Following four pesticides were used for the wheat crops.

Aldrin: Organochlorine pesticides, such as dieldrin and Aldrin, are commonly used in agriculture to manage pests, especially insects that live in the soil.

**Endrin:** Agriculture uses endrin, an organochlorine insecticide, to control pests, especially a range of insect pests.

**DDT:** Dichlorodiphenyltrichloroethane or DDT is an artificially produced organochlorine substance. It is essential for preventing typhus, malaria, and other illnesses spread by insects.

**Thiodane:** The trade name "Thiodan" refers to an insecticide known as "endosulfan." An organochlorine compound called endosulfan is used as a broad-spectrum insecticide on crops like cotton, fruits, vegetables, and tea to manage a range of pests.

### **3.2.2** Pesticides for Sugarcane

The following pesticides were used for sugarcane crops.

**Sugarcane Special:** These pesticides are specifically designed for the crop, sugarcane in this case. **Horticulture:** Fruits, vegetables, flowers, and ornamental plants are all grown in horticulture, and the term "horticulture pesticide" refers to a broad category of pesticides used to keep these crops free of weeds, diseases, and pests.

**Sempra:** Sempra is a suspension concentrate formulation used to control annual dicotyledons and grasses in winter and spring cereals through selective contact and residual herbicide.

### **3.2.3** Pesticides for Potatoes

Following pesticides were used for potatoes:

**Emesto 24 fs:** Emesto Prime is a new fungicide that helps farmers of potatoes treat their seed. It is effective against several soil- and seed-borne pathogens.



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**King Pokair:** King Poker is designed to help crops absorb more nutrients, giving them the building blocks they require for healthy growth.

Antracol: It is a contact fungicide with propineb technical that is used to treat rice, tomatoes, grapes, potatoes, pomegranates, leaf spots, and early and late blight.

## 4. **RESULTS AND DISCUSSIONS**

The data obtained after examining crops in an area of 32 kanal over a period of four years (2020 to 2023) gave different dynamics for all three crops. Final details are as under.

**Wheat:** Wheat yields fluctuated from 2.2 tons with Aldrin (2020) to 2.1 tons with Endrin (2021), peaking at 2.3 tons with DDT (2022), but dropped to 1.9 tons with Thiodan (2023) due to quality concerns. Despite DDT producing the highest yield, Thiodan was chosen in 2023 due to the dangerous impacts of DDT such as residuals and soil resistance.



*Figure 1: Wheat production over four years along with the targeted pesticides under observation.* 

**Sugarcane:** Sugarcane yields improved from 29.76 tons with Sugarcane Special (2020-2021) to 37.2 tons with Horticulture (2022), but decreased to 33.48 tons with Sempra (2023), still surpassing the initial yields. Despite Horticulture providing the highest yield, the subsequent use of Sempra saw a decline, yet remained more productive than Sugarcane Special.



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Figure 2: Sugarcane production over three years along with the targeted pesticides under observation.

**Potato:** From 2020 to 2023, potato yields were consistent at 7.44 tons with Emesto 24FS and Antracol, but dropped to 6.7 tons with King Pokair, which was then replaced by Antracol for better yield and crop quality. While pesticides like Emesto 24FS and Antracol are effective, overuse of such chemicals can degrade land quality over time, leading to premature soil barrenness. Thus, although pesticides enhance crop production, they are not sustainable long-term solutions.



*Figure 3: Potato production over three years along with targeted pesticides under observation.* 



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# 5 CONCLUSION

This study highlights the pressing issue of pesticide contamination in agricultural soils of Pakistan especially in the Jalalpur Nangyana district of Sargodha Tehsil. The research findings emphasize the critical importance of addressing pesticide contamination in Pakistan's agricultural soils. Urgent measures are required to regulate pesticide use, promote sustainable agricultural practices and explore alternative methods, such as biopesticides, to mitigate health and environmental risks.

#### 6 ACKNOWLEDGEMENTS

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