HIGHLY HAZARDOUS PESTICIDES (HHPs)

State Situation Report Jharkhand, India

IPEN Toxics-Free SDGs Campaign

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1. Introduction to the country

India is the second largest populated country in the world, with an estimated population of 1.37 billion people. It is one of the oldest civilizations in the world and possesses a rich cultural heritage. The country is located in the Asian continent and situated in the South Asia region. India is the seventh largest country in terms of the land area, with a geographical area coverage of 3.287 million square km. India is also the most populous democracy in the world. The country is subdivided into 28 states and 8 Union Territories. New Delhi is the national capital of India. The country is diverse in terms of climatic conditions and divided into 15 agro-climatic zones.

India is a megadiverse country, with a habitat for 8.6% of all mammal species, 13.7% of bird species, 7.9% of reptile species, 6% of amphibian species, 12.2% of fish species, and 6.0% of all flowering plant species. Fully a third of Indian plant species are endemic. India also contains four of the world's 34 biodiversity hotspots, or regions that display significant habitat loss in the presence of high endemism.[1]

About Jharkhand

Jharkhand is one of the prominent tribal states in eastern India. The state capital of Jharkhand is Ranchi. The state was carved out of the southern part of Bihar in the year 2000. Agriculture is the major occupation for more than 70% of the families in the state, most of whom are small and marginal farmers. The state is bordered by Bihar in the north, West Bengal in the east, Odisha in the south, Chhattisgarh in the west and Uttar Pradesh in the northwest. The state has a total geographical area of 7.97 million hectares and a total estimated population of 39 million. For administrative purposes, the state is divided into 24 districts, which are grouped into 5 divisions; namely, Palamu, North Chhotanagpur, South Chhotanagpur, Kolhan and Santhal Pargana.

Jharkhand comes under the agro-climatic zone VII of India which is known as the Eastern Plateau and Hill region. This can be further subdivided into three agro-climatic sub zones in the state viz. the Central and North Eastern Plateau zone, Western Plateau and South Eastern Plateau[2]. Average annual rainfall varies between 1100 to 1400 mm and most of the rain is in the monsoon period falling between late June to early September.

1.1 General overview of the country and its agriculture activities

Agriculture has always been the mainstay of the Indian economy. The history of agriculture in India dates back to the Indus Valley Civilization. Agriculture is the

[1] https://en.wikipedia.org/wiki/India

[2] State Agriculture Management and Extension Training Institute (SAMETI), Jharkhand

primary source of livelihood for about 58% of India's population along with its allied sectors, and the largest livelihood provider in India. An increasing population and more food demands called for an immediate and drastic action to increase yield. The action came in the form of the "Green Revolution." The green revolution in India refers to a period from 1965 to 1977 when Indian agriculture practices were converted into an industrial system due to the adoption of modern methods and technology such as the use of High Yield Variety (HYV) seeds, tractors, irrigation facilities, pesticides and fertilizers.

India's agricultural economy has undergone structural changes. Between 1970 and 2011, the GDP share of agriculture has fallen from 43% to 16%. This isn't because of the reduced importance of agriculture or a consequence of agricultural policy, but rather largely because of the rapid economic growth in other non-agricultural sectors like services and industrial output between 2000 and 2010.

According to the Economic Survey in Agriculture year 2019-20 (as per Fourth Advance Estimates), total food grain production in the country is estimated at a record 296.65 million tonnes. As per the survey, India's agricultural and allied exports were approximately INR 252 crores (US $ 33.53 million). As stated by the 2020-21 Economic Survey (first advance estimates), agriculture contributes 19.9% of the Gross Domestic Product (GDP). Even though there has been an overall contraction of the economy during the Covid-19 pandemic, the agriculture sector has shown a growth of 3.4%.[3]

As per Agriculture Census 2015-16, the average size of operational holding declined to 1.08 hectare in 2015-16 as compared to 1.15 hectare in 2010-11. The small and marginal holdings (<2 ha) now constitute 86%, while the large holdings (>10 ha) are merely 0.57% of the total land holdings. This has prompted experts to suggest inputs like chemical nutrients, insecticides and pesticides as a solution for better gains from small land parcels. With more than 51% of the farmed area being rainfed cultivation, the agriculture sector has been pushed to look at different solutions.

Although the economic contribution of agriculture to India's GDP is steadily declining with the country's broad-based economic growth, agriculture still employs the largest section of the population and it plays an important role in the national socio-economic culture.

Sustainable agriculture, in terms of food security, rural employment, and environmentally sustainable technologies such as soil conservation, sustainable natural resource management and biodiversity protection, are essential for holistic rural development. Indian agriculture and allied activities have witnessed a green revolution, a white revolution, a yellow revolution and a blue revolution; now those participating in agriculture activities are also considering agroecology, with the promotion of Integrated Pest Management (IPM) and Natural Pest Management (NPM). Additionally, the

[3] PIB release on the Economic Survey (Ministry of Finance) published on 29th January, 2021

government has initiated some programs like the Mission on Organic Farming, Pramparagat Krishi Vikas Yojana, which is making a move towards non-chemical-based farming systems.

Agriculture status and activities in Jharkhand

The state has a total cultivated area of 1.8 million ha, comprising 22% of the geographical area. The net irrigated area is about 0.16 million ha, which is almost 9.3% of the total cultivated area. The crop intensity of the state is 126%, and the farming is largely rain-fed in this region. The major crops of the state are maize, rice, wheat and chickpea. Jharkhand has 1.4 million ha area under rice cultivation, which are mainly rain-fed shallow and upland areas. The areas under rice cultivation have been increasing over the past three decades with crop productivity and input demands of seeds, fertilizers and pesticides as well. The state average productivity of rice is about 1.2 tonnes/ha. To improve crop productivity, the agriculture department is introducing drought tolerant short duration varieties like Vandana, Anjali, Sadabahar, Birsa Dhan 109, and Birsa Dhan 110; hybrid paddy seeds and adoption of integrated weed management practices are encouraged. With a regular market push of rice production demands of high yielding/hybrid varieties seeds, chemical fertilizers and pesticide use is also on rise. Pigeon-pea occupies about 85000 ha area with an annual production of 54000 tons. The average productivity in different parts of the state fluctuates between 544 and 1511 kg per hectare. Traditionally, long duration varieties of pigeon-pea are grown as rain-fed crops on sloppy land and intercropped with millets and short terms.

In the state of Jharkhand, the crop production and productivity are lower than the national average and far lower than the agriculturally developed states in the country. Over the years, the farmers' income has not been very significant, which is attributed to fragmentation of land holdings, low levels or absence of irrigation, deterioration of soil health, and lack of proper marketing channels. Therefore, one of the main agendas of both central and state governments is to increase agriculture production and farmers' incomes, and to increase the contribution of agriculture in the economy.

Many central and state government agricultural schemes are being implemented to increase the production and productivity of crops and allied activities. The state government has also initiated several measures, including increasing farm productivity, bringing remunerative prices to farmers by improving access to markets and market linkage, shifting to sustainable agricultural practices, strengthening agricultural extensions, and improving the implementation of risk management measures. In addition, farmers are increasingly using HYV seeds, chemical fertilizers, and pesticides to enhance crop production. However, the use of chemical pesticides, both during the

application of pesticides by farmers and during consumption by consumers, constitutes a health hazard.

In Jharkhand, for organizing need-based training programs for implementation by different project line departments and the farming community, the government has a state level autonomous Institute State Agriculture Management & Extension Training Institute (SAMETI). It functions with the technical guidance of the National Institute of Agricultural Extension Management.

According to the SAMETI, the major constraints of agriculture in Jharkhand are as follows:

- Run off loss and soil erosion and low levels of irrigation
- Mono-cropping
- Cultivation of wasteland
- Lack of organized marketing facilities
- Soil acidity and poor soil conditions
- Increase in kharif area/area expansion-coverage of fallow land; increase in pulses, oil seed and coarse cereals area
- Inadequate seed
- Low farm mechanization
- Low credit/insurance
- Poor infrastructure for post-harvest and value addition

In addition to the above challenges listed by SAMETI, increased use of highly hazardous pesticides and their toxic risks on humans and the environment is also an emerging concern. The field experiences also suggest that, over the past three decades, the farmers' use of pesticides has been getting more common to control pest infestations in their crops. The market push of quick acting pesticides is leading the use of highly hazardous pesticides. There have been several experiences of pest resistance, but no systematic study on it is available in Jharkhand at present.

Rice swarming caterpillar, *Spodoptera Mauritia* Boisd. (Lepidoptera: Noctuidae) has emerged as a regular pest in eastern India, including in the states of Odisha and Jharkhand[4].

1.2 Main crops produced in the country

India is home to a good diversity of crops and farm products, which may be classified into –

Cereals – Rice, wheat, maize, millets

[4] Emerging insect pests in Indian agriculture, *Mandeep Rathee and Pradeep Dalal*

Pulses & legumes - Pigeon-peas, lentils, chickpeas, gram, green gram, black gram, soybeans, cowpeas, green peas, etc.

Tubers & bulbs - Potatoes, onion, yams

Horticulture crops – Fruits including papaya, lemon, mango, guava, lichi and vegetables

Cash crops – Sugarcane, cotton, rubber, coffee, tea, jute, oilseeds

As per the FAO world agriculture statistics, India is the world's largest producer of many fresh fruits like banana, mango, guava and papaya; vegetables like chickpea and okra; major spices like dry chili pepper dry and ginger; fibrous crops such as jute; and staples such as millets and castor oil seed. India is the second largest producer of wheat and rice, the world's major food staples, as well as cashew nuts[5]. The list of top produce share among agriculture commodities from the FAO world agriculture statistics with production in the year 2019 is given here-

As Top Producer		**As 2nd Top Producer**		**As 3rd Top Producer**	
Commodity	**Production (in Tons)**	**Commodity**	**Production (in Tons)**	**Commodity**	**Production (in Tons)**
Banana	30460000	Wheat	103596230	Coconut	14682000
Chickpeas	9937990	Paddy	177645000	Potatoes	50190000
Castor oil seed		Cashew nut with cell	743000	Lentils	1227820
Dry chilis and pepper	1743000	Cauliflower and broccoli	9083000	Sesame	689310
Coir	581641	Green Peas	5562000		
Ginger	1788000	Eggplants	12680000		
Jute	1709460	Goat meat	553380		
Mangoes, mangosteen and guavas	25631000	Cabbages and other brassicas	9127000		
Millets	10235830	Garlic	2910000		
Okra	6176000	Sugarcane	405416190		
Papaya	6050000	Onions	22819000		
Pigeonpeas	3315440	Tea	1390080		
Beeswax	25691				

Rice is the staple food crop of the majority of Indian people. India is the second largest producer of rice in the world after China. In states like Assam, West Bengal and Odisha, three crops of paddy are grown in a year. These are *Aus, Aman and Boro*. The top rice

[5] FAOSTAT 2019, Countries by Commodity Food and Agriculture Organization of the United Nations https://www.fao.org/faostat/en/#rankings/countries_by_commodity

producing states of the country are West Bengal, Punjab, Uttar Pradesh, Andhra Pradesh and Bihar. National Food Security Mission, Hybrid Rice Seed Production and Rashtriya Krishi Vikas Yojana are a few government initiatives to support rice cultivation. All the above-mentioned programmes are looking into improved production with chemical inputs or market-based inputs into the farm. This has led to disappearance of many traditional varieties and also made the staple crop one that receives the highest amount of pesticides.

Major Crops in Jharkhand

The major crops grown in Jharkhand are paddy, wheat, maize, pulses, oilseeds and horticulture crops. For the small and marginal farmers located in peri-urban areas of Jharkhand, vegetable cultivation is one of the major cash crops. Their livelihood is mainly dependent upon vegetable cultivation.

Agriculture in Jharkhand is monsoon-based and most of the farming activity is rain-fed in nature, and largely depends on the available soil moisture during the post monsoon period. The state has low irrigation coverage, and only 13% of the total cultivated area is under irrigation, compared to the national irrigation coverage of 49%[6].

There has been a continuous increase in the productivity of crops at the national level, as well as at the state level in Jharkhand over the period of 2014-15 to 2019-20 as shown in table below, with use of high yielding seed varieties and improved package of crop practices including line sowing, balanced used of soil nutrients, and timely agriculture operations.

Yield of cereals, pulses and oilseeds over the period in Kg/hectare:

Crops	**Year 2014-15**		**Year 2019-20***	
	India	**Jharkhand**	**India**	**Jharkhand**
Cereals	2331	2134	2756	2257
Pulses	728	1004	817	1034
Oilseeds	1075	664	1236	766

*Source: Directorate of Economics & Statistics, * 4th Advance estimate*

1.3 National pesticide registration and control policy framework

Unregulated and indiscriminate use of pesticides became a concern in India in 1958 when the government of India appointed a Commission of Enquiry. The purpose of this Commission was to enquire and suggest, inter-alia, remedial measures following a number of deaths in Kerela and Madras (Tamil Nadu). The deaths occurred because of the consumption of imported wheat contaminated by the pesticide parathion, which was accidentally shipped together with food grains.

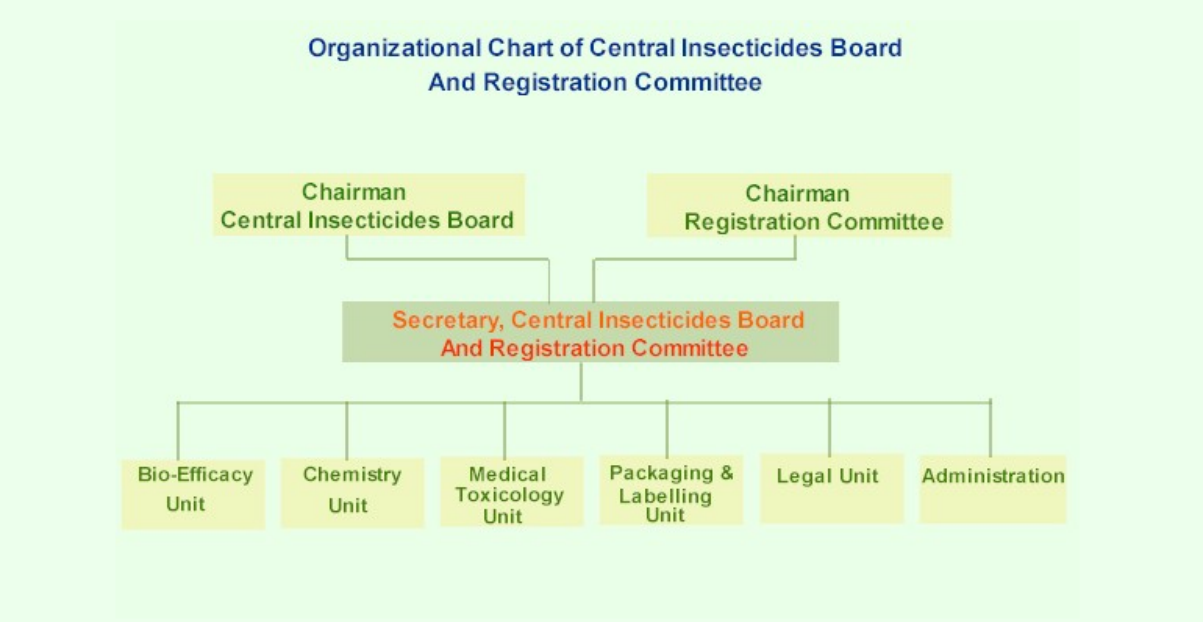
[6] Land Use Statistics 2016-17, Directorate of Economics and Statistics, Govt. of India

The whole question of pesticide use and legislation was studied in 1964-67 by an Expert Committee of the Indian Council of Agricultural Research headed by Prof. M.S. Thacker. Based on the recommendations of the Expert Committee, a comprehensive Insecticides Act was passed in 1968 to regulate the import, manufacture, sale, transport, distribution and use of insecticides, with a view to prevent risks to human beings and animals and for other matters connected therewith. The enforcement of the Act was transferred to the Ministry of Agriculture in the year 1970 by the Ministry of Health and Family Planning. The Department of Agriculture of this Ministry took immediate steps to frame the Rules and constituted the Central Insecticides Board and Registration Committee. The provisions of the Insecticides Act were brought into force with effect from 1st August, 1971. [7]

In the Act and the Rules framed thereunder, there is compulsory registration of the pesticides at the central level. License for their manufacture, formulation and sale are dealt with at the state level. According to CIBRC, with the enforcement of the Insecticides Act in the country, pesticides of very high quality are made available to the farmers and general public for household use (for protecting the agricultural crops from the ravages of pests and humans from diseases and nuisance caused by public health pests), and the health hazards involved in their use have been minimised to a great extent. For the effective enforcement of the Insecticides Act, the two bodies have been constituted at the central level viz. the Central Insecticides Board and Registration Committee(CIBRC).[6]

The organizational chart of the CIBRC as per the website of the Directorate of Plant Protection, Quarantine & Storage[8] is as follows -

[7] http://ppqs.gov.in/divisions/central-insecticides-board-registration-committee/about-cibrc
[8] http://ppqs.gov.in/about-us/organization-chart-cibrc



The Insecticides Act, 1968 infers power to the Central Insecticides Board to advise the central as well as state governments on the issues related to risk of pesticides to human beings and appropriate safety measures to prevent such risks, whereas the Registration Committee registers the pesticides. The registration process is laid under the Act and under Insecticides Rules, 1971. According to these provisions, any person desiring to import or manufacture any insecticide may apply to the Registration Committee for the registration of such insecticide and there shall be a separate application for each such insecticide.

On receipt of an application for the registration of an insecticide, the Committee may, after such inquiry as it deems fit and after satisfying itself that the insecticide to which the application relates conforms to the claims made by the importer or by the manufacturer, as the case may be, as regards [on such conditions as may be specified by it] and on payment of such fee as may be prescribed, the insecticide, allot a registration number thereto and issue a certificate of registration in token thereof within a period of twelve months from the date of receipt of the application.

The Registration Committee may, if necessary, direct inspection of the 'testing facility' for establishing the authenticity of the data.

As per the Act, the state government may, after consultation with the Board and subject to the condition of previous publication by notification in the Official Gazette, make rules for the purpose of giving effect to the provisions in this Act and not inconsistent with the rules, if any made by the central government[9].

[9] Insecticides Act, 1968 Article 37.1

1.4 Authorities responsible for the registration of pesticides, roles of different Ministries in the country

The Registration Committee, under the Central Insecticides Board and Registration Committee (CIBRC), Ministry of Agriculture and Farmers Welfare, is the body that receives and process the registration of pesticides.

The Pesticides Unit of the Directorate compiles data received during Zonal Conferences for Kharif and Rabi Seasons every year from the Department of Chemicals & Petrochemicals and Directorate General of Statistics & Commercial Intelligence, Kolkata. Kharif crops are the crops like rice, maize, etc. sown just before the onset of rainy season, and Rabi crops are crops like wheat, potato, etc. that are sown at the end of rainy season or beginning of the winter season.

The Pesticides Unit monitors the demand and availability of pesticides in States/Union Territories for adoption of crop protection measures. The Unit coordinates with the States/UTs, Ministry of Chemicals & Fertilizers, Department of Chemicals & Petrochemicals and pesticide industries for assessing the demand of pesticides for ensuring their timely availability. With coordination of the Statistics Unit, it also collects and compiles various data on demand and consumption of pesticides, and also about the selling and distribution points of pesticides in the country, etc. Major demand of the pesticides in the country, for control of diseases, insect pests and weeds, are met from the country's production.

Pesticides are regulated in India through the Insecticides Act, 1968 and Insecticides Rules, 1971. The experience in administering this Act over the last five decades has exposed certain gaps which spurred the need to propose a new law. The Pesticide Management Bill (PMB) has been in discussion since 2008. The Draft Pesticide Management Bill 2017 was released by the Union Ministry of Agriculture and Farmers Welfare (MoFAW) for stakeholder comments on February 19, 2018[10]. Subsequently, a new Pesticide Management Bill was created and was approved by the Union Cabinet on February 12, 2020.

1.5 International chemical conventions and agreements related to pesticides (Stockholm, Montreal Protocol, Rotterdam, SAICM), whether or not the country has ratified (or participates) and the name of the focal point or Designated National Authority (DNA) for each

India is party to most of the international chemical conventions and agreements related to pesticides; has ratified and participates in them. The status of these important agreements, with the designated national authorities, are as follows -

[10] https://www.downtoearth.org.in/blog/agriculture/pesticide-management-bill-2020-must-address-important-concerns-69303#:~:text=The%20Draft%20Pesticide%20Management%20Bill,Cabinet%20on%20February%2012%2C%202020.

Convention & Agreements	Ratification status	Designated Nodal Authority
Strategic Approach to International Chemicals Management (SAICM)	Party to SAICM since inception	Hazardous Substances Management Division Ministry of Environment, Forest & Climate Change
Stockholm Convention on Persistent Organic Pollutants	Ratified in 2006	Ministry of Environment, Forest & Climate Change
Montreal Protocol	Signatory since 1992	Ministry of Environment, Forest & Climate Change
Rotterdam Convention	Acceded to the convention in 2006	Department of Chemicals and Petrochemicals is the Designated National Authority (DNA) for industrial chemicals and Department of Agriculture, Co-operation & Farmers Welfare is the DNA for pesticides to perform the national functions.

2. Status of pesticide use in the country

There are 293 pesticides registered in India, and it is reported that 104 pesticides are still being produced/used in the country despite being prohibited in two or more nations around the world[11]. In India, insecticides, fungicides, and herbicides are used. Insecticides account for the majority of the total. In India, the present pattern of the usages of pesticide is insecticides>herbicides>fungicides+bactericides>other-pesticides, whereas the global pesticide use pattern is herbicides>fungicides+bactericides>insecticides>other-pesticides[12]. Currently, India is the world's fourth largest producer of pesticides. The Indian pesticides industry was worth Rs 214 billion (approx. US $ 288 Million) in 2019, according to Research and Markets. The market is expected to reach Rs. 316 billion (approx. US $ 425 Million) by 2024, with a compound annual growth rate of 8.1%[13].

The country saw a steady rise of 15% in pesticide consumption since 2016 until 2018-19, but there was a small dip in the year 2019-20. Since then, there has again been an increase in usage[14]. The country is using more than 70,000 MT of pesticide, though within the country there is wide disparity in pesticide usage.

[11] Insecticides / Pesticides Registered under section 9(3) of the Insecticides Act, 1968 for use in the Country :(As on 01.03.2021), GoI 2021

[12] FAO 2018, https://www.fao.org/faostat/en/#data/RP

[13] Stakeholders Dialogue on Current Challegnes and Way Forward for Pesticides Management, TAAS, SPS, IPS & ESI retrieved p1&2 from http://www.taas.in/documents/pub-activity-43.pdf

[14] Consumption of Chemical Pesticides in various states/UTs during 2016-17 to 2020-21 http://ppqs.gov.in/statistical-database

Pesticide uses in Jharkhand

In Jharkhand, pesticide use has picked up in the last three decades. As per our observation the use of pesticides is mostly common in selected pockets where the farmers are following commercial cropping in peri-urban locations, while consumption is less in the remote villages where farmers are still following subsistence farming.

A focus group discussion (FGD) was conducted with farmers in 8 villages in 3 districts of Jharkhand to understand the use of pesticides. The FGD was conducted in Bengabad and Gandey blocks of Giridih district, Devipur block of Deoghar district and Sadar block of East Singhbhum districts, and covered a total 131 farmers, out of which 46 were using pesticides. Interviews were also conducted with three seed input dealers to understand the pesticides in circulation.

The following information was gathered –

- None of the participants had idea about any training on pesticide use in any of these villages by any agency.
- 80% of the farmers using pesticides buy pesticide on the local pesticide seller's recommendation. Only 8% are following advisory services provided by the Krishi Vigyan Kendra (KVK) and other agencies. KVK is an integral part of the National Agricultural Research System (NARS) and aims at assessment of location-specific technology modules in agriculture and allied enterprises, through technology assessment, refinement and demonstrations. KVKs have been functioning as Knowledge and Resource Centres of agricultural technology supporting initiatives of the public, private and voluntary sector for improving the agricultural economy of the district and are linking the NARS with extension system and farmers[15].
- 76% of the farmers cover only their face with a towel or cloth sheets while spraying pesticides in the field. Only 15% of the respondents are using goggles, and hand gloves along with the face cover.
- Due to an absence of information, understanding about pesticides is very low. Even the micronutrients foliar sprays like Boron20 were reported by the farmers as a pesticide.
- Cypermethrin 25% EC is recommended for cotton, okra and brinjal only. However, it was revealed during the discussion that in two of the instances, Cypermethrin 25% EC was used by the farmers for paddy crop (which is not a recommended crop) in Bhojpur village of Devipur block in Deoghar district and Beyangbil village in Jamshedpur block of East Singhbhum district. Cypermethrin 10% has been used in all kinds of vegetables in Bishwanathi village of Devipur,

[15] https://kvk.icar.gov.in/aboutkvk.aspx

Deoghar as broad spectrum; whereas the use is recommended for cotton, cabbage, okra, brinjal, wheat and sunflower only. Use of Imidacloprid is not recommended for chili crop but it has been reported in Pandnatanr village of Gandey block of Giridih district by the farmers. Likewise, Fenvalerate 20% has been used on cabbage in Beyangbil village in Jamshedpur block of East Singhbhum district in absence of information and knowledge. This is recommended for cauliflower, cotton, brinjal and okra only.

- Open grazing is a common practice in these areas and the farmers reported health effects like itching eyes, loss of appetite and diarrhoea among animals near the farms that applied pesticides.

The list of particular pesticides with chemical ingredients and crop use as per the focus group discussion with farmers is as follows –

List of chemical pesticides used by the farmers participating in the focus group discussion -

Pesticide type	**Chemical name written on bottle/package**	**Active ingredients**	**Type of crop the pesticides are used on by farmers**
Herbicide	Grass Kill	Butachlor 50% E.C.	Paddy
Herbicide	Rajor, Wrecker Plus, Hobbit	Pretilachlor 50% E.C	Paddy, maize
Insecticide	Super Killer Super Cyprin	Cypermethrin 25% EC	Paddy, okra, brinjal
Insecticide	Perfect Prothrin Googly, Current Plus	Profenophos 40% + Cypermethrin 4% E.C.	Recommended for cotton; used in paddy, okra, brinjal
Insecticide	Super Cyper	Cypermehtrin 10% E.C.	All types of crops at the time of fruiting (Recommended for brinjal, cabbage, cotton, okra, sunflower, wheat)
Insecticide	Chloro Ultra	Chlorpyriphos 20% EC	Paddy, cabbage, onion, beans
Insecticide	Yorker	Chlorpyriphos 50% EC Cypermethrin 5% EC	Cowpeas, brinjal, tomato, chili
Insecticide	Admire	Imidacloprid 70% WG	Chili, paddy
Insecticide	Jimmy Deluxe	Diafenthiuron 50% WP	Chili
Insecticide	Actara	Thiamethoxam 25% WG	Paddy, brinjal, potato,
Insecticide	Fame	Flubendiamide 39.35%	Brinjal

		m/m SC	
Insecticide	Sumi Taz	50% SP Cartap Hydrochloride	Brinjal
Insecticide	Sumiprempt	Pyriproxyfen 5% EC + Fenpropathrin 15% EC	Brinjal
Insecticide	Nagfam	Fenvalerate20% EC	Cabbage, cauliflower, okra
Insecticide	Shark	Deltamethrin1%+ triazophos 35% EC	Paddy, chili, vegetables
Fungicide	Antracol	Propineb a.i. 70% WP	Vegetables, paddy
Fungicide	Folicur	Tebuconazole 250EC (25.9% w/w)	Chili
Fungicide	Pluton	Azoxystobin 11.5% Mancozeb 30% WP	Tomato

The active ingredients in market pesticides identified in interaction with the input dealers included the following chemicals - Metaxyl, Mancozeb, Pretilachlor, Carbendazim, Carfentrazone-Ethyl, Paraquat dichloride, Noniphenolethlyene, Cocamine ethaxolate, Butachlor, Atrazine, Profenophos, Cypermethrin, Thiamothoxam, Diafenthiuron, Flocinamid, Lambda-cyhalothrin, Imidacloprid, Oxyfluorfen, Quinalphos, Chlorpyrifos, Dimethly benzene, Fenvalerate, Azoxystorbin, Propineb, Tebuconazole, Flubendiamide, Azoxystobin, Cartap hydrochlirde, Pyriproxyfen, Fenpropathrin, Fenvalerate, Deltamethrin and Triazophos.

Apart from the above-mentioned pesticides applications, there have been study references of other pesticides usages in Jharkhand[16]. Recently, Glyphosate has also been reported for pre-weed control in Jharkhand under a study conducted by PAN India.[17]

2.1 The list of nationally registered pesticides

As of March, 2021 there are 293[18] insecticides/pesticides registered in India under section 9(3) of the Insecticides Act, 1968 for use in the country.

Sl. No.	Name of the Pesticide	Sl. No.	Name of the Pesticide
1	2,4-D Amine salt	34	Beta Cyfluthrin
2	2,4-Dichlorophenoxy Acetic Acid	35	Bifenazate
3	Abamectin	36	Bifenthrin
4	Acephate	37	Bispyribac Sodium
5	Acetamiprid	38	Bitertanol

[16] Hill, J., Singh, S., Ranjan, P., Nishant (2018). Misuse of chemical pesticides in Jharkhand: What should be done? Ranchi: Society for Promotion of Wastelands Development (SPWD), Eastern Region Office

[17] State of Glyphosate use in India, Dileep Kumar, April 2020

6	Afidopyropen	39	Boscalid
7	Allethrin	40	Brodifacoum
8	Alphacypermethrin	41	Bromadiolone
9	Alphanaphthyl Acetic Acid	42	Buprimate (FI-WRT)
10	Aluminium Phosphide	43	Buprofezin
11	Ametroctradin	44	Butachlor
12	Ametryn	45	Captan
13	Amisulbrom (FI-WRT)	46	Carbendazim
14	Ampelomyces quisqualis	47	Carbofuran
15	Anilophos	48	Carbosulfan
16	Atrazine	49	Carboxin
17	Aureofungin	50	Carfentrazone Ethyl
18	Azadirachtin (Neem Products)	51	Carpropamid
19	Azimsulfuron	52	Cartap Hydrochloride
20	Azoxystrobin	53	Chlorantraniliprole
21	Bacillus sphaericus	54	Chlorfenopyr
22	Bacillus subtillus	55	Chlorfluazuron
23	Bacillus thuringiensis var. galleriae	56	Chlorimuron ethyl
24	Bacillus thuringiensis var. israelensis	57	Chlormequat Chloride (CCC)
25	Bacillus thuringiensis var. kurstaki	58	Chlorothalonil
26	Barium Carbonate	59	Chlorpropham (TI), TIM
27	Beauveria bassiana	60	Chlorpyriphos
28	Benalaxyl (TIM)	61	Chlorpyriphos Methyl
29	Benalaxyl M	62	Chromafenozide
30	Bendiocarb	63	Cinmethylene
31	Benfuracarb	64	Clethodim (FI-WRT)
32	Bensulfuron Methyl	65	Clodinafop-propargyl
33	Bentazone TI	66	Clomazone
Sl. No.	**Name of the Pesticide**	**Sl. No.**	**Name of the Pesticide**
67	Clothianidin (FI-WRT)	108	Ethiprole
68	Copper Hydroxide	109	Ethofenprox (Etofenprox)
69	Copper Oxychloride	110	Ethoxysulfuron
70	Copper Sulphate	111	Ethylene Dichloride and Carbon Tetrachloride mixture
71	Coumachlor	112	Etoxazole (FI)
72	Coumatetralyl	113	Famoxadone
73	Cuprous Oxide	114	Fenamidone
74	Cyantraniliprole	115	Fenazaquin
75	Cyazofamid	116	Fenitrothion
76	Cyenopyrafen (FI-WRT)	117	Fenobucarb (BPMC)
77	Cyflufenamide (FI-WRT)	118	Fenoxaprop-p-ethyl

78	Cyflumetofen	119	Fenpropathrin
79	Cyfluthrin	120	Fenpyroximate
80	Cyhalofop-butyl	121	Fenvalerate
81	Cymoxanil	122	Fipronil
82	Cypermethrin	123	Flocoumafen (FI-WRT)
83	Cyphenothrin	124	Flonicamid
84	Cyproconazole (TI)	125	Fluazifop-p-butyl
85	Dazomet	126	Flubendiamide
86	Deltamethrin (Decamethrin)	127	Flucetosulfuron
87	Diafenthiuron	128	Fluchloralin
88	Dichloro Diphenyl Trichloroethane	129	Fluensulfone 47% TC (MUP) (FI)
89	Dichloropropene and Dichloropropane mixture	130	Flufenacet
90	Diclofop-Methyl	131	Flufenoxuron
91	Diclosulam	132	Flufenzine
92	Dicofol	133	Flumioxazin
93	Difenoconazole	134	Fluopicolide
94	Diflubenzuron	135	Fluopyram and its metabolite
95	Dimethoate	136	Flupyradifurone
96	Dimethomorph	137	Flusilazole (TI)
97	Dinocap	138	Fluthiacet methyl (TIM)
98	Dinotefuron	139	Fluvalinate
99	Dithianon	140	Fluxapyroxad
100	Diuron	141	Fomesafen
101	Dodine	142	Forchlorfenuron
102	D-trans Allethrin	143	Fosetyl-Al
103	Edifenphos	144	Gibberellic Acid
104	Emamectin Benzoate	145	Gossyplure (PB-RopeL)
105	Epoxyconazole	146	Glufosinate Ammonium
106	Ethephon	147	Glyphosate
107	Ethion		
Sl. No.	**Name of the Pesticide**	**Sl. No.**	**Name of the Pesticide**
148	Haloxyfop-R-methyl {Haloxyfop-R-methyl 10.55%.EC formulation under category (FI)}	180	Metaldehyde
149	Helosulfuron methyl	181	Metamifop TI
150	Hexaconazole	182	Metamitron (TIM)
151	Hexazinone	183	Metarhizium anisopliae
152	Hexythiazox	184	Methabenzthiazuron
153	Hydrogen Cyanamide	185	Methomyl
154	Imazamox	186	Methoxyfenazide (FI- WRT)
155	Imazethapyr	187	Methyl Bromide
156	Imidacloprid	188	Methyl Chlorophenoxy Acetic Acid (MCPA)

157	Imiprothrin	189	1-MethylCyclopropene 3.3% V.P (1-MCP)(FI-WRT)
158	Indaziflam {combination formulation Indaziflam+ Glyphosate ammonium under category (FI)}	190	Metiram
159	Indoxacarb	191	Metofluthrin
160	Iprobenfos (Kitazin)	192	Metolachlor
161	Iprodione	193	Metrafenone
162	Iprovalicarb	194	Metribuzin
163	Isoprothiolane	195	Metsulfuron Methyl
164	Isoproturon	196	Milbemectin
165	Kasugamycin	197	Monocrotophos (Monocrotophos is banned for use on vegetables.
166	Kresoxim Methyl	198	Myclobutanil
167	Lambdacyhalothrin	199	Novaluron
168	Lime Sulphur	200	Nuclear polyhyderosis virus of Helicoverpaarmigera
169	Lufenuron	201	Nuclear polyhyderosis virus of Spodopteralitura
170	Magnesium Phosphide Plates	202	Oxadiargyl
171	Malathion	203	Oxadiazon
172	Mancozeb	204	Oxathiapipron
173	Mandipropamid	205	Orthosulfamuron
174	Mepiquate Chloride	206	Oxycarboxin
175	Meptyldiinocop	207	Oxydemeton-Methyl
176	Mesosulfuron Methyl (combination formulation Mesosulfuron Methyl + Iodosulfuron Methyl Sodium)	208	Oxyfluorfen
177	Metaflumizone	209	Paclobutrazol
178	Metalaxyl	210	Paraquat dichloride
179	Metalaxyl-M	211	Penconazole
Sl. No.	**Name of the Pesticide**	**Sl. No.**	**Name of the Pesticide**
212	Pencycuron	250	S-bioallethrin
213	Pendimethalin	251	Sodium acifluorfen (Combination formulation Clodinafop- propargyl + Sodium acifluorfen)
214	Penflufen*	252	Sodium paranitrophinolate
215	Penoxsulam		
216	Permethrin	253	Spinetoram
217	Phenthoate	254	Spinosad
218	Phosalone	255	Spiromesifen
219	Picoxystrobin'TIM	256	Spirotetramat
220	Pinoxaden	257	Streptomycin + Tetracycline
221	Prallethrin	258	Sulfentrazone (TIM)

222	Pretilachlor	259	Sulfosulfuron
223	Primiphos-methyl	260	Sulfoxaflor
224	Prochloraz TI	261	sulphur
225	Profenophos	270	Thiodicarb
226	Prohexadione Calcium	271	Thiomethoxam
227	Propamocarb hydrochloride technical 66% w/w min	272	Thiophanate-Methyl
228	Propanil	273	Thiram
229	Propaquizafop	274	Tolfenpyrad (TIM)
230	Propergite	278	Triadimefon
231	Propetamphos	279	Triafamone (combination formulation Triafamone 20% w/w + Ethoxysulfuron 10% WG % w/w SC FI)
232	Propiconazole	281	Triasulfuron
233	Propineb	282	Trichoderma harzianum
234	Propoxur	283	Trichoderma viride
235	Pseudomonas fluorescens	284	Tricyclazole
236	Pymetrozin (FI), TIM	285	Trifloxistrobin
237	Pyraclostrobin	286	Triflumezopyrim (TIM)
238	Pyrazosulfuron ethyl	287	Triflumizole (FI-WRT)
239	Pyrethrin (pyrethrum)	288	Trifluralin {The registration, import, manufacture, formulation, transport, sell and it's all uses except use in wheat shall prohibited and completely banned vide S.O. 3951(E) dated 8th August 2018}
243	Pyriproxyfen (TI)	289	Validamycin
244	Pyrithiobac sodium	290	Verticillium lecanii
245	Pyroxasulfon (FI- WRT)	291	Zinc Phosphide
246	Quinalphos	292	Zineb
247	Quizalofop ethyl	293	Ziram
248	Quizalofop-P-tefuryl		
249	Saflufenacil		

2.2 The List of HHPs amongst list of nationally registered pesticides

As per the PAN International List of Highly Hazardous Pesticides (HHPs), 2019, globally, there are a total of 28 pesticides listed under extremely hazardous (Class Ia) and 49 pesticides listed under Class Ib, according to the World Health Organization (WHO)-recommended classification of hazardous pesticides. This HHP, list compared with the abovementioned nationally registered pesticides list of India (2019), infers that the 109 pesticides registered in India are highly hazardous. This is around 37% of the nationally registered list of pesticides. However, only 3 of the pesticides (Brodifacoum, Bromadiolone and Flocoumafen) are listed among Class 1a, and Beta-cyflutrhin, Cyfluthrin, Carbofuran, Coumatetralyl, Edifenphos, Methomyl, Monocrotophos,

Oxcydemeton-methyl, Propetamphos and Zinc phosphide are listed under WHO Class Ib,[19] together constituting only 4.4% of the nationally registered list.

Common HHPs in Jharkhand

From the focus group discussions and interaction with input dealers, the following 20 pesticides (6.8% of total pesticides in the national registration list) fall within the PAN International List published in March, 2019 of Highly Hazardous Pesticides - Mancozeb, Carbendazim, Paraquat dichloride, Butachlor, Atrazine, Profenofos, Cypermethrin, Diafenthiuron, Lambda-cychalothrin, Imidacloroprid, Oxyfluorfen, Quinalphos, Chlorpyrifos, Fenvalerate, Propineb, Flubendiamide, Fenpropathrin, Deltamethrin and Triazophos. Glyphosate is another HHP which is reported in use in many locations in Jharkhand, according to various reports.

2.2.1 Active ingredients [20]

Insecticides: Insecticides are classed chemically as carbamates (Carbaryl), organochlorines (Endosulfan), organophosphorus (Monocrotophos), pyrethroids (Permethrin), neonicotinoids (Imidacloprid), various pesticides such as spinosyns (Spinosad), benzolureas (Diflubenzuron), and antibiotics (Abamectin).

Fungicides: Fungicides are categorised as aliphatic nitrogen fungicides (Dodine), amide fungicides (Carpropamid), aromatic fungicides (Chlorothalonil), dicarboximide fungicides (Famoxadone), dinitrophenol fungicides (Dinocap), and others.

Herbicides: Herbicides include anilide herbicides (Flufenacet), phenoxyacetic herbicides (2, 4-D), quaternary ammonium herbicides (Paraquat), chlorotriazine herbicides (Atrazine), sulfonylurea herbicides (Chlorimuron), and others.

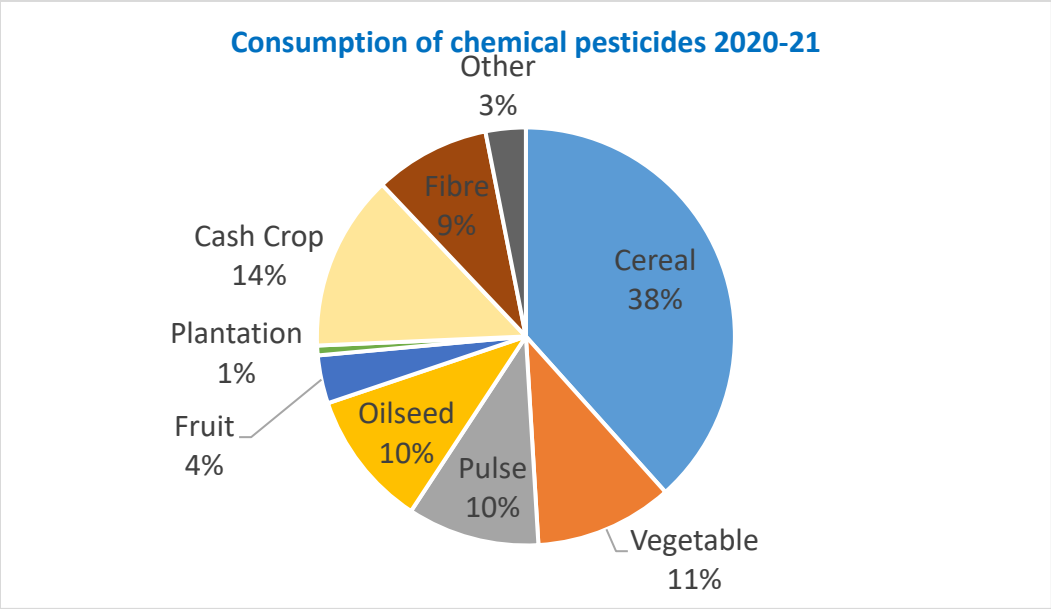
Rodenticides: Rodenticides are classed as inorganic rodenticides (Zinc Phosphide, Aluminium Phosphide) or organic coumarin rodenticides (Bromadiolone, Coumatetralyl)

2.2.2 Crops using HHPs

Farmers use a major amount of pesticides on cereal crops, utilizing around 38% of the total consumption, followed by use in cash crops, vegetables, pules, oilseeds, fibre, fruits, plantation and other usage.

[19] https://pan-international.org/wp-content/uploads/PAN_HHP_List.pdf

[20] Classification of Pesticides: A Review, Article in International Journal of Research in Ayurveda and Pharmacy, September, 2018 by Meghna M Akashe, Ashwin V Nikam & Uaday V. Pawade. https://www.researchgate.net/publication/327536516_CLASSIFICATION_OF_PESTICIDES_A_REVIEW



2.3 General data on the volume of use of HHPs for agriculture

During the period of 2016-17 to 2020-21, the fifteen most consumed pesticides from national as well as imported sources were as follows-

Top 15 pesticides in terms of consumption in India[21]

Pesticide	***Use in MT***
Mancozeb	13613.464
Chlorpyriphos	5131.679
Glyphosate	3139.816
Carbendazim	2880.247
Phorate	2691.798
Malathion	2660.974
Quinalphos	2613.81
Butachlor	2284.568
Cypermethrin	2147.956
Pretilachlor	2056.507
2,4-D Amine Salt	2003.177
Fipronil	1982.444
Profenophos	1935.399
Fenvalerate	1834.426
Monocrotophos	1821.226

Phorate has been banned by the government of India with effect from March, 2020 and is not reported in use now. Seven other top consumed pesticides in the list above - Butachlor, Carbendazim, Chlorpyriphos, Malathion, Mancozeb, Monocrotphos, and 2,4-D

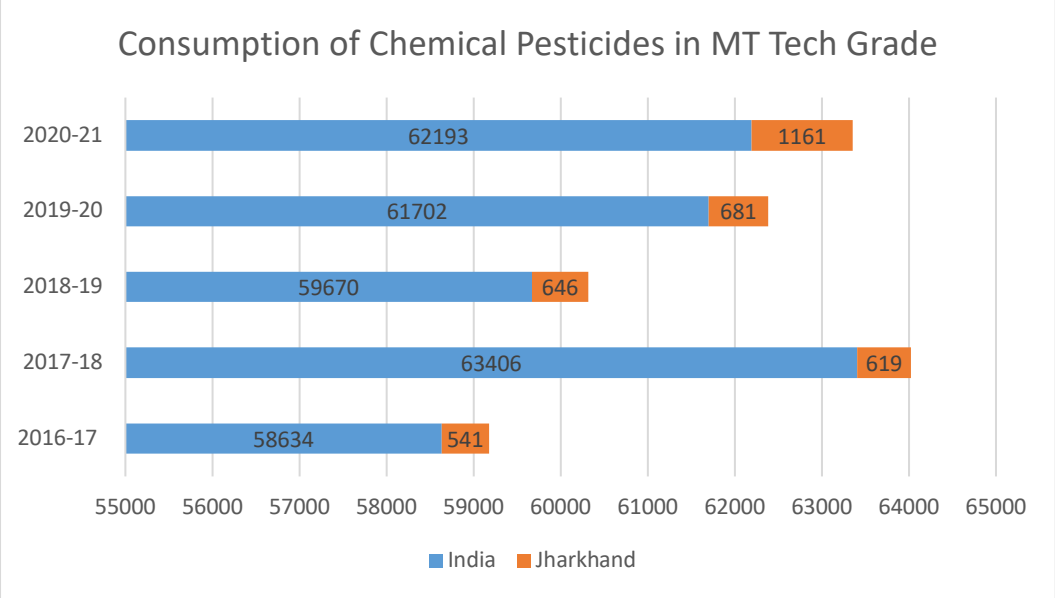
[21] Consumption of Chemical Pesticides – (sections indigenous & imported), during 2016-17 to 2020-21, Directorate of Plant Protection, Quarantine & Storage, Dept of Agriculture, Cooperation & Farmers Welfare

- are among the list of 27 pesticides likely to be banned with an intent and draft notification by the government in May, 2020, as these are harmful to humans and animals[22].

Out of the list above, 10 of the pesticides - Mancozeb, Chorpyrifos, Glyphosate, Carbedazim, Quinalphos, Butachlor, Cypermethrin, Pretilachlor, Profenofos, and Fenvalerate - are commonly found in the study area in Jharkhand.

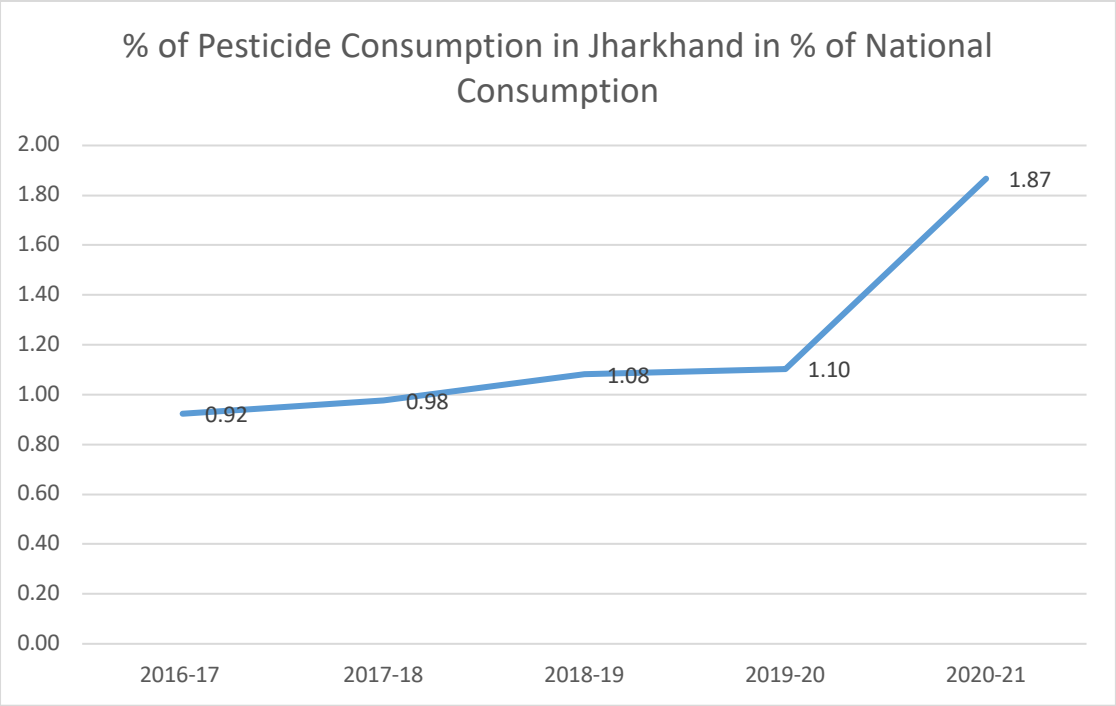
Consumption of chemical pesticides in the state of Jharkhand

In India the consumption trend of chemical pesticides fluctuated over the period of 2016-17 to 2020-21. This consumption data includes extreme, high, moderate and slightly toxic pesticides together. Jharkhand has been a "natural" state, with least chemical pesticide influence, but over the recent period there has been a steady growth in consumption of chemical pesticides, and it almost doubled in during the period 2016-17 to 2020-21 from 0.92% to 1.87%[23].



[22] https://www.thehindu.com/news/national/telangana/move-to-ban-27-pesticides-hailed/article31644063.ece

[23] Consumption of Chemical Pesticides in various states/UTs during 2016-17 to 2020-21 http://ppqs.gov.in/statistical-database



State share of pesticide consumption to national consumption. Source: http://ppqs.gov.in/statistical-database

Consumption of Chemical Pesticides in various states/UTs during 2016-17 to 2020-21

Unit: Quantity in MT Technical Grade

Year	2016-17	2017-18	2018-19	2019-20	2020-21
India	**58634**	**63406**	**59670**	**61702**	**62193**
Jharkhand	541	619	646	681	1161
% Consumption-state share	0.92	0.98	1.08	1.10	1.87

Source: http://ppqs.gov.in/statistical-database

Area under pesticide application

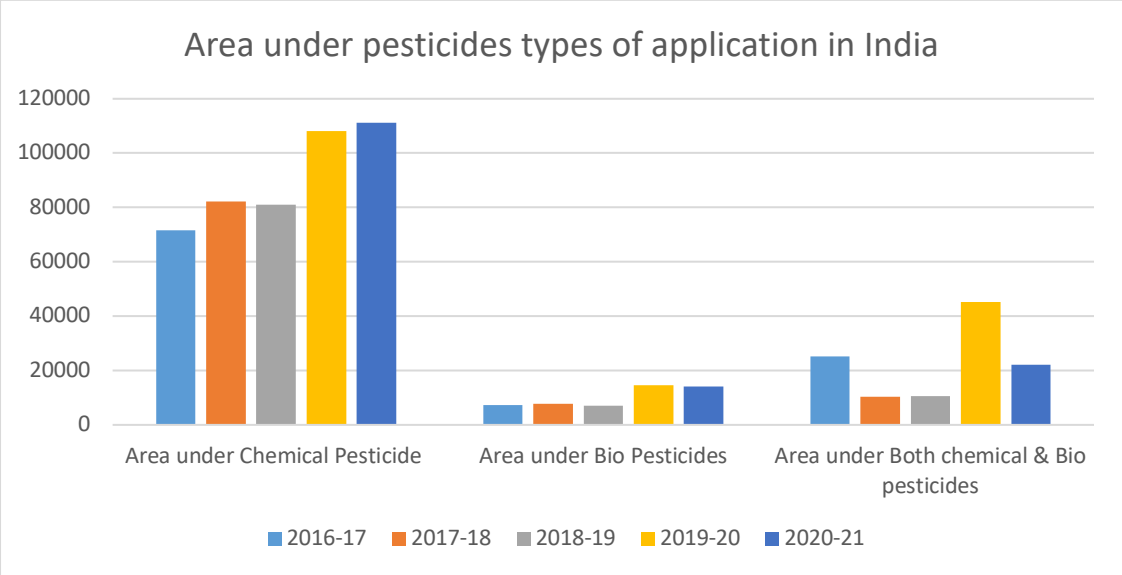
The percentage area under pesticide use of the total cultivation area of the country has decreased[24] over time with promotion of organic farming, integrated pest management practices and safe food demands, but there is an increase in the overall pesticide consumption. This implies that the pesticide application rate has increased at many of the farming locations like Jharkhand, where the application of pesticides was very low.

[24] Area under Cultivation and under Use of Chemical & Bio-pesticides during 2016-17 to 2020-21 http://ppqs.gov.in/statistical-database

Area under cultivation and pesticide use (Area in '000 Ha)

Year	Area under Cultivation	Area under Chemical Pesticide	Area under Bio-Pesticides	Area under Both Chemical & Bio-Pesticides	Total Area under Pesticides	Area Not under Use of Pesticides	% Share of Area under Chemical Pesticide to Total Area under Cultivation
2016-17	120798	71645	7267	25125	104037	28621	59.3
2017-18	132011	82189	7738	10268	100195	36052	62.3
2018-19	141555	81120	7119	10572	98812	45628	57.3
2019-20	198552	108035	14636	45213	167884	52874	54.4
2020-21	188595	111289	14014	22046	147349	41246	59.0

Area under cultivation and pesticide use in India 2016-17 to 2020-21[25]



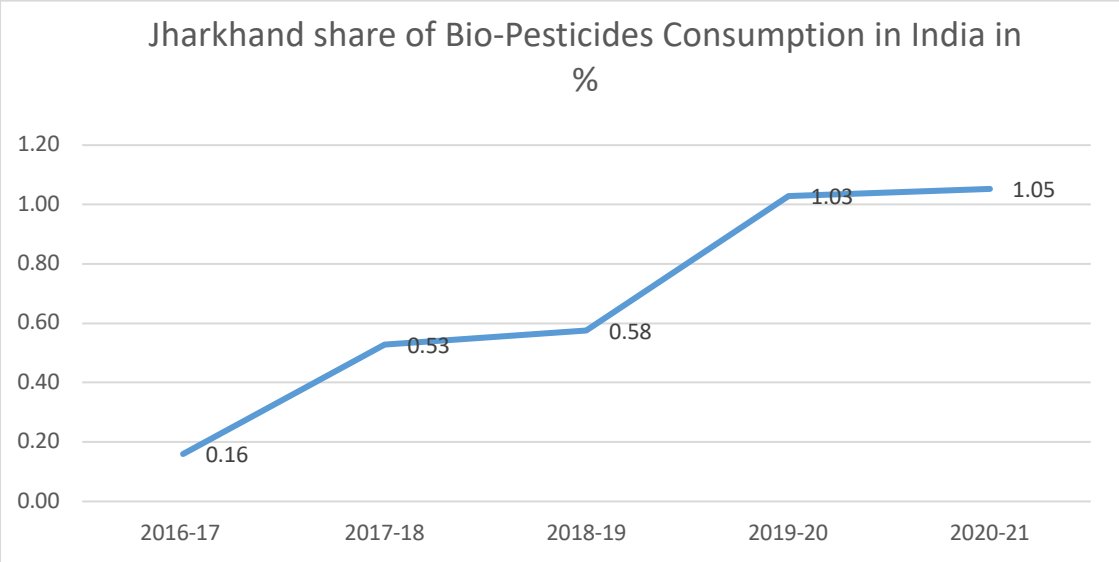
There is an increase in users of chemicals as well as bio-pesticides; this implies that there is some improvement in the farmers practicing bio-pesticides only. Likewise, the increase in the areas of chemical pesticides may be attributed to fallow cultivation promotions and increasing use of pesticides in multiple agriculture and weed management.

[25] Source: Area under Cultivation and under Use of Chemical & Bio-Pesticides during 2016-17 to 2020-21 http://ppqs.gov.in/statistical-database

Consumption of bio-pesticides

	Consumption of Bio-Pesticides in MT Tech Grade				
	2016-17	**2017-18**	**2018-19**	**2019-20**	**2020-21**
Jharkhand	11	38	41	91	91
India	**7190**	**7174**	**7203**	**8847**	**8645**

National and state consumption of bio-pesticides 2016-17 to 2020-21[26]



State share of Consumption of Biol Pesticides in national consumption.

The state share of Jharkhand in national bio-pesticide consumption in MT has increased almost seven times during the period 2016-17 to 2020-21.

A wide range of variations have been noted between the approved use of pesticides and recommended use of pesticides as well as actual use in the field. Additionally, farmers are not following the recommended waiting period (the recommended period between last application and harvest), leaving the produce unsafe for consumption due to pesticide residues. Monocrotophos, for example, despite being banned for use on food crops, is still widely used by farmers on vegetables as well as on its main permitted use for cotton, as demonstrated by the Ministry of Agriculture and Farmer Welfare's "Monitoring of Pesticide Residues at National Level" scheme. This scheme frequently identified Monocrotophos at above the maximum residue limit in samples of vegetables from markets and at the farm gate. Prophenofos 40% + Cypermethrin 4% EC is recommended for cotton bollworm complex, but frequently used on vegetables for a long period. Farmers are using Butachlor within a month, against the recommended

[26] Consumption of Bio-Pesticides Formulations in Various States/UTs during 2016-17 to 2020-21 http://ppqs.gov.in/statistical-database

period of 90 to 120 days. There are also examples of using Chlorpyriphos 01.50% DP on many vegetables in addition to the recommended use of paddy.

Various studies on pesticide use in Jharkhand on indicate that the farmers do not have good access to the particular use of pesticides, nor information about their application methods and safety protocols to follow. The CIBRC list of approved uses are not strictly followed by extension agencies at the national and state level. There have been examples of use of insecticides approved for use on cotton. Most of the farmers rely on the input dealer recommendations for pesticides use in their field. Though the government has introduced a Diploma in Agriculture Extension Services for Input Dealers (DAESI) to improve the quality of advisory services by the input dealers, most of the input dealers need orientation on the prescribed and restricted use of pesticides.

2.4 General data on the volume of use of HHPs for non-agriculture (household and public health) purposes

Some common uses of pesticides for non-agriculture purposes (primarily for household and public health purposes) include use of Bifenthrin 2.5% EC and Chlorpyrifos 50% EC for termites, during pre- and post-construction and also in plywood, veneer and wood. Broadifacoum 0.005%, Bromadiolone 0.005%, Coumatetralyl 0.75%, Flocoumafen 0.005%, and Zinc Phosphide 80% powder is used for rat control. Deltamethrin 02.50% WP, Bifenthrin 10% WP, Chlorpyriphos Methly 40% EC, DDT 50% WP, and Deltamethrin are used for mosquito control. Alphacypermethrin is used for impregnated bed nets for mosquito control for public health. Allethrin is a common pesticide used in the manufacture of mosquito coils. The method of use, dosage and dilution are guided and controlled by the appropriate authority.

2.5 List of HHPs banned in other countries but in use in the country

The study found only one highly hazardous pesticide, Triazophos, used in Jharkhand but banned in India. Triazophos was only recently (December 2020) completely banned in India, and was found in use in some locations.

66 HHPs banned in other countries but in use in India were put under review by the Anupam Varma committee. On recommendations of the committee and CIBRC, use of Aluminium phosphide, Bifenthrin, Carbosulfan, Chorfenapyr, Chloratholonil, Dazomet, Diflubenzuron, Ethofenprox, Fenpropathrin, Iprodione, Kasugamycin, Mepiquat chloride, Predilachlor, Propargite, Metaldehyde, Paraquat dichloride, Propineb, and Zinc phosphide has been recommended to continue with further review suggestions. DDT has been restricted to public health purposes only. Feintrothion and Endosulfan were also banned with a complete phaseout. In the year 2018, the government notified a ban on 18 pesticides: Alachlor, Dichlorvos, Phorate, Phospamidon, Triazophos, Trichlofon Benomyl, Carbaryl, Diazinon, Fenarimol, Fenthion, Linuron, Methyl Ethyl Mercury

Chloride, Methyl Parathion, Sodium cyanide, Thiometon, Tridermorph, and Triffulralin[27].

A further ban was notified in the year 2020 on 27 pesticides, including Acephate, Atrazine, Befuracarb, Butachlor, Captan, Carbendazim, Carbofuran, Chlorpyriphos, Delamethrin, Dicofol, Dimethoate, Dinocap, Diuron, 2,4-D, Malathion, Methomyl, Monocrotophos, Oxyflurofen, Pendimethalin, Quinalphos, Sufosufluron, Thiodicarb, Thiophanate methyl, Thiram, Zineb, and Ziram[28].

After getting objections from the industry against proposed bans, the government has appointed an expert committee to review these objections and submit their report for final decision by the government.

HHPs in use in Jharkhand

There are a total of 20 HHPs in use in Jharkhand as per the PAN International List of Highly Hazardous Pesticides published in March, 2019, which is 6.8% of the national registration list of pesticides. The focus group discussion and direct study confirms use of 17 (5.78%) HHPs. These HHPs are: Paraquat dichloride, Propineb, Triazophos, Atrazine, Butachlor, Carbendazim, Chlorpyrifos, Deltamethrin, Fenpropathrin, Flubendiamide, Fenvalerate, Diaefenthiuron, Lambda-cyhalothrin, Imidaclorpid, Mancozeb, Oxyfluorfen, Quinalphos and Glyphosate, which are still commonly found in use in Jharkhand. This is not an exhaustive list as there may be more HHPs used in the other agriculture-intensive areas of Jharkhand other than the study area.

2.6 Human health, environmental impacts or human rights issues related with HHPs in the nation

Pesticides are used to kill the pests and insects that attack crops and harm them. Different kinds of pesticides have been used for crop protection for centuries. Pesticides benefit the crops; however, they also impose a serious negative impact on the environment and human health. Excessive use of pesticides may lead to the destruction of biodiversity. Many birds, aquatic organisms and animals are under the threat of harmful pesticides for their survival. Pesticides are a concern for the sustainability of environment and global stability[29].

Some of the common pesticides in Jharkhand like Propineb, Butachlor, Fenopropathrin, Mancozeb, and Oxyfluorfen are likely to be carcinogenic, as per US EPA (US Environmental Protection Agency) & IARC (International Agency for Research on

[27] https://www.newindianexpress.com/cities/chennai/2018/aug/15/centre-bans-18-pesticides-activists-say-not-enough-to-deal-with-toxic-deaths-1858004.html
[28] https://www.thehindu.com/news/national/telangana/move-to-ban-27-pesticides-hailed/article31644063.ece
[29] Effects of Pesticides on Environment, In Book Plant Soil and Mcrobes Volume 1: Implications in crop science, Edition 2016, Publisher: Springer International, Editors Khalid Rehman Hakeem et al

Cancer) classifications in PAN pesticides list, 2019. These pesticides may impact human health severely.

Pesticides can persist in the environment for decades, posing a threat to the entire ecological system on which food production depends. They reduce biodiversity, destroy beneficial insect populations, and reduce the nutritional value of food. Their effects on non-target organisms are hugely underestimated.

Environmental impacts –

Impacts on non-target organisms – eg: earthworms, natural predators controlling pest population levels, pollinators, etc.

Loss of biodiversity –

A diverse environment sustains many types of lifeforms, all of which are interdependent. These may range from microbes to insects such as ants, beetles and wasps; to birds; to large animals such as the elephant; and predators such as foxes, wolves, wild dogs, lions, tigers and bears. Such a system has the ability to maintain its balance so that no one species becomes dominant. Sometimes, pest may also be beneficial to biological systems by consuming and controlling other pests.

In some cases, a pesticide may eliminate a species essential to the functioning of the entire community, or it may promote the dominance of an undesired species, or it may simply decrease the number and variety of species present in the community. This may disrupt the dynamics of the food webs in the community by breaking the existing dietary linkages between species[30].

Some of the commonly used pesticides in Jharkhand like Chlorpyrifos, Deltamethrin, Fenopropathrin, Fenvalerate, Diafenthiuron, Lambda-cyhalothrin, Imidaclorpid, and Quinalphos are, according to the PAN pesticide classification 2019, highly toxic to bees. This may have, in the long term, adverse effects on bee populations. Additionally, loss of crop diversity and local flora may occur as bee pollination may become seriously negatively affected due to the effect of these pesticides.

Impact on soil micro flora –

The degraded pesticides interact with the soil and with its native microorganisms, thus altering its microbial diversity, biochemical reactions and enzymatic activity. Any alteration in the microbial diversity and soil biomass eventually leads to disturbance in soil ecosystem and loss of soil fertility. Pesticide application may also inhibit or kill certain groups of microorganisms and outnumber other groups by releasing them from

[30] https://www.researchgate.net/profile/Ishwar-Yadav/publication/313445102_Pesticides_Classification_and_Its_Impact_on_Human_and_Environment/links/589b09a04585158bf6fb8080/Pesticides-Classification-and-Its-Impact-on-Human-and-Environment.pdf

the competition. They may also adversely affect the soils' vital biochemical reactions, including nitrogen fixation, nitrification, and ammonification by activating/deactivating specific soil microorganisms and/ or enzymes. Pesticides have also been reported to influence mineralization of soil organic matter, which is a key soil property that determines the soil quality and productivity.[31]

Impact on water quality–

The excessive use of pesticides is also affecting water quality through chemical contamination. Increased use of herbicides found in all the irrigated/ command areas is a cause of major concern. These areas are one of the major users of pre- and post-emergence herbicides (Glyphosate, Pendimethalin, etc).[32]

Commonly used pesticides in Jharkhand (like Chlorpyrifos and Flubendiamide) have high toxic effects on the aquatic life and may affect fish culture in the ponds within the catchment area of the farm fields using these pesticides.

Impacts on human health –

Pregnant women exposed to pesticides are at higher risk of miscarriage and pre-term delivery, and their babies may be born with birth defects. Studies show cocktails of pesticides in umbilical cords and first faeces of new-borns. Both parents can transfer exposure to pesticides to the child. Fathers exposed to pesticides in the period three months prior to conception can supposedly pose a risk to the foetus, while maternal exposure is most dangerous from one month before conception through the first trimester of pregnancy. Additionally, pesticides can pass through breast milk to the breastfeeding child.

General symptoms of pesticide poisoning[33]

Mild Poisoning	**Moderate Poisoning**	**Moderate Poisoning**
Any of the following:	Any of the mild symptoms, plus any of the following:	Any of the mild symptoms, plus any of the following:
Irritation of the nose, throat, eyes, or skin	Vomiting	Inability to breathe
Headache	Excessive salivation	Extra phlegm or mucous in the airways
Dizziness	Coughing	Small or pinpoint pupils
Loss of appetite	Feeling of constriction in	Chemical burns on the skin

[31] Pesticides: Environmental Impacts and Management Strategies by HK Gill & Harish Garg, DOI 10.5772/57399
[32] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2984095/
[33] Pesticides Classification and its Impact on Human Health and Environment by Ishwar Chandra Yadav & Ningombam Linthoingambi Devi, (pp 140-158). Edition: Vol 6, Toxicology, Chapter 7 https://www.researchgate.net/publication/313445102_Pesticides_Classification_and_Its_Impact_on_Human_and_Environment

	throat and chest	
Thirst	Abdominal cramps	Increased rate of breathing
Nausea	Blurring of vision	Loss of reflexes
Diarrhea	Rapid pulse	Uncontrollable muscular twitching
Sweating	Excessive perspiration	Unconsciousness
Weakness or fatigue	Profound weakness	Death
Restlessness	Trembling	
Nervousness	Muscular incoordination	
Changes in mood	Mental confusion	
Insomnia		

Common chronic diseases of pesticides are as follows-

- Cancer: childhood and adult brain cancer, renal cell cancer, lymphocytic leukemia, prostate cancer
- Neuro-degenerative diseases including Parkinson's disease, Alzheimer's disease
- Cardio-vascular disease including artery disease
- Diabetes (Type 2 Diabetes)
- Reproductive disorders
- Birth defects
- Hormonal imbalances including infertility and breast pain
- Respiratory diseases (asthma, chronic obstructive pulmonary diseases (COPD).

Systematic data on harms associated with pesticide poisoning at the global, national and state level are very limited. Death due to poisoning is reported under the category "injury, poisoning and certain other externalities," which also includes conditions other than the poisoning from highly hazardous pesticides.

There have been some occasional examples of pesticides' impact on human health in India, as follows[34] -

Year	Place	Source	Effect
1984	Bhopal, Madhya Pradesh	Release of Methyl Isocyanate gas used in the production of Carbamate pesticides	Thousands of premature deaths, as well as births of physically and mentally disabled children
1977-87	Kasaragod, Kerala	Aerial spraying of Endosulfan in cashew plantation	Poisoning of villagers, including children

[34] https://www.hhrjournal.org/2021/12/human-rights-perspective-on-pesticide-exposure-and-poisoning-in-children-a-case-study-of-india/#_edn30

2005	Magrawa village, Gujarat	Food contamination with Ethion (a pesticide) at a social gathering	15 people poisoned, many of whom died
2013	Dharamasati Gandaman village, Bihar	Food prepared in cooking oil kept inside a can of Monocrotophos (an insecticide) in a government-run primary school.	Poisoning and death of 23 children

Source: PAN Asia Pacific, Global governance of hazardous pesticides to protect children beyond 2020 (2017); A. Dewan, B. Patel, R Pal, et al. "Mass ethion poisoning with high mortality." Clinical Toxicology 46/1 (2009) pp 85-88

2.7 The precautionary principle and national provisions to phase out HHPs, ban pesticides, and cancel or restrict the already-registered pesticides

Pesticides are regulated in India under the Insecticides Act, 1968, and the Insecticide Rules, 1971. The Central Insecticide Board and Registration Committee (CIBRC) advises the Ministry of Agriculture and Farmers' Welfare on pesticide safety[35]. Its mandate includes reviewing matters relating to –

(a) the risk to human beings or animals involved in the use of insecticides and the safety measures necessary to prevent such risk, and

(b) the manufacture, sale, storage, transport and distribution of insecticides with a view to ensuring safety for human beings or animals.

CIBRC also advises the government on other pesticides such as herbicides and fungicides. The Registration Committee of the CIBRC is responsible for deciding which individual pesticide compounds can be registered for production and sale, domestically and for export. The Insecticides Act does not provide for regular review of registered pesticides, suggesting that registration is currently permanent. Other expert committees occasionally reassess specific registered pesticides if a problem arises, recommending restrictions or bans.

The Food Safety and Standards Authority of India (FSSAI) is the responsible authority in India for recommending tolerance limits of various pesticides in food commodities.

The State Agriculture Universities, State Agriculture departments and other crop-specific institutions like the National Horticultural Board, Species Board of India and other institutions also make recommendations for agriculture practices, which includes use of pesticides specific to local needs based on the local specific research on crops, diseases and insects.

[35] http://ppqs.gov.in/central-insecticides-board

Labelling pesticides has been introduced to indicate the toxicity of pesticides, with following specifications:

Toxicity labels used on pesticides used in India

Label	Label colour	Level of toxicity	Oral lethal dose (LD_{50} mg/kg)	Examples of pesticides (LD_{50} mg/kg)[52]
	Red	Extremely toxic	1-50	Phorate (2) Monocrotophos (14)
	Yellow	Highly toxic	51-500	Chlorpyrifos (135) Fenvalerate (c450)
	Blue	Moderately toxic	501-5000	Atrazine (c2000) Glyphosate (4230)
	Green	Slightly toxic	>5000	Mancozeb (>8000) Oxyfluorofen (>5000)

Some of the persistent organic pollutants (POPs) like Hexachlorbenzene (HCB) and Mirex were never registered in India as pesticides.

The State Departments of Agriculture grant licenses for production of pesticides under central regulations. The Insecticide Inspectors are responsible for enforcement of the Insecticide Act, including implementation of pesticide bans and ensuring that the non-registered products are not used. The state authorities are also responsible for training users of pesticides through extension programs.

2.8 Companies/associations representing the pesticide industry in the country

The Pesticides Manufacturers & Formulators Association of India (PMFAI) represents the over 250 India-based pesticide manufacturers, formulators, and traders. PMFAI member companies manufacture, formulate, sell and distribute almost all the crop protection products that have potential in India[36].

Crop Care Federation of India (CCFI) is one of the oldest and foremost associations of the agrochemical companies In India, with a member base of over 50 leading companies. These companies comprise "Basic Technical Producers" and also major formulators, thus representing the complete gamut of the agrochemical business.[37]

[36] https://www.pmfaiindia.org/
[37] https://cropcarefed.in/

Agro Chem Federation of India (ACFI) liaises with central and state governments, associated government and non-government departments, academic institutions, and farmer associations, etc. [38]

3. National endeavors to phasing out HHPs

3.1 Projects/programs and campaigns to phase out HHPs

The government of India has imposed bans on many HHPs in recent years, which is a positive sign towards HPPs phase out in India. The government has also adopted Integrated Pest Management under the scheme Strengthening & Modernization of Pest Management Approach in India (SMPMA) since 1985, which was rolled out in 1994. Under the program, IPM packages have been developed for 87 crops[39]. This needs further active encouragement and engagement of all the stakeholders towards controlling adverse effects of pesticides by taking the information and activities from laboratories to farm fields. Under the National Institute of Plant Health Management, the Department of Agriculture & Farmers Welfare, the government of India is organizing various programs for different stakeholders, including youth, on organic farming and balanced use of fertilizer and pesticides. Presently, most of the courses are meant for agriculture graduates and needs to further include Farmer Producer Companies and field-based agriculture workers for a massive outreach. The government has also promoted Organic Farming Associations at national and state levels and a Participatory Guarantee System for organic certification; however, the organic movement is picking up at a slow rate and needs active promotion by all concerned.

NGOs in India are playing a vital role in phasing out HHPs and the national campaign for eliminating Endosulfan is a clear example where environmental organizations have contributed significantly. CSE, PAN India, Thanal and other civil society organizations (CSOs) have continuously raised the issues of pesticides misuse for corrective actions, which have in turn been taken up at appropriate forums and often redressed.

Pesticide Action Network (PAN) India is a national non-profit organization working since 2013 in collaboration with the Pesticide Action Network International community. The organization focuses on controlled use of chemical pesticides for life and environment safety and promotes ecological farming to reduce dependency on toxic chemicals[40].

Kheti Virasat Mission is a non-profit organization promoting organic and toxic-free farming in Punjab. It promotes toxic-free farming through campaigns, study, and participatory action for Participatory Guarantee System (PGS) promotion.

[38] https://www.acfiindia.com/
[39] http://ppqs.gov.in/divisions/integrated-pest-management/ipm-glance
[40] https://pan-india.org/

Centre for Science and Environment promotes research, mass education and advocacy on environment, water, food and toxins, renewable energy, climate change and related issues.

Toxics Link is an environmental NGO, dedicated to bringing toxics-related information into the public domain; relating both to struggles and problems at the grassroots level as well as global information to the local levels.

The Bharat Swabhiman campaign promotes natural, toxic-free farming across the country through its nationwide cadre base.

In Jharkhand, Society for Promotion of Wasteland Development, ASA, Bharat Swabhiman campaign, and Sukhar Virodhi Abhiyan are few associations and campaigns to phase out HHPs.

3.2 Main challenges in the process of campaigning the phasing out of HHPs

The majority of farmers in India are small and marginal farmers engaged in conventional agriculture practices. Adhering to the standards and guidelines is difficult for them in the absence of proper education and knowledge of use. Most of these farmers are not aware of the particular use of pesticides, their toxicity and health risks. The comparatively low price of HHPs (in comparison to bio-products) and the instant results are big lures for farmers, most of whom are not very literate and unable to understand the hidden costs and long-term devastating effects of HHPs. Middlemen are highly influential and push sales of the pesticides. As most of the farmers rely on local sellers for the pesticide recommendations, they need to be properly oriented and monitored. Some of the challenges are:

- Limited number of organizations and campaigns working on pesticide management and phasing out of HHPs
- Lack of funding, incentives and self-financing to promote ecological farming and natural farm input use
- Limited evidence and local data base on HHP use and its health risks. This also becomes more challenging when the name of chemicals is not mentioned in the products and sometimes even creates a risk of availability of banned products in disguise.

3.3 Recommendations and project ideas that support the national HHPs phase out

At the policy level, the state government should make policies that keep agro-ecological approaches as the key guiding principles for its agriculture policy. It should undertake

state-wide programmes to promote soil health and incentivize crop diversity. It can build upon some of the ongoing programmes like the soil health card, National Food Security Mission, Pramparagat Krishi Vikas Yojana and Agriculture Technology Management Agency (ATMA). (Parampargat Krishi Vikas Yojna is part of the Soil Health Management scheme under the National Mission of Sustainable Agriculture. It promotes organic farming through a mix of traditional wisdom and improved farming practices to ensure long term soil fertility build-up, resource conservation and climate smart agriculture. The scheme promotes the Participatory Guarantee System for organic farming.)

To establish and promote these principles, the state of Jharkhand should take the following steps:

1 Identify and map the pockets in the state which have low use of pesticides and other chemical inputs.

2 Create a pool of experts to identify the ecologically suitable approach in these regions. As opposed to external input-intensive farming, agro-ecology requires a deep knowledge on how food systems function. It combines local and scientific knowledge. Rather than a fixed set of practices, agro-ecology is neither a defined system of production nor a production technique. The set of practices implemented in a given location should be adapted to the environment and socio-economic contexts.

3 Create a media campaign on the benefits of an agro-ecological approach, and harp on the bad impacts of chemicals on pollinators.

4 The State should promote agricultural universities to undertake more research on agro-ecological practices, and their impacts. Research on production and productivity of mixed farming systems needs to be undertaken.

5 The Krishi Vigyan Kendra should be involved in establishing demonstration models and extension activities.

6 Use the farm field school approach to spread the scale of its adoption. The current crop-based farm field school approach will have to be tweaked so as to cater to the agro-ecological approach.

7 Start a state level incentive programme for farmers practicing natural farming with sufficient yield, and create a strong database of good production without use of HHPs.

8 Improve the access to market. The government should promote a collectivization approach (SHG/ farmer group/ FPO) to improve access of the farmers to better markets.

9 Undertake proper monitoring of pesticide sales and use in the state by the regulatory authorities.

As far as the current situation is concerned, the state should also enforce:

Proper coordination and better regulation of pesticides
The farmers are not properly informed about the usage, precautions, and dosage of pesticides. They are dependent upon the traders. The farmers are using chemicals on crops which are not as per the approved usage.

Manufacturers and input dealers must provide complete information to farmers
Though the name of chemicals and all ingredients are usually displayed on label, they should be given in Hindi as well, as it's commonly used for communication, and a major fraction of the population in the state is not acquainted with the English language.

Raise awareness among the farming community about the dangers of pesticides
Information regarding the dangers and negative health effects of pesticides needs to be provided to farmers. This can be done through newspaper articles, via TV and radio, and through other advertising strategies. The government has a large budget for newspaper advertisements, which can be used for this purpose. A board can be put up in every GP and every Block office showing dangers of pesticides, the need to use protective masks and clothing, and the need to follow the guidelines (approved use, dosages, waiting periods). Provision of systems and standard operating procedures for acute medical emergencies should also be made.

According to The Insecticides Rules 1971 article 3c, one function of the Central Insecticides Board is to advise tolerance limits for insecticides, residues, and an establishment of minimum intervals between the application of insecticides and harvest in respect of various commodities. Such information is not easily accessible to the farmers, which was evident from the discussion held with farmers, and needs to be popularized with help of extension agencies and FPOs.

Develop a 'Code of Conduct' for Pesticide Companies
Advertisements are, by design, suited to the commercial interest of the advertiser and aimed at influencing the buying behavior of farmers, who are often uneducated and unaware of the marketing tactics.

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