DOI: 10.21088/jswm.0975.0231.18326.6

Journal of Social Welfare and Management
Volume 18 Number 3, September-December 2026

REVIEW ARTICLE

Entry of Pesticides in India

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HOW TO CITE THIS ARTICLE:

Sanskriti Tripathy, Tridibesh Tripathy. Entry of Pesticides in India. J Soc Welfare Manag. 2026; 18(3): 179–183.

ABSTRACT

Barter system in the Indian economy existed as India was an agronomy primarily since ancient times. The article touches upon the issue of agriculture through the role of community, society & governance. In the beginning it briefly touches upon the area & the crops that were extensively cultivated.

Following that, it moves on to methods in agriculture towards not only increasing the production but also protection of crops. It moves on to the tax system that evolved in the Mughal era & sails on to the British era. The British era gave birth to the idea of cash crop & staple crop.

After that the article deals with the idea of food security & the ways & steps taken to address the elements that lead to food security. A table is given showing the share of agriculture in the Gross Value Added in the economy. This is a testimony towards the efforts & steps mentioned above.

At the distal end of the article, the evolving methods of crop protection are given. The journey towards environment friendly methods to the use of chemicals & the advent of green revolution that focused exclusively on production is the last focus of this article.

KEYWORDS

• Agriculture • Crop Protection • Pesticides • Green Revolution

INTRODUCTION

Principally India is an agrarian economy the prehistoric roots of which lie in the field of agriculture. This is because since 9000 BCE, India followed a multitude of regionally distinct paths instead of a particular point of origin. The Neolithic era was characterized by the cultivation of winter crops like Wheat & Barley etc. in the northwestern borders of the Indian subcontinent like Mehrgarh.

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➢ **Revised:** 22-06-2026 ➢ **Accepted:** 26-08-2026

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Rice was intensively cultivated in the Middle Ganges and the Vindhya-Ganga trajectory. The South Indian peninsular region mainly focused on cultivating indigenous varieties of small millets and pulses like moong bean. Civilizations like the Indus adopted a flexible and advanced multi-cropping pattern that specifically focused on 'risk management'.[1 to 5]

This pattern of cultivation involved growing winter crops and summer crops together which helped reduce the risk of dependence on a single crop. The evolution of agriculture has been the result of mainly three factors, technology, environment and social policy. With the advent of the Iron Age, the Indian agricultural base expanded with the northern and southern regions continuing to focus on rice and millet farming. The medieval period focused on the advancement of existing facilities and the linking of agriculture with the government during the Mughal period as stated in the Ain-i-Akbari**.** The land was classified for tax collection. A state controlled revenue system was established including the ten year settlement system called as the Todarmal system.[5,6]

The British prioritized extensive commercialization of agriculture through the construction of canals, cultivation of cash crops like cotton or indigo and the establishment of stringent as well as exploitative land revenue systems. Post-independence India connected modern scientific technologies with agriculture treating the farming sector as a national priority This association gave birth to major changes like the Green Revolution that helped provide higher yields but resulted in problems like environmental pollution accompanied by regional, social and economic disparity. India faced the challenges of severe drought and food shortages. Hence, as a consequence of global political relations, the India- US technological ties alleviated the Indian agricultural sector from the threat of food insecurity.

Key institutional anchors like the Commission on Agricultural Cost & Prices (CACP) & Food Corporation of India (FCI) were established during this time. The current agricultural landscape is attempting to focus on agricultural sustainability and crop diversification. The World Bank states that until 2023, about 60% of India's total land area was dedicated to the agricultural sector.[7,8,9]

The land use statistician report published by the Department of Agriculture & Farmers Welfare for 2023-24 states that about 58.6% of the total land area was available for agricultural purposes and 58.51% of the total land area was used for agriculture. The net sown area was estimated to be 45.3% of the total land area while the gross cropped area was reported to be 217.88 million hectares. The figures state that for 2023-24, rice had the largest area of cultivation of 49.8 million hectares.[9,10]

According to the preliminary annual estimates of the Department of Agriculture and Farmers Welfare for the National Income of India for 2022-23 as stated in the annual report of 2024-25, the agriculture and allied sectors comprised about 18.4% of the Indian Gross Value Added (GVA) at current prices. The GVA share of the agriculture sector for the six consecutive time periods is given in the following box.

Box 1- GVA share of agriculture sector given in brackets against the years from 2018-2024.

2018-19 (17.6%), 2019-20 (18.3%), 2020-21 (20.4), 2021-22 (18.9%), 2022-23 (18.2%), 2023-24 (17.7%)

As per the above box, it shows a positive yet uneven growth pattern as it experiences a rise and fall of approximately 2%. As per the annual provisional economic estimates with respect to the agriculture sector for 2023-24, its contribution to GDP/GVA turned out to be nearly 17.7%. The expected growth rate as per the annual report of the department for 2024-25, has been estimated to be 1.4%. Through the evaluation of the current and previous trends, it can be observed that agriculture has not increased its contribution in the economic growth of India over the past years.

About 50 percent returns have been ensured from MSP with increased focus on the production of Kharif crops. In the current climate, government policies prioritize price support, food security, income support, market regulation, diversification and maximization of the production. To support this maximization, the government depends on several sources of crop protections like chemical pesticides, traditional methods and other modern agricultural techniques. The agrochemical industry acts as the major supporter of the farming sector.[11,12,13]

The Food & Agricultural Organization (FAO) estimates that about 40% of the world's

agro produce is lost to pest attacks and plant diseases. Pest attacks annually damage forty percent of India's crop yield. Currently, India is the fourth largest producer of crop protection chemicals in the world with a global market share of about 14%. By 2028, the industry is expected to grow up to USD 12.58 billion. The major drivers of the growth of this industry are the rising population and a parallel rise in the evolution of market models. The crop protection sector is continuously developing innovative methods of pest management. Several such chemicals are also being replaced by natural and organic inputs. However, examples like that of the food and economic crisis of Sri Lanka indicate that the direct substitution of crop protection chemicals may not be the ultimate solution as it might destabilize the production process.[13,14,15]

The ancient traces of the crop protection sector of India can be found in traditional scriptures like the Rigveda, Atharvaveda, Arthasastra etc. These texts give reference to various ancient crop protection practices. Kunapa, a preparation of liquid manure sourced from parts of carcasses was sprinkled on the trees with imbalanced Vata, a humur as per Ayurveda. For the treatment of Pitta disorders, trees were drenched with a decoction of milk, honey, licorice and Madhuca Indica. Oil was applied to the soil around the trees to protect them from termites and frost. Powdery mildew was prevented in the plants with the application of curd mixed with Asafoetida. Most of the plants used for these purposes were biocide. These methods were however environment friendly yet incompatible with the pace of development and modernization. With the advent of industrialization the next era in the crop protection sector was that of the inorganic chemicals like copper sulphate, arsenic and bordeaux mixture. Their introduction marked the beginning of chemical pest control. The use of inorganic chemicals lasted up till the end of World War II.[13-17]

Synthetic chemicals like DDT were extensively used as Non-Pharmaceutical Agents on soldiers and refugees to combat the outbreak of Malaria and Typhus during the same time. Chemical warfare was a crucial aspect of the World War II with pesticides like the organophosphates being a crucial part of it as most of the military research focused on nerve agents. The result of large-scale utilization of pesticides during the war resulted in the scale up of their manufacturing infrastructure. This marked the beginning of the era of synthetic pesticides. Synthetic pesticides came to India post World War II around 1948.[11-17]

They were imported for the control of malaria and locusts. So they initially served the purpose of stabilizing the public health sector. From the 1950s, domestic production of the pesticides like Benzene Hexa Chloride (BHC) & Dichloro Diphenyle Trichloroetane (DDT) began & thus the green revolution followed.[17-21]

Reflections

The recent guidelines issued by the GOI on the issue of pesticides come to the fore front while writing this article. The Genetically Modified (GM) crops also come to the mind. One group was for the GM crops & the other against. We do not consider the GM as totally harmful as eventually they enrich the soil & increase the production. The problem might occur at random places that are spread across an area. This is not the case with pesticides. These are spread over a large area & hence the issue of pesticide management, role of private & public sector come to play.[17-21]

More than the adherence to the laws, regulations & rules, it is the behavior of the people & farmers having lands is crucial. The management of landless farmers is an active part of the pesticide management under the Swacch Bharat Mission (SBM) & it is to be aspired that in SBM 2.0 its implementation will lead to effective pesticide management.[17-21]

CONCLUSION

As agriculture is at rural, semi urban & urban areas, the role of local bodies 7 co-operatives at all these levels in the pesticide management is very important. At the rural level in villages, the Panchyati Raj Institutions (PRI) have to work on this front. Similarly at the block level the block panchayat & at the district level, the district panchayat have to rise to the occasion on the issue of pesticide management.

In the semi urban areas, the municipal boards, muincipalties & in the cities the corporations have to work on these issues. It is critical that all these stakeholders work in tandem with the GOI & state governments so

that interventions start to percolate from the corporations to the village panchayat.

Acknowledgement

The lead author acknowledges the contribution of the co-author.

Declaration: Both the authors have contributed significantly

Conflict of Interest: Nil

Funding: Nil

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DOI: 10.21088/jswm.0975.0231.18326.7

Journal of Social Welfare and Management
Volume 18 Number 3, September-December 2026

Review Article

Libraries in the Age of AI: Emerging Trends, Challenges and Prospects

Kaushal Chauhan

How to cite this article:

Kaushal Chauhan. Libraries in the Age of AI: Emerging Trends, Challenges and Prospects. J Soc Welfare Manag. 2026; 18(3): 183–189.

ABSTRACT

Artificial Intelligence (AI) is increasingly transforming the landscape of libraries by redefining how information is organized, accessed, and utilized. Libraries, traditionally known as repositories of knowledge, are now evolving into dynamic, technology-driven spaces where AI is playing a crucial role in reshaping services and operations. AI offers opportunities to automate routine and time-intensive tasks such as cataloging, metadata enrichment, and classification, thereby allowing librarians to dedicate more time to user engagement and research support. Beyond automation, AI-driven tools enhance user experiences through personalized recommendations, intelligent search systems, natural language processing for reference queries, and virtual assistants that extend library services beyond physical boundaries. At the same time, the integration of AI brings with it significant challenges. Ethical concerns, including issues of algorithmic bias, transparency, and data privacy, must be carefully addressed to ensure that AI applications in libraries remain equitable and trustworthy. The reliance on user data for personalization raises questions about consent and the protection of intellectual freedom. Furthermore, libraries must balance technological advancement with their core values of inclusivity, accessibility, and neutrality. This paper examines the impact of AI on libraries by exploring its current applications, analyzing the ethical and privacy implications, and identifying challenges in implementation. It also considers potential future directions for AI integration, such as predictive analytics for collection development, immersive learning environments, and AI-assisted research support. Ultimately, the study highlights that while AI has the potential to revolutionize library services, its success depends on thoughtful adoption, ethical frameworks, and the continuous alignment of technology with the human-centered mission of libraries.

KEYWORDS:

• Artificial Intelligence (AI) • Libraries Services • Automation • Intelligent Search Systems • Virtual Assistants • AI-assisted Research Support

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➢ **Received:** 15-09-2026 ➢ **Accepted:** 25-10-2026

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