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## Market status and adoption trends of bio-pesticides in Durg District, Chhattisgarh

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### Abstract

The present study entitled “Market Status and Adoption Trends of Bio-Pesticides in Durg District, Chhattisgarh” was conducted to assess the growth, distribution and adoption of bio-pesticides as sustainable alternatives to chemical pesticides. Primary data were collected from 100 farmers across 20 villages in Durg and Dhamdha blocks using a structured interview schedule, while secondary information was sourced from official reports and published literature. Analytical tools including percentage analysis, arithmetic mean and Garrett’s Ranking Technique were employed to examine adoption patterns and constraints.

The findings revealed that the overall turnover of leading dealer firms in the study area was ₹448.43 lakhs, of which ₹121.90 lakhs (27.18%) was contributed by bio-pesticide sales. Dhamdha block recorded the highest turnover and adoption share (36.80%), followed by Bori (33.33%), while Murmunda showed the lowest share (16.66%). The study further highlighted the role of distribution networks, with a greater number of associated retailers contributing to higher bio-pesticide sales. Farmers’ adoption was influenced by factors such as availability, awareness, comparative cost and perceived effectiveness of bio-products. Overall, the results suggest that while bio-pesticides are gaining importance in the agricultural input market of Durg district, their penetration remains limited, indicating scope for policy support, awareness campaigns, and strengthening of supply chains to promote sustainable crop protection practices.

**Keywords:** Bio-Pesticides, IPM, sustainable agriculture, market status, adoption trends, Chhattisgarh

### Introduction

Biopesticides, which are derived from naturally occurring organisms or substances, have emerged as sustainable alternatives to conventional chemical pesticides. They are known for being biodegradable, eco-friendly, target-specific and compatible with Integrated Pest Management (IPM) strategies (Tijjani *et al.*, 2017 and Shukla *et al.*, 2019) <sup>[8, 6]</sup>. Unlike synthetic pesticides, biopesticides pose minimal risk to human health and the environment and leave no harmful residues, making them suitable for safe and sustainable agriculture (Kumar and Singh, 2015) <sup>[4]</sup>.

Globally, the use of biopesticides is growing at an annual rate of 10%, with microbial agents like *Bacillus thuringiensis* accounting for the majority share (Shukla *et al.*, 2019) <sup>[6]</sup>. In India, however, their adoption is still limited, representing around 9% of total pesticide usage, though this is expected to increase significantly in the coming decades (Keswani, 2020) <sup>[3]</sup>.

India has emerged as one of the important producers and consumers of bio-pesticides, with the domestic market showing consistent growth due to rising awareness, supportive policies and increasing demand for residue-free produce. However, adoption remains uneven across regions, primarily due to limitations in market penetration, awareness among farmers, distribution networks and comparative pricing with synthetic pesticides. Chhattisgarh, recognized as the “Rice Bowl of Central India,” has a predominantly agrarian economy where sustainable crop protection is essential for long-term productivity. Within the state, Durg district holds prominence as a major agricultural hub with diversified cropping systems, making it an important region to assess the market dynamics of bio-pesticides (Choudhary *et al.*, 2018; Singh *et al.*, 2020) <sup>[1, 7]</sup>.

This study was undertaken to analyze the market status and adoption trends of bio-pesticides in Durg district, with particular emphasis on turnover of dealers, distribution channels and farmer acceptance. By identifying the current level of penetration and challenges faced by stakeholders, the research aims to provide insights into the potential for expanding bio-pesticide use in the region, contributing to sustainable agricultural development (Patel *et al.*, 2019; FAO, 2021) <sup>[5, 2]</sup>.

## Materials and Methods

### Study Area

The study was conducted in Durg district, located in the Chhattisgarh plains region of central India. The district spans 8,537 square kilometers, with diverse topography including forested areas and agricultural plains. Durg has a strong agricultural base, with major crops including paddy, wheat, soybean, maize, and various vegetables such as tomato, brinjal, cabbage, cauliflower, and okra. The total vegetable production area in the district is approximately 41,809 hectares, producing 768.14 thousand metric tons.

### Sampling Technique

A multistage random sampling method was employed:

- **District selection:** Durg was purposively selected due to its relatively higher usage and awareness of biopesticides.
- **Block selection:** Two blocks Durg and Dhamdha were selected out of the three in the district.
- **Village selection:** From each block, 10 villages were randomly chosen, resulting in a total of 20 villages.
- **Respondent selection:** A total of 100 respondents (5 farmers per village) were selected through random sampling.

### Data Collection

- Primary data were collected using a pre-tested structured interview schedule. The questionnaire included items on demographic profile, landholding, cropping patterns, pest control practices, awareness and perceptions of biopesticides and factors influencing their adoption.
- Secondary data were sourced from journals, reports, articles, official records and websites including data from the National Agriculture Board and the Department of Horticulture, Government of Chhattisgarh.

### Analytical Tools

To analyze the data, the following tools were used:

- Percentage and frequency analysis to summarize responses and perceptions.
- Arithmetic mean to compute average scores.
- Garrett's Ranking Technique was applied to rank constraints and influencing factors based on farmer responses. The formula used was:

$$\text{Percentage Position} = 100 \times (\text{Rij} - 0.5) / \text{Nj}$$

Where,

Rij = Rank given for the constraint by the individual.

Nj = Number of constraints ranked by the individual.

The mean scores were computed and used to rank each factor in descending order.

## Results and Discussion

This chapter discusses the univarietal analysis of the data collected from farmers and dealers during the field survey. The findings and conclusions drawn from the data collected and the goals of the study are presented.

### Leading bio-pesticide companies in Durg and Dhamdha blocks

The table 1 provides detailed information on the average turnover from the mentioned companies that the chosen dealers earned overall. It also shows the turnover that came specifically from selling bio-pesticides. The percentage of bio-pesticides sold or advertised by those dealers is also included. The data reveals that dealers in Dhamdha and Durg block earned approximately 92.19 Lakhs in total revenue from bio-pesticides in a year. This amount represents 51.22% of their annual average revenue from all products. It indicates that the marketing of organic pesticides is growing in the area.

According to a report from the Agriculture Department of Chhattisgarh, the use of bio-pesticides in the state increased by 12% from 2019 to 2023.

### Market share

Market share is the percentage of the market that a particular company has. It is computed by dividing the turnover of a business from the sales of a specific product over a specified time period by the total sales of the top five businesses under study during that same time period. This number gives a broad idea of how big a company is in relation to its competitors and its market. The market share of the various businesses manufacturing biopesticides in the research region has been estimated in this section. Below is an estimate of the market share of biopesticides manufacturers in the Durg and Dhamdha blocks.

### Dealers' detail

The survey found that the dealers came from different villages in the Durg block and Dhamdha. After graduating, they had long been dealerships, selling a range of chemical and biological crop protection goods from several renowned Chhattisgarh and Indian companies. Some distributors and suppliers of chemical and biological pesticide are listed in table 2.

To help them grow their business in the neighbourhood, the biopesticide dealers hired a range of sub-dealers or shops. They said that different proportions of farmers applied bio-pesticides. All of these details are displayed below, along with the quantity of sub-dealers and each chosen dealer's dealership experience:

### Turnover of the leading biopesticide dealers in Durg and Dhamdha blocks

Table 3 presents the turnover of leading biopesticide dealers in the Durg and Dhamdha blocks, reflecting the relative market performance of bio-based plant protection products. The aggregate annual turnover of the six dealer firms was ₹448.43 lakhs, of which ₹121.90 lakhs (27.18%) was contributed by biopesticides. Notably, Dhamdha registered the highest turnover (₹96.40 lakhs) with a substantial 36.80% share from biopesticides, followed by Bori (33.33%). In contrast, Murmunda accounted for the lowest share of biopesticides (16.66%) despite an overall turnover of ₹55.23 lakhs, whereas Kumhari, Nagpura, and Durg

exhibited moderate levels of adoption, ranging between 20–26%. These findings suggest that market penetration of biopesticides remains uneven across locations, with certain blocks demonstrating stronger adoption trends.

The distribution network appears to be a decisive factor influencing sales performance. Dealer firms located at Dhamdha (5 retailers) and Bori (4 retailers) reported the highest turnover from biopesticides, indicating that a larger number of associated retailers facilitated wider product availability and stronger market presence. In contrast, Murmunda, with only 2 retailers, recorded the lowest sales, underscoring the limitations of a weak distribution chain. This highlights the critical role of retail linkages in ensuring accessibility and promoting adoption of biopesticides among farmers. Overall, the results indicate that although biopesticides have captured over one-fourth of the agro-input market in Durg district, there is significant potential for expansion. Strengthening distribution channels, enhancing farmer awareness, and supportive policy interventions could further accelerate the market growth of biopesticides in the region.

## Conclusion

The study revealed that biopesticides account for about 27.18% of the total turnover of leading dealer firms in Durg district, with higher adoption observed in Dhamdha and Bori blocks compared to lower levels in Murmunda. The analysis highlighted that adoption is strongly influenced by distribution networks, as dealers with more retailers reported greater sales of biopesticides. Despite increasing awareness of their environmental and health benefits, challenges such as limited availability, higher relative costs and farmers' dependence on chemical pesticides continue to restrict wider use. Strengthening retail networks, enhancing farmer awareness through training and demonstrations and providing supportive policy measures such as subsidies and incentives are crucial to expand the market potential of biopesticides. Overall, the findings emphasize that while biopesticides are gaining importance in Durg district, significant opportunities remain to scale up their adoption for sustainable agricultural development.

**Table 1:** List of the leading bio-pesticide companies in Durg and Dhamdha blocks, together with their turnover

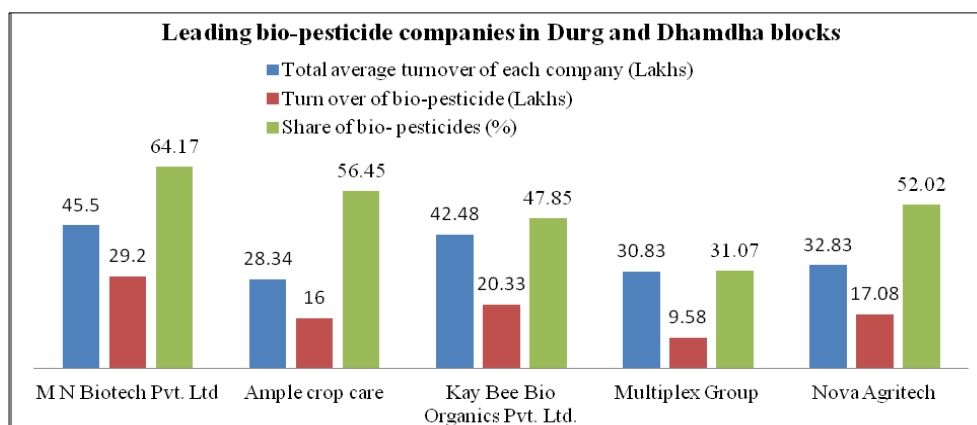
S. No.	Name of Company	Total average turnover of each company (Lakhs)	Turn over of bio-pesticide (Lakhs)	Share of bio-pesticides (%)	Rank
1.	M N Biotech Pvt. Ltd	45.50	29.20	64.17	I
2.	Ample crop care	28.34	16.00	56.45	II
3.	Nova Agritech	32.83	17.08	52.02	III
4.	Kay Bee Bio Organics Pvt. Ltd.	42.48	20.33	47.85	IV
5.	Multiplex Group	30.83	9.58	31.07	V
	Total	179.98	92.19	51.22	

**Table 2:** Name of Suppliers/Distributor companies

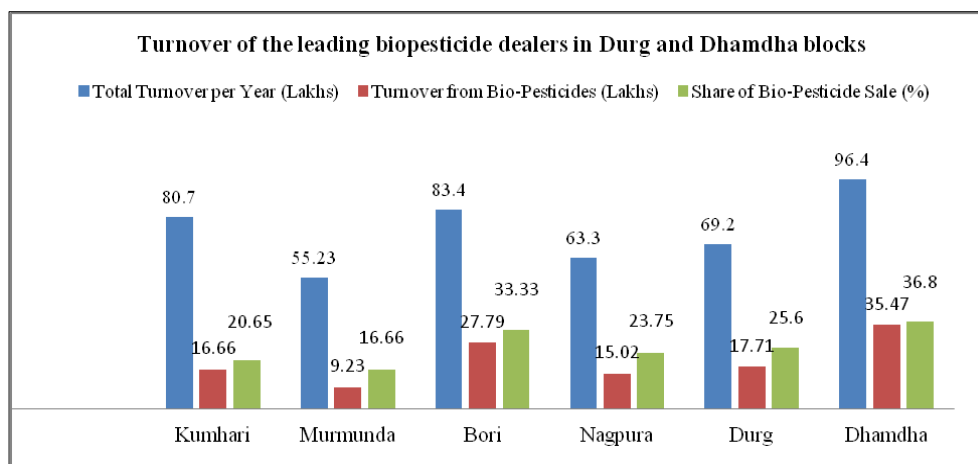
Name of Bio-pesticide Companies	Name of Chemical pesticide companies
M N Biotech Pvt. Ltd, Ample crop care, Kay Bee Bio Organics Pvt. Ltd., Multiplex group, Nova agritech Bionic India ltd, Atul Biotech, JU agri-science, hpm chemicals and fertilizers ltd., Tropical Agro-chemicals, India Pesticides Ltd.	Bayer, Syngenta India, Dhanuka Agro tech, hpm, Bharat biotech, UPL, karnataka agro chemicals, global agrochem, Richlife international pvt. Ltd. etc

**Table 3:** Shows the turnover of the leading biopesticide dealers in Durg and Dhamdha blocks

S. No.	Dealer Firms	Total Turnover per Year (Lakhs)	Turnover from Bio-Pesticides (Lakhs)	Share of Bio-Pesticide Sale (%)	No. of Retailers
1	Kumhari	80.70	16.66	20.65	3
2	Murmunda	55.23	9.23	16.66	2
3	Bori	83.40	27.79	33.33	4
4	Nagpura	63.30	15.02	23.75	3
5	Durg	69.20	17.71	25.60	2
6	Dhamdha	96.40	35.47	36.80	5
	Total	448.43	121.90	27.18	19



**Fig 1:** Leading bio-pesticide companies in Durg and Dhamdha blocks



**Fig 2:** Turnover of the leading biopesticide dealers in Durg and Dhamdha blocks

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