replacing the existing protocal with a robust pesticide registration process that include thorough safety assessments, environmental impact analysis, and regular reviews of pesticide registration based on new scientific findings, hazardous pesticides may be kept off the market. In order to minimize unnecessary pesticide use, all farmers must have access to required pesticide applicator training programs that cover pesticide identification, safe mixing, application procedures, calibration of the application equipment, the use of safety equipment, disposal methods, follow up of the pre-harvest requirements on the label and setting pest thresholds.

POLICY MEASURES FOR PESTICIDE CONSUMPTION AND SAFETY MEASURES FOR PESTICIDE APPLICATION

Extensive farmers' training on biopesticides application

Training in making and applying bio-pesticides is useful for controlling pests and diseases using environment friendly natural ingredients and for following more sustainable farming practices. In addition, it is important to disseminate them to local farmers because of environmental protection, sustainable pest control and health protection. Mass adoption of bio-pesticide application and other organic farming practices is essential for the benefit of all the farmers who are adopting the same.

Government Initiatives in the promotion of sustainability measures

Several initiatives like Paramparagat Krishi Vikas Yojana (PKVY) and MOVCDNER programs offer farmers financial aid of Rs 31000/ha and Rs 32500/ha for 3 years respectively, for organic seeds, vermi-compost, organic manure, bio-fertilizers, bio-pesticides, botanical extracts, etc. Lack of funding support to the farmers is one among the main challenges faced by the PKVY in its successful accomplishment. Hence, there is an urge to ensure the provision of sizable fund in the form of subsidies on purchase cost, short and medium term loan and crop insurance scheme for following traditional indigenous practices, such as buying organic inputs, promoting on-farm biomass recycling and certification.

Market Accessibility

Limited demand for organic inputs is existing because of lower level of production resulted in lower income in the initial period of bio-pesticide application. Encouraging premium pricing for crops produced organically is required to overcome price instability as well as to incentivize the use of bio-pesticides. Inadequate transportation and storage facilities call for government support in framing policies to establish producer organizations, farmers co-operatives, separate selling counters in farmers market, direct marketing channels thereby facilitating the farmers to adopt organic farming practices. High levels of pesticide residues due to excessive pesticide application in soil, water and ultimately food which demands most effective actions to steer clear of pesticide-related risks and to encourage the usage of biological method of pest control, adoption of organic farming, integrated pest management practices. Prohibitions on unauthorized pesticides, enactment of laws and regulations regarding organic farming, promotion of using bio-pesticides, farmers training, provisions for facilitating functions viz, supply of biological inputs, transportation, financial assistance and marketing of organic products and price support systems are to be implemented with suitable policies.

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PESTICIDE CONSUMPTION IN INDIA AND FARMERS PERCEPTION – AN INSIGHT INTO CURRENT TRENDS

This policy brief is based on the research project, "Pesticide Usage Behaviour of Vegetable Farmers and Its Impact on Soil Health and Human Health" handled by Dr. A. Janaki Rani, (Professor) in the Dept. of Agricultural Extension & Rural Sociology, CARDS, Tamil Nadu Agricultural University, Coimbatore with financial support from the Indian Council of Social Science Research (ICSSR) during 2024-26.
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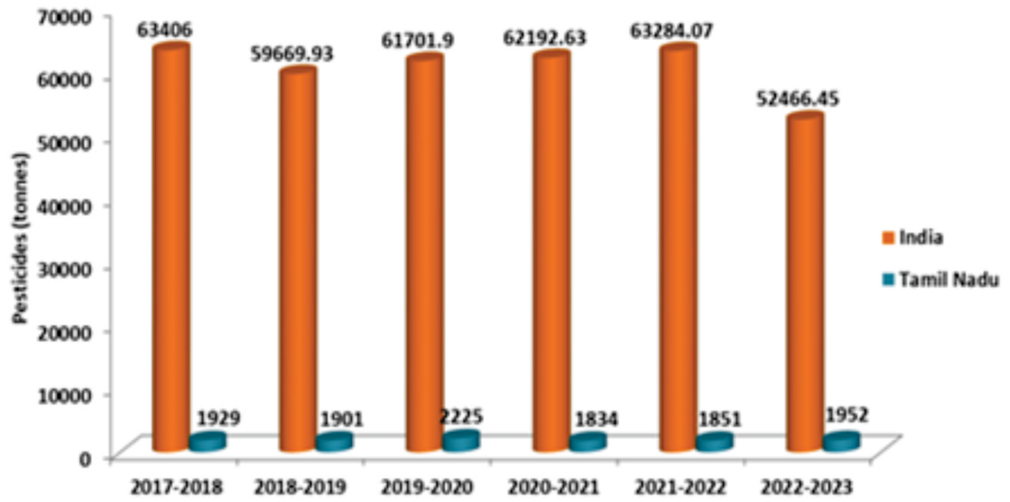
BACKGROUND

India has to produce more fruits, vegetables, and dairy products in addition to grain crops to ensure food security due to the country's expanding population and rising earnings. This will need a faster transition of the agricultural industry to be a more competitive, diversified, sustainable, and productive one. A large portion of food production is lost due to weeds, plant diseases, and insect pests, among other causes hence, pesticides are extensively used throughout the world, especially in agriculture in order to sustain the crop production and productivity. It is predicted that global agricultural pesticide consumption will rise marginally over the coming years, from approximately 4.3 million metric tons in 2023 to a value of approximately 4.41 million metric tons in 2027. According to the Directorate of Plant Protection, Quarantine & Storage, India is ranked 13th in terms of total pesticide use, with high pesticide consumption recorded in 2017–18 (63406 tonnes) and low consumption in 2022–23 (52466.45 tonnes), which has decreased from 63284.07 tonnes in 2021–2022. This raises issues regarding the long-term productivity of agricultural land as well as the wider environmental effects. Pesticides benefit crops, but they can have a detrimental impact on the environment and human health. The most widely used pesticides, which pose risks to both humans and the environment include pyrethroids, carbamates, organophosphates, and organochlorine.



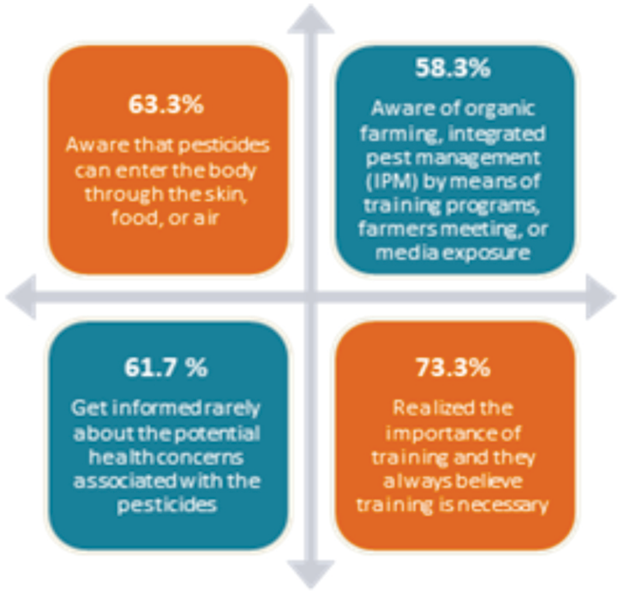
Consumption of Pesticides in India & Tamil Nadu (tonnes)

IMPACT OF PESTICIDES ON SOIL, ENVIRONMENT AND HUMAN HEALTH

Pesticides can either be poisonous or non-toxic based on their chemical composition. The overuse of chemical pesticides have the potential to cause pesticide-resistance, which can deteriorate soil health by requiring higher doses to maintain the same level of control. A vicious cycle may result from this degradation lowers the land's fertility and productivity and forces more fertilizer to be used to sustain yields. Pesticides have the ability to diffuse and volatilize into the atmosphere, runoff or wind, which can subsequently contaminate aquatic bodies also. They have adverse impacts on soil invertebrates, change the trophic structure in their environments, and have poisonous effects on them. Pesticides have an effect on people when they are applied to crops. When people come into direct contact with pesticides, they can influence their respiratory systems, mouths, skin, and eyes. They can also produce acute reactions including skin rashes, headaches, sneezing, and irritation. Long-term ingestion of pesticides applied fruits and vegetables leads to accumulation, which raises the levels of toxins in bodily organs and results in chronic illnesses as cancer, heart disease, diabetes, necrosis, neurotoxicity, asthma, reproductive disorders, etc.

FARMERS' PERCEPTION ON IMPACT OF PESTICIDES APPLICATION

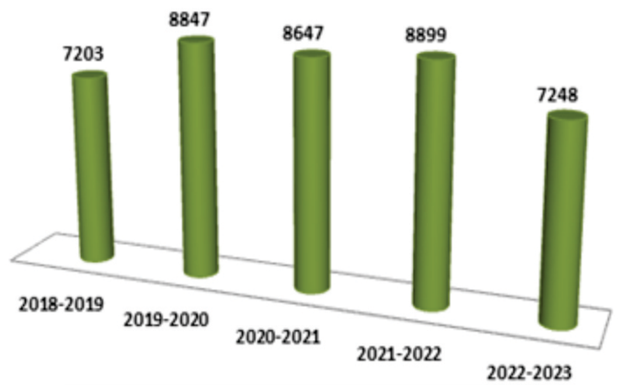
Farmers' decisions to choose organic farming or suitable methods to maintain vegetable output are influenced by their perceptions towards the effects of pesticides on the environment and human health. The study was conducted in Coimbatore district of Tamil Nadu to reveal the farmers perceptions on pesticide usage and its impact.



Farmers' Perception on Pesticides Application

Most farmers (63.3%) are aware that pesticides can enter the body through the skin, food, or air. All of them concurred that pesticides are bad for animals' health, and they are aware of how using pesticides affects the environment because of obvious effects of such residues on soil, water contamination, or harm to local wildlife. There is a need to create awareness about the effect of pesticides and the importance of shifting to environment friendly organic farming, integrated pest management practices, applying bio-pesticides for plant protection. The farmers perceived that the pesticides can control the pests very easily and might contribute for the yield increase of crops. The respondents (58.3%) are always likely to be aware of organic farming, integrated pest management (IPM), or biological controls, whether through training programs, farmers meeting, or media exposure. In contrast, the 61.7 per cent of the respondents get informed rarely about the potential health concerns associated with the pesticides they use. Additionally, there is a knowledge gap because farmers might not be aware of the long-term impacts of exposure, especially if they rely on peers or dealers for advice instead of receiving official training.

About 73.3 % of the farmers realized the importance of training and believe that training is necessary because of identifying gaps in understanding about safe pesticide usage. These farmers may place a high value on structured education because they have personally experienced the negative repercussions of improper pesticide application. They expressed their great concern about the long-term health effects of pesticide exposure, indicating a deep comprehension of the cumulative risks. Given the substantial health concerns, extension agencies should continue to emphasize the dangers of eating or drinking while applying pesticides to ensure that all farmers use safety methods. It is clear that for increasing agricultural production, only sustainable approaches should be employed without further degradation of the natural resources. Moreover, possible reclamation measures have to be taken for the restoration of soil health and productivity. Hence, biopesticides have become a viable substitute that can lead to safe organic farming. The target-specificity and ecologically friendly characteristics of biopesticides are making them increasingly popular on a global scale.



Consumption of Chemical and Bio-Pesticides in India (tonnes)

The use of biopesticides is still extremely low in underdeveloped nations like India when compared to traditional chemical pesticides. Accordingly, the reduction of pesticide use is a prime issue on policy agendas worldwide. For example, the European Union's Farm-To-Fork Strategy aims at a 50 per cent reduction of pesticide use and risks by 2030. However, existing policies often fail to promote widespread adoption of low-pesticide or no-pesticide production and farmers' reservations about them continue to be an obstacle to their adoption.

NEED FOR THE PROMOTION OF BIO PESTICIDES IN AGRICULTURE

India is dedicated to accomplish the Sustainable Development Goals (SDGs) of the UN, which include SDG 3 to guarantee healthy lives and advance well-being for people of all ages . The Government of India promotes organic inputs and chemical-free agricultural products to improve people's health through the organic farming programs of Paramparagat Krishi Vikas Yojana (PKVY), Mission Organic Value Chain Development for North Eastern Region (MOVCDNER), and Capital Investment Subsidy Scheme (CISS).

There are 362 biocontrol labs and units operating in India, according to the Directorate of Plant Protection, Quarantine and Storage (DPPQS), but only a small number of them are used for manufacturing. In India, however, research indicates that the use of biopesticides has grown over the past few decades. By