2018
APRIL REPORT

MISUSE OF
CHEMICAL PESTICIDES IN JHARKHAND :
WHAT SHOULD BE DONE ?

SPWD
Society for Promotion of Wastelands Development

This report is to be cited as: 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.

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Layout and design: Ravi (9708583770)

Printed at: Dinesh Art Printers (9507992995)

Executive Summary

On the 3rd April 2018, at the 2nd International Agroecology Symposium in Rome, the Director-General of the Food and Agriculture Organization (FAO) José Graziano da Silva called for healthier and more sustainable food systems. Observing that the focus on increasing production at any cost has not been sufficient to eradicate hunger, he said that most food production has been based on high-input and resource-intensive farming systems at a high cost to the environment, and as a result, soil, forests, water, air quality and biodiversity continue to degrade. Citing agroecology as the solution, he said that we need to promote a transformative change in the way we produce and consume food by developing sustainable food systems that offer health and nutritious food.[1]

This report, Misuse of chemical pesticides in Jharkhand: What should be done? focuses on the menace of chemical pesticides. Though just one component of the private sector led agricultural model that also comprises hybrid seed and chemical fertiliser, it is chemical pesticides that are the most harmful to humans and the environment. The careless promotion of an unsustainable, uneconomic and unhealthy mode of agriculture by most government agencies and programmes, and by some of the major non-government agencies, in combination with a lack of regulation of the chemical pesticide industry, is jeopardising the health and well-being of all people – be they the rich and privileged or the poor, the family members of elected representatives, bureaucrats and input dealers or those of farmers and farm labourers.

Chemical pesticides are highly hazardous chemicals that cause a wide range of health problems, ranging from acute effects for those who handle the chemicals, such as eye problems, headaches and skin problems, to chronic long-term effects for farmers and consumers, which may never be diagnosed or treated, such as various types of cancers, forms of dementia, immune system and hormone imbalances which may increase the risk of obesity, diabetes, and reproductive problems. Pesticides travel through the umbilical cord from mother to foetus, and after birth, through breast milk to babies and young children. These cocktails of pesticides can cause a range of problems, including deformities, delays in cognitive development, and other disorders such as autism. Pesticides may cause accidental mass poisonings, as seen in 2013 in a Bihar school, or lead to mass poisonings of farmers and farm workers, as seen in Maharashtra and other Indian states in 2017. Easy access to pesticides has been shown to increase the rate of suicide in populations, with some doctors linking predisposition to suicide with exposure to pesticides. And that is just the effect on human health. Pesticides persist in the environment for decades and reduce biodiversity. They are decimating bee and bird populations, and polluting water sources, soil and air. Pesticides bio-magnify in the food chain, which is why their residues are found in the bodies of arctic polar bears.

In India, highly hazardous chemical pesticides that are banned in other countries continue to be sold openly. Not only are they sold without a requirement of prescription, the input dealers recommend them for use on crops (or for other uses, such as to kill mosquitoes) for which their use is not approved. The pesticide industry is unscrupulous, caring little for farmers or consumers. For this reason it is imperative that the central and state governments regulate the sector properly. Yet this report highlights that regulation is thin on the ground; if not absent. India's pesticide trade continues to be governed by a 50-year Act that till date has not been implemented properly. The Insecticides

[1] http://www.fao.org/news/story/en/item/1113475/icode/

Rules 1971 that accompany the 1968 Act specify, for example, that those engaged in spraying operations should receive an annual medical examination; and that those handling and applying pesticides should be adequately protected with appropriate clothing and respiratory devices. Yet such protective equipment is not available in shops, neither has any farmer worn such equipment.

It is now well established that the 1968 Insecticides Act was intended to facilitate the sale and use of pesticides rather than to protect farmers, farm labourers and consumers by facilitating the judicious use of pesticides. It is therefore of great concern to many in civil society that the central government continues to defer the phasing out (banning) of the most highly hazardous pesticides and the passing of a new Bill to replace the outdated and inadequate 1968 Act. The draft Pesticides Management 2017, it is quite apparent, has been largely shaped by the interests of the pesticide industry and contains little to no improvements on the 1968 Act; including no provisions to minimise pesticide use. Several state governments have however taken steps to improve pesticides regulation, most notably Sikkim state which has banned all chemicals in agriculture. Kerala is an exemplary state for its bans and efforts to improve regulation.

In Jharkhand, the focus of this report, pesticide consumption has risen six-fold in the past six years, similar to the trend found in most northern Indian states. The case study from Bero block in Ranchi district shows that the sampled farmers have used a total of 42 insecticides, eight herbicides, and eight fungicides; of which just four of the insecticides, three of the herbicides, and one of the fungicides were used on approved crops, i.e. applied to crops for which approval is given by the Central Insecticides Board and Registration Committee (CIBRC), Government of India. Highly toxic pesticides like Monocrotophos, which is banned for use on vegetables in India since 2005, is found to be used by farmers on chilli, capsicum, and cucumber. Six of the insecticides found to be used are approved for use only on cotton, which is not even grown in Jharkhand. Corporates like India's United Phosphorus Limited are fully aware of this, yet their salespersons continue to sell such products to input dealers, who in turn push the products on unknowing farmers.

This report highlights the unsafe use and storage of pesticides by farmers and farm labourers. None of the farmers were found to be aware of the concepts of approved use, waiting period or of the need to use personal protective equipment. 70% of the surveyed farmers have suffered health effects from pesticide exposure. More generally, none of the farmers understand the dangers of the highly hazardous pesticides they use. None had received any training or advice from government agencies. Farm labourers deserve mention. Of four interviewed, one was found to use his bare hand to mix pesticides with water, and another was found to have suffered temporary paralysis of his lower arm after he had spilt pesticide on his arm and leg while mixing pesticide and loading his spray machine. The input dealers have a limited understanding of the dangers of pesticides, which indicates a complete failure of the responsible agencies to properly regulate the sector.

It would wrong to compare Jharkhand's pesticide consumption with that of other states to argue that Jharkhand's farmers use relatively less pesticide. Pesticide consumption is falling in the progressive southern states of Andhra Pradesh, Telangana and Karnataka due to farmer movements (notably, Zero Budget Natural Farming), consumer awareness and pressure, and subsequent support by the respective state governments. Such a movement – led by farmers, consumer groups, and civil society organisations – is the need of the hour in Jharkhand.

Acknowledgements

This study was conducted by Society for Promotion of Wastelands Development (SPWD), Eastern Region Office, with its partner organisation Asian Institute for Sustainable Development (AISD). At SPWD we thank our colleagues Sanjay Gorai, Sanjay Singh, Mukund Abhishek Kujur, Ashok Kumar Dutta, Puja Sharma, Arpita Verma, Sachin Kumar Dubey, Binod Kumar and Anupam Ekka. We also thank SPWD's Chairman Shri I. P. Abrol and Executive Director Pramod Tyagi for their support.

Special thanks to co-author Nishant, project coordinator for MKSP, whose energy and passion to assist the farmers of Bero block to switch to organic farming (under the government programme MKSP) is an inspiration for his staff, the farmers, and onlookers alike. Thanks also to Pawan Kumar Mahto, Sanjay Oraon, Mukesh Kumar Yadav and Praveen Singh for assistance during the field study.

We thank the input dealers, especially the two who were most helpful in the research. We do not wish to bracket all input dealers into the homogenous category of 'mercenaries'! We believe that with the right support and training the input dealers can become an essential part of a future regulatory system that places the well-being of farmers and the environment at the forefront.

We also thank the Block Agricultural Extension Officer for kindly agreeing to talk with us. We recognise the constraints imposed upon such officers, namely the fact that they are charged with covering several positions simultaneously. We hope that the findings of this report can be taken in the right way by elected government representatives, bureaucrats and the officers of the concerned agencies, and that with an improved understanding of the serious implications of an unregulated pesticide sector, more sincere steps can be taken to safeguard the well-being of the farming population (farmers, farm labourers, and their families).

We thank C. Jayakumar and Dileep Kumar at Pesticide Action Network-India for covering the fieldwork expenses of this study and for providing clarification on several points.

We thank Kavitha Kuruganti of Alliance for Sustainable and Holistic Agriculture (ASHA) and Soumik Banerjee in Godda district for advice on various topics.

In Ranchi we'd also like to thank the following for attending meetings called on the topic of pesticide misuse in Jharkhand: Balram (Right to Food Campaign), Ajitha George and Raimul Bandra (BIRSA MMC), Daniela Bezzi (freelance journalist), Bineet Mundu and Bhubneshwar Sawaiyan (BIRSA, Land Rights Campaign Centre), Amardip Singh (Environmental Scientist, Research and Planning, XISS), Prathyush Sivadasan (Ekjut), Martin Mathai sj (at High Court, Ranchi), Meghnath (AKHRA), Elina Horo (Adivasi Womens Network), Pawan Kashyap (Field and Forest cooperative), and Prem Verma (Jharkhand Nagrit Prayas and Jharkhand Alternative Development Forum).

We apologise in advance for any mistakes in the text. This topic's a complicated one as the reader will come to see.

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Ranchi, 20th April 2018

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1. Introduction

Pesticides, defined as "any substance or mixture of substances of chemical and biological ingredients intended to repel, destroy or control any pest or regulate plant growth",[2] are designed to kill and harm living organisms. They are applied to protect crops, but they also negatively impact upon human health and the environment, including non-target organisms such as friendly insects. Global pesticide use has continued to increase even though there is evidence that use of pesticides is excessive, uneconomic and indeed unnecessary. There is now global consensus on the need to reduce pesticide use substantially – which will not unduly reduce yields – and to reduce the occupational risks incurred by the farmers and farm labourers who handle the chemicals.

In Jharkhand, according to government data, in the past six years there has been a 6-fold increase in the total consumption of chemical pesticides.[3] An analysis of average pesticide consumption (in kg per 1000 persons), using 2012 population census data, shows that in Jharkhand, consumption has risen from 2.2 to 13.9 kg per 1000 persons over the period 2010-11 to 2016-17. A 2017 study of 493 farming households across the state found that 75% use chemical pesticides.[4] This increase in pesticide use is neither sustainable nor desirable.

Farmer and farm labourers' direct exposure to pesticides is a major cause of ill health and mortality. Studies show that an estimated 30 lakh people are unintentionally poisoned by pesticides across the world each year, causing around 2 lakh deaths by acute poisoning (each year).[5] 99 percent of such deaths are believed to occur in the Global South (non-Western countries) where health, safety and environmental regulations are weak and/or not enforced.[6] In India in late 2017 exposure to pesticides caused the deaths of over 40 and hospitalisation of over 1000 farmers and farm workers in the cotton fields of Yavatmal district, Maharashtra[7] and in Telangana;[8] and an estimated 200 to 300 persons were hospitalised and at least six died in three districts of Tamil Nadu.[9] A total of 442 farmers and farm workers are recorded to have died due to inhalation of pesticides between 2013-14 and 2017-18.[10] Intentional poisoning, i.e. self-poisoning with pesticides is the leading means of

[2] Food and Agriculture Organization of the United Nations (FAO) & World Health Organization (WHO). 2016. *International Code of Conduct on Pesticides Management: Guidelines on Highly Hazardous Pesticides.* Rome. p.vi.

[3] Directorate of Plant Protection, Quarantine and Storage (2016-17 figures are provisional) http://ppqs.gov.in/divisions/pesticides-monitoring-documentation

[4] Hill, J. 2017. *Agrarian crisis in Jharkhand: Results of a farmer survey*. Ranchi: BIRSA MMC.

[5] Svensson, M., Urinboyev, R., Svensson, A.W., et al. (2013). *Migrant agricultural workers and their socio-economic, occupational and health conditions — a literature review*. Lund University. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2297559. p.5.

[6] Report of the Special Rapporteur on the Right to Food. 2017. United Nations General Assembly A/HRC/34/48. http://www.ohchr.org/EN/Issues/Food/Pages/Annual.aspx

[7] Jayakumar, C. 2017. Foreword. In: Reddy, D. N. & Kumar A. D., D. *Pesticide poisonings in Yavatmal district in Maharashtra: Untold realities*. Kerala: Pesticide Action Network (PAN) India.

[8] https://timesofindia.indiatimes.com/city/nagpur/pesticide-related-cases-cropping-up-in-telangana-too/articleshow/61083342.cms

[9] http://www.kisanswaraj.in/2017/12/07/

[10] https://www.hindustantimes.com/mumbai-news/in-three-years-pesticides-killed-183-farmers-in-maharashtra/story-EM2QjJewwec6dKgqglKFLO.html

suicide in much of the world. The World Health Organisation's *World Health Statistics 2017* suggests that limiting access to the means of suicide is an effective way of reducing it.[11]

The side effects on human health and the environment are particularly grave in the Global South where use of highly hazardous pesticides is widespread and there is a low level of awareness on risks. Numerous studies have concluded that pesticide exposure can cause several types of cancer, Parkinson's disease and Alzheimer's disease. Further evidence suggests disruption of the immune system and hormone imbalances which may increase the risk of obesity, diabetes, reproductive problems etc. Exposure of unborn babies to cocktails of pesticides passed via the umbilical cord can cause birth defects, and continued exposure of babies and young children to pesticides passed through breast milk and food can cause a delay in cognitive development, behavioural effects, and disorders like autism and attention deficit hyperactivity disorder.[12] Pesticides are also a drain on the resources of farming families. The costs of purchasing pesticides and the health costs expended on treating the effects of pesticide exposure could be better spent on purchasing food and other necessary goods that would improve the health and well-being of families. Finally, pesticides affect wildlife and the environment, e.g. they are decimating bee populations, birds, and wildflowers. They are also persistent and mobile, e.g. found in the bodies of arctic polar bears.

Concerned about the increasing use of chemical pesticides by farmers in Jharkhand, the Society for Promotion of Wasteland Development (SPWD), Eastern Region Office made contact with Pesticide Action Network-India.[13] PAN-India was preparing to conduct a study in several states on the use of five highly hazardous pesticides, and invited SPWD to carry out the field research in Jharkhand state. While conducting the research with PAN-India, we decided to collect data on all the pesticides used by farmers. This report presents the findings of this study.

This report begins with a literature review (section 2) that gives an overview of pesticides and their effects and presents the classification systems of the World Health Organisation and PAN International. Section 3 presents a brief overview of the Indian policy environment to understand why pesticide use is increasing and whose responsibility it is to regulate the sector. Section 4 gives a brief overview of pesticide use and the policy environment. Section 5 and 6 present the methodology and findings of the qualitative study conducted in Ranchi district's Bero block, which highlights widespread misuse of chemical pesticides. The conclusion and recommendations (section 7) present the solution to the problem of pesticide misuse: a phased ban on the sale and use of pesticides starting with the most dangerous, the proper regulation of pesticide sales and use, and a shift to agro-ecological (organic) farming using non-pesticidal management (NPM).

This report does not address many angles of pesticide regulation in India; for example the registration process to be followed to manufacture and sell pesticides, the use of growth hormones, ripening chemicals, synthetic colours and other chemicals, or the testing of pesticide residues in produce sold on the market. Its chief concern is the health and safety of the farmers and farm labourers who are routinely exposed to chemical pesticides in their farm activities.

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[11] WHO. 2017. *World health statistics 2017: Monitoring health for the SDGs, Sustainable Development Goals*. Geneva: World Health Organisation. http://www.who.int/gho/publications/world_health_statistics/2017/en/

[12] Eyhorn, F., Roner, T., & Specking, H. 2015. *Reducing pesticide use and risks – What action is needed?* Briefing paper. Helvetas. https://assets.helvetas.org/downloads/briefing_paper_pesticide_reduction_including_conclusions.pdf

[13] http://www.pan-india.org/

2. Chemical Pesticides

2.1 Effects of Chemical Pesticides

Pesticides, according to the UN Special Rapporteur on the right to food[14], are a global human rights concern. Pesticides can cause mass poisonings such as those seen in Peru in 1999 when 24 schoolchildren died after consuming Parathion packaged to look like milk and in India in 2013, when 23 schoolchildren died after eating food laced with Monocrotophos. Pesticides are routinely used in suicides, especially in rural areas. The impacts of chronic exposure to hazardous pesticides include cancer, Alzheimer's and Parkinson's diseases, hormone disruption, developmental disorders and sterility. These effects may only manifest years after exposure, making diagnosis and treatment extremely challenging. Effects of exposure to multiple pesticides are poorly understood. Farmers and farm workers are routinely exposed to toxic pesticides, bringing to their homes and families residues on their bodies and clothes. 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 newborns. 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. Pesticides pass through breast milk too.[15]

Consumers are at risk from pesticide residues found in contaminated drinking water, and plants and animal food sources. Foods often contain cocktails of pesticides. Traces on fruits and vegetables may be reduced by washing and cooking, but in some cases levels can be increased by cooking. Washing has no effect on vegetables treated with systemic pesticides, because systemic pesticides are taken up by the plant and distributed through its tissues.[16] Pesticides may bio-accumulate in farmed animals through contaminated feed, e.g. in the milk of cows, and be used in poultry and eggs. They also bio-magnify in the food chain. In the UK, data was presented at a conference in November 2017 showing that the number of chemicals applied to the vegetables sold in supermarkets has increased 17-fold over the past 40 years. In the same conference, evidence was presented to show that the regulatory system for pesticides is failing: as one scientist pointed out, "there are simply too many potential combinations of chemicals to test and regulate".[17] In sum, there is no way of ensuring safe use of pesticides in agriculture.

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. For example, a recent study shows that over the past 27 years, the biomass of flying insects in German nature reserves has declined by 76 percent.[18] Other studies show a 15

[14] Report of the Special Rapporteur on the Right to Food. 2017.
[15] ibid.
[16] The neonics include Imidacloprid, Thiacloprid, Thiamethoxam, Acetamiprid, and Clothianidin. The first four have been identified to be used in Jharkhand.
[17] http://www.gmwatch.org/en/news/latest-news/17988-scientists-warn-of-toxic-chemical-cocktail-in-food
[18] Hallmann C.A., Sorg M., Jongejans E., Siepel H., Hofland N., Schwan H., et al. 2017. More than 75 percent decline over 27 years in total flying insect biomass in protected areas. *PLoS ONE* 12(10): e0185809. https://doi.org/10.1371/journal.pone.0185809

percent drop in Germany's bird population over the past 10 years,[19] and a one-third drop in bird populations in the French countryside.[20] Studies show that the use of organophosphates disorientates birds, such that they lose their ability to find north; and the use of neonics (neonicotinoids) has caused loss of weight in birds and a steep drop in bee populations which are pollinators for most crops.[21] Due to their harmful effects of honey bees, in 2013 the European Commission severely restricted the use of three neonics (Clothianidin, Imidacloprid and Thiamethoxam), such that they can only be used on crops grown in greenhouses.[22]

Glyphosate, the active ingredient of some herbicides, is a particularly controversial pesticide. In 2015 the WHO's International Agency for Research on Cancer (IARC) announced that Glyphosate is a probable carcinogen. However in the same year the European Food Safety Agency (EFSA) concluded that it is unlikely to pose a carcinogenic threat to humans. On 12 December 2017, the European Commission renewed the approval of Glyphosate for 5 years.[23] In recent months studies have revealed links between Glyphosate exposure and shorter pregnancies;[24] and autism in children.[25] Recent research shows high levels of Glyphosate residues in yellow peas, chickpeas, and lentils exported by India to Canada – even in 'organic' pulses; and that correspondingly, pulses exported from Canada to India contain very high levels of Glyphosate residue.[26] It is estimated that 50% of the dry peas and lentils consumed in India come from Canada. Glyphosate is suspected to be a Glycine mimic, and replacing Glycine in protein chains, it corrupts them and leads to multiple diseases.

2.2 Types of Pesticides

There are hundreds of chemical pesticide formulations, some with a single active ingredient and some combination products. Pesticides can be categorised in different ways according to their function, mode of action, chemical grouping, toxicity, or hazardousness. Most often pesticides are distinguished by their function, i.e. insecticides, herbicides, fungicides, rodenticides. The Indian 'crop protection' market share in 2015 comprised insecticides 60%, herbicides 16% and fungicides 18%.[27] This differs from the global pesticides sales share, which comprises herbicides 42%, insecticides 27% and fungicides 22%.[28]

Insecticides can also be classified by the mode of entry in the insect body. Stomach poisons are applied to foliage, such that as the insects move about they pick up the poison on their feet or

[19] https://www.legalreader.com/people-finally-noticing-insect-collapse/
[20] https://www.theguardian.com/world/2018/mar/21/catastrophe-as-frances-bird-population-collapses-due-to-pesticides
[21] https://www.surreynowleader.com/news/on-life-support-research-shows-common-pesticides-starve-disorient-birds/
[22] Member States continue to debate this matter. https://ec.europa.eu/food/plant/pesticides/approval_active_substances/approval_renewal/neonicotinoids_en
[23] https://ec.europa.eu/food/plant/pesticides/glyphosate_en On the same day the EC responded to a civil society initiative to ban Glyphosate that had garnered over 1,000,000 signatures from across 22 countries.
[24] https://ehjournal.biomedcentral.com/articles/10.1186/s12940-018-0367-0
[25] http://healthimpactnews.com/2014/mit-researcher-glyphosate-herbicide-will-cause-half-of-all-children-to-have-autism-by-2025/
[26] Mitra, T. 2017. *Poison foods of North America* https://www.amazon.com/POISON-FOODS-NORTH-AMERICA-navigating-ebook/dp/B06XS4Y6H2#reader_B06XS4Y6H2
[27] http://ficci.in/spdocument/20744/Agrochemicals-Knowledge-report-2016.pdf p. 13
[28] Eyhorn, F., Roner, T., & Specking, H. 2015. *Reducing pesticide use and risks – What action is needed?*

antennae, and while cleaning these parts, ingest the poison. Some of these poisons are mixed with food to kill higher animals, like rodents. Systemic insecticides, most of which act primarily as stomach poisons, are applied to seeds, roots, stems of leaves of plants, and absorbed and translocated to various parts of the plant in doses lethal to the insects which feed on them. Contact poisons are applied as sprays or dusts, either directly onto the body of insects or onto places they frequent, killing the insects by clogging spiracles and respiratory system or by entering the blood and acting as a poison. Other pesticide categories include inert dusts, fumigants, and repellents.[29]

Table 2.1: The different chemical groupings of insecticides

Chemical grouping	Description	Example
Pesticides of plant origin	Classified as bio-pesticides	Azadirachtin, derived from neem
Derived from micro-organisms	Classified as bio-pesticides	Emamectin Benzoate
Synthetic pyrethroids	Exhibit high activity against insects, low mammalian toxicity, effectiveness at low dosages, rapid action and degradation to innocuous residues; highly toxic to honey bees, and in some cases potential endocrine disruptors.	Cypermethrin, Fenvalerate
Organophosphates	Both systemic and non-systemic, i.e. contact. Some are highly toxic (WHO Class I) and most are proven to be highly toxic to honeybees.	Chlorpyrifos, Diazinon, Dichlorvos (DDVP), Dimethoate, Fenthion, Fenitrothion, Methyl Parathion, Monocrotophos, Oxydemeton-Methyl, Phorate, Phosphamidon, Thiometon, Triazophos
Carbamates		Carbofuran, Aldicarb
Chlorinated hydrocarbons	Persist for a long time in plants, in the soil, and accumulate in the body fat of birds, fish and mammals	DDT, Endosulphan, Aldrin, Benzene hexachloride, Chlordane, Dieldrin, Endrin, Heptachlor, Toxaphene
Neonics (Neonicotinoids)	Harmful effects on honey bees	Acetamiprid, Imidacloprid, Thiacloprid, Thiamethoxam
Phenylpyrazoles	Broad spectrum insecticides, e.g. Fipronil is active against soil and foliar insects, and effective against insects resistant to carbamate, organophosphate and pyrethroid insecticides	Fipronil, Ethiprole
Miscellaneous insecticides	Include those from pyridine and pyrazolium groups	Fenpyroximate, Flonicamid

The older herbicides include Butachlor, a selective pre-plant and pre-emergence herbicide, and Paraquat dichloride, a broad spectrum herbicide. Some herbicides have been banned for

[29] Atwal, A.S., & Dhaliwal, G.S. 2000. *Agricultural pests of South Asia and their management*. New Delhi: Kalyani Publishers. pp. 103-106.

manufacture, import and use e.g. Metoxuron and Nitrofen. Popular herbicides include Atrazine, Glyphosate, and Quizalofop ethyl.

The fungicides include copper fungicides (e.g. Copper oxychloride), sulphur and allied compounds, carbamates (e.g. Carbendazim, Mancozeb, Propineb, Metiram), mercury compounds, nitrogen compounds (e.g. Dinocap) and antibiotics. More recently bio fungicides derived from micro-organisms are available on the market, e.g. Kasugamycin, Validamycin.

2.3 WHO Classification of Pesticide Hazard

In 1985 the UN Food and Agricultural Organization (FAO) adopted the *International Code of Conduct on the Distribution and Use of Pesticides*, in recognition of growing evidence of risks and harms associated with the use of pesticides. This was 10 years after the World Health Organisation had approved the *WHO Recommended Classification of Pesticides by Hazard* in 1975. In the 2000s further progress was made. In 2002 the UN Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonised System of Classification and Labelling of Chemicals (UNCETDG/GHS) approved *The Globally Harmonised System of Classification and Labelling of Chemicals.* Later, the WHO hazard classes were revised to align with those of the GHS, resulting in *The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009.*

The WHO's classification of hazard is based primarily on the acute oral and dermal toxicity to the rat, since these determinations are standard procedures in toxicology[30] (table 2.2). The LD_{50} value is a statistical estimate of the number of mg of toxicant per kg of bodyweight required to kill 50% of a large population of test animals.

Table 2.2: WHO classification of pesticide hazard based on acute and dermal toxicity to the rat

WHO class		LD_{50} for the rat (mg/kg body weight)	
		Oral	Dermal
Ia	Extremely hazardous	< 5	< 50
Ib	Highly hazardous	5 – 50	50 – 200
II	Moderately hazardous	50 – 2000	200 – 2000
III	Slightly hazardous	Over 2000	Over 2000
U	Unlikely to present acute hazard	5000 or higher	5000 or higher

According to the GHS classification, class Ia and Ib pesticides are 'fatal if swallowed' (oral) and 'fatal in contact with skin' (dermal). For this reason, campaigners seek that these pesticides are banned. Class II pesticides, which are 'moderately hazardous', are classified as 'toxic if swallowed' (oral) and 'toxic in contact with skin', whereas 'slightly hazardous' pesticides are 'harmful if swallowed or in contact with the skin'.

International environmental treaties have delivered limited success in enabling a transition from use of hazardous pesticides to safer alternatives.[31] The Stockholm Convention on Persistent Organic Pollutants[32], adopted in 2001 and entered into force in 2004, prohibited and restricted the use of an initial set of 12 now largely obsolete pesticides and chemicals. The Rotterdam Convention on the

[30] The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009. See http://www.who.int/ipcs/publications/pesticides_hazard_2009.pdf
[31] Report of the Special Rapporteur on the Right to Food. 2017. p. 13.
[32] http://www.pops.int/

Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade,[33] entered into force in 2004, and built on the voluntary Prior Informed Consent (PIC) procedure initiated by UNEP and FAO in 1989. The pesticides subject to the Rotterdam Convention include Methyl Parathion and Phosphamidon (WHO class Ia) and Monocrotophos (WHO class Ib). These conventions have had limited impacts because of the decision making process which allowed one country to obstruct the listing of pesticides, e.g. Paraquat in the Rotterdam Convention.

In 2006, the Strategic Approach to International Chemicals Management (SAICM) was adopted under the auspices of the UN Environmental Programme (UNEP). It recognised the need for action to reduce dependency on pesticides, and to phase out highly toxic pesticides and promote safer alternatives. That same year, the FAO endorsed SAICM. By 2007 the FAO Council informed the Committee on Agriculture (COAG) of its intention for a new initiative for pesticide risk reduction. In late 2007, the FAO/WHO Joint Meeting on Pesticide Management (JMPM) discussed a paper titled *Addressing Highly Toxic Pesticides (HTPs)*, and identified criteria to identify highly hazardous pesticides (HHPs). These criteria were as follows:

- Pesticides classified by the WHO as classes Ia and Ib (extremely and highly hazardous)
- Pesticides meeting the criteria of carcinogenicity categories 1A and 1B of the GHS
- Pesticides meeting the criteria of mutagenicity categories 1A and 1B of the GHS
- Pesticides meeting the criteria of reproductive toxicity categories 1A and 1B of the GHS
- Pesticides listed by the Stockholm Convention in its Annexes A and B, and para 1 of Annex D
- Pesticides listed by the Rotterdam Convention in its Annexes III
- Pesticides listed under the Montreal Protocol
- Pesticides that show a high incidence of severe or irreversible adverse effects on human health or the environment.

By 2009 the European Union abandoned its former paradigm based only on pesticide risks, with a new authorisation Regulation 1107/2009/EC, which emphasises the need to take intrinsic hazards into account. Thereafter, pesticides proven to be carcinogenic, mutagenic, toxic for reproduction and endocrine disruptors would no longer be authorised for sale/use in the EU.[34]

2.4 PAN International List of Highly Hazardous Pesticides (HHPs)

While welcoming the decisions made by the FAO Council, the COAG and the JMPM, the Pesticides Action Network International felt that the list of HHP criteria had some important shortcomings; in particular, that pesticides with endocrine disrupting properties, eco-toxicology properties, or inhalation toxicity had not been taken into account. Therefore, in 2009 PAN International decided to build on the JMPM criteria to develop a more comprehensive set of hazard criteria, as used by the EU and the US Environmental Protection Agency (EPA). The FAO and WHO definition of HHPs[35] is:

[33] http://www.pic.int/

[34] Pesticide Action Network (PAN) International. 2018, March. PAN International list of highly hazardous pesticides. Hamburg: PAN International. http://www.pan-germany.org/download/PAN_HHP_List.pdf p.4

[35] FAO and WHO (2016): International Code of Conduct on Pesticide Management. Guidelines on Highly Hazardous Pesticides, Rome 2016 http://www.fao.org/publications/card/en/c/a5347a39-c961-41bf-86a4-975cdf2fd063/

Highly Hazardous Pesticides means pesticides that are acknowledged to present particularly high levels of acute or chronic hazards to health or environment according to internationally accepted classification systems such as WHO or GHS or their listing in relevant binding international agreements or conventions. In addition, pesticides that appear to cause severe or irreversible harm to health or the environment under conditions of use in a country may be considered to be and treated as highly hazardous.

First published in 2009, the latest PAN International List of Highly Hazardous Pesticides (HHPs) published in March 2018[36] lists 306 pesticides (up from 297 pesticides listed in the December 2016 edition). The List serves as a list of pesticides to be ***progressively banned***. The List groups hazard criteria according to the following 4 groups:

Group 1: Acute toxicity

Under this category, 27 pesticides are classified as WHO class Ia (extremely hazardous), and 48 as WHO class Ib (highly hazardous). 49 pesticides, many of which are also class Ia or Ib, are classified as 'H330', which means 'fatal if inhaled' according to the Globally Harmonised System (GHS).

Group 2: Long term (chronic) health effects

This group includes proven carcinogens, heritable mutations, human reproductive toxicants, and endocrine disruptors. 54 pesticides are classified as endocrine disruptors or potential disruptors. 29 are considered known or presumed human reproductive toxicants. 4 are known to induce or regarded as if they induce heritable mutations in the germ cells of humans. Among carcinogens, 71 are considered by the EPA to be probable or likely carcinogens, whereas another 1 is considered a carcinogen by the EPA. 10 are considered carcinogens (3) or probable carcinogens (7) by the IARC, and 12 are considered carcinogens by the EU GHS.

Group 3: Environmental hazard criteria

115 of the pesticides are considered to be highly toxic to bees, 29 to be very toxic to aquatic organisms, 16 to be very persistent in water, soil or sediments, and 21 to be very bioaccumulative.

Group 4: International regulations (global pesticide-related conventions)

25 of the pesticides are listed in Annex III of the Rotterdam Convention (on the Prior Informed Consent for Certain Hazardous Chemicals and Pesticides in International Trade), 7 in Annex III of the Stockholm Convention (which aimed at the global elimination of Persistent Organic Pollutants), and 1 (Methyl Bromide) in the Montreal Protocol on Substances that Deplete the Ozone Layer.

PAN International states that the List of HHPs is a work in progress. As and when robust, evidence-based and publicly accessible data becomes available, the List will be updated to include recorded cases of pesticides that have shown a high incidence of severe or irreversible adverse effects on human health or the environment. The current list is limited for various reasons such as poorly understood side effects, e.g. pesticides with endocrine disrupting properties; inadequate measures

[36] http://www.pan-germany.org/download/PAN_HHP_List.pdf

to identify substances of high environmental concern; and non-inclusion of *all* WHO class II (moderately hazardous) pesticides even though some are known to cause health problems.[37]

[37] Ibid. p. 9.

3. Pesticides in India: Legal and Policy Environment

3.1 Insecticides Act 1968, Insecticides Rules 1971, and the CIBRC

Recent deaths and hospitalisation of farmers in Maharashtra, Telangana and Tamil Nadu point to the almost complete failure of the various agricultural agencies charged with managing the sale and use of pesticides[38]. The Centre for Science and Environment has categorically stated the urgent need to fix several longstanding gaps in pesticide management in India, including a ban on the use of WHO class Ia and Ib pesticides, and a new Pesticides Management Bill to stop unsafe use and to improve enforcement. An editorial by the Hindu makes similar points: that farmers "had to rely mainly on the advice of unscrupulous agents and commercial outlets for pesticides, rather than on agricultural extension officers, shows gross irresponsibility on the part of the government".[39]

A few recent examples show the extent of the failure of the government to regulate pesticide sales and use. On 16th April 2018 the Times of India reported that farmers are using Profex Super (Profenofos 40% + Cypermethrin 4%) on oranges trees for the past two years in Nagpur and Amravati districts of Maharashtra. Profex Super, according to the Central Insecticides Board, is approved for use only on cotton. The Director of Central Citrus Research Institute said that the pesticide is not recommended for orange and should never be used.[40] On 31st March 2018 the Times of India reported that Glyphosate is being widely used in Yavatmal district. The Yavatmal agriculture officer said the label on the product's container reads that it is recommended for use only on tea plantations and barren land, and that "Since there are no tea plantations in Yavatmal district, there is no need to allow the use of glyphosate".[41]

So what exactly are the regulations in India that guide pesticide manufacture, sale and use? To understand this we have to go back half a century. The question of pesticide use and regulation was studied in 1964-67 by an expert committee of the Indian Council of Agricultural Research (ICAR) headed by Professor Thacker. As a result the Insecticides Act, 1968[42] was passed to regulate the import, manufacture, sale, transport, distribution and use of insecticides. The enforcement of the Act was transferred to the Ministry of Agriculture in the year 1970. The Insecticides Rules, 1971[43] were immediately framed, and the Central Insecticides Board and Registration Committee (CIBRC) formed. The states were simultaneously advised to appoint all functionaries mentioned in the Act. In the Act and the Rules framed there under, there is compulsory registration of pesticides at the Central level, while licence for their manufacture, formulation and sale are dealt with at the State level. For the effective enforcement of the Insecticides Act, two bodies were constituted at the Central level, i.e. the Central Insecticides Board and the Registration Committee.

[38] http://www.cseindia.org/content/maharashtra-farmer-deaths-highlights-gross-negligence-pesticide-management-india
[39] http://www.thehindu.com/opinion/editorial/toxic-farming/article19866336.ece
[40] https://timesofindia.indiatimes.com/city/nagpur/now-indiscriminate-use-of-pesticides-on-orange-crop/articleshow/63774733.cms
[41] https://timesofindia.indiatimes.com/city/nagpur/agri-department-moots-glyphosate-ban-in-ytl/articleshow/63550947.cms?utm_source=facebook.com&utm_medium=social&utm_campaign=TOIDesktop
[42] See http://cibrc.gov.in/insecticides_act.htm
[43] http://cibrc.gov.in/insecticides_rules.htm

According to the **Insecticides Act, 1968**, the Central Insecticides Board (CIB) advises the central and state governments on issues relating to risk to human beings and safety measures to prevent such risk (article 4.2.a), whereas the Registration Committee (RC) registers pesticides (article 5.a.i).

The post of 'Pesticide Inspector' is an important one.[44] Under article 20.1 it says:

> The Central Government or a State Government may, by notification in the Official Gazette, appoint persons in such number as it thinks fit and possessing such technical and other qualifications as may be prescribed to be Insecticides Inspectors for such area as may be specified in the notification.[45]

The Pesticide Inspector has the ability, if they find that a pesticide is being sold in contravention of the Act, to stop the distribution, sale and use of a pesticide (article 21.1.d):

> to stop the distribution, sale or use of an insecticide which he has reason to believe is being distributed, sold or used in contravention of the provisions of this Act or the rules made thereunder, for a specified period not exceeding twenty days, or unless the alleged contravention is such that the defect may be removed by the possessor of the insecticide, seize the stock of such insecticide.

Under article 37.1, it says:

> 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.

As stated, to enforce the Insecticides Act 1968, the Insecticides Rules 1971 were drafted and the CIBRC formed. According to the **Insecticides Rules 1971**, one function of the Central Insecticides Board is to (article 3.c):

> advise tolerance limits for insecticides, residues and ***an establishment of minimum intervals between the application of insecticides and harvest*** in respect of various commodities [bold italics added for emphasis].

As such, Chapter V of the Insecticides Rules 1971 – titled 'Packing and labelling' – is of interest when considering the information farmers are entitled by law to be provided.[46] In article 16 'Prohibition of sale or distribution unless packed and labelled' it says:

> No person shall stock or exhibit for sale or distribute [or cause to be transported] any insecticide unless it is packed and labelled in accordance with the provisions of these rules.

[44] According to the Directorate of Plant Protection website, for the past six years Jharkhand state has 43 Pesticide Inspectors http://ppqs.gov.in/divisions/pesticides-monitoring-documentation?page=1

[45] See http://cibrc.nic.in/insecticides_rules.htm for the qualifications, according to the Pesticides Rules 1971 (article 26), that a Pesticide Inspector must possess.

[46] Note: We feel that given the ground conditions in India and Jharkhand in particular, i.e. one in which farmers are not receiving training or information on the hazardous nature and correct (approved) usage of pesticides, the information ought to be provided to farmers on the pesticides label and leaflet itself.

In article 18, 'Leaflet to be contained in a package', it says under 18.1 (a-g) that:

> The packing of every insecticides shall include a leaflet containing the following details, namely
>
> a. the plant disease, insects and noxious animals or weeds for which the insecticide is to be applied, the adequate direction concerning the manner in which the insecticide is to be used at the time of application;

Though the above text in article 18.1.a is vague, it means to say that the leaflet should provide information on the crops to which the pesticide can be applied, and the waiting period to be observed between application and harvest.

However, a deeper analysis shows that the Central government, through the CIBRC, does not currently require of manufacturers' that they provide this essential information on the leaflets. On the CIBRC website there is a link 'Guidelines for Registration'[47] (this can also be found on the website of the Directorate of Plant Protection, Quarantine and Storage[48]). Under 1.2, a Word document titled 'Guidelines for registration of pesticides (other than herbicides)' can be downloaded. Under section D, titled 'packaging', point 60 refers to 'Leaflets to contain', and here, under sections c, d, e, and f, we can see that it is **Not Required** (NR) for information regarding 'Detailed directions concerning usages', 'Time of application', 'Application equipment', and 'Waiting period' (Figure 3.1). This is unsatisfactory and rather odd, because if such information is not provided on the label or leaflet accompanying the pesticide, from where else will farmers access such information?

Figure 3.1: Guidelines for registration of pesticides (edited to show material of concern)

1.2 GUIDELINES FOR REGISTRATION OF PESTICIDES (OTHER THAN HERBICIDES) U/S 9(3)/ 9(3B) - as on 05-10-2011

Abbreviations :

R	:	Required	NR	:	Not Required
TIM	:	Technical Indigenous Manufacture	TI	:	Technical Import
FI	:	Formulation Import	FIM	:	Formulation Indigenous Manufacture
IM	:	Indigenous Manufacture	NF	:	New Formulation
CBN	:	Combination	AR		Already Registered

Sl. No.	Parameter	9(3B)			9(3)								9(4)
		TI	TIM	FIM	TI	TIM	FI	FIM	TI Vs TIM	TIM Vs TI	TI (New Source)	NF** (IM)	TIM* (AR) Vs TI
D.	**PACKAGING**												
60.	Leaflets to contRn												
a.	DetRled Chemical composition on leaflets accompanying small labels (upto 250 ml size contRner)	NR	NR	R	NR	NR	NR	R	R	R	NR	R	NR
b.	Introductory para about the pesticide	R	R	R	R	R	R	R	R	R	R	R	R
c.	DetRled directions concerning usages	NR	NR	R	NR	NR	R	R	NR	NR	NR	R	NR
d.	Time of application	NR	NR	R	NR	NR	R	R	NR	NR	NR	R	NR
e.	Application equipment	NR	NR	R	NR	NR	R	R	NR	NR	NR	R	NR
f.	WRting Period	NR	NR	R	NR	NR	R	R	NR	NR	NR	R	NR

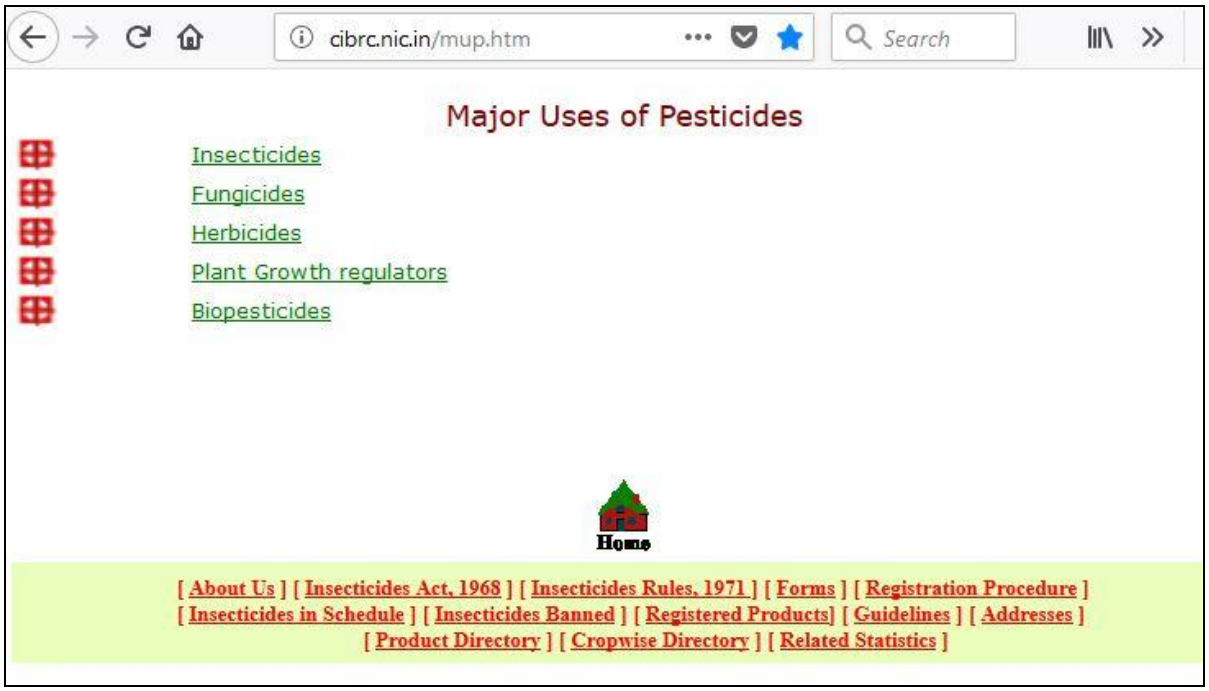
[47] http://cibrc.nic.in/guidelines.htm

[48] http://ppqs.gov.in/divisions/insecticides-act/cib-rc/guidelines?page=3, see page 4, entry no. 40

The Central Insecticides Board and Registration Committee (CIBRC), does however, maintain a list on its website titled 'Major Uses of Pesticides', which provides information on the approved uses, dosage to be applied, and waiting periods to be observed for insecticides, herbicides and fungicides.[49] One problem with the website of the CIBRC is that it presents information only in English language, which means that even if input dealers and farmers were aware and able to access the content, they would not understand it or be able to navigate through the various pages. Indeed, the website of the CIBRC presents information in a scattered way and is poorly maintained.

For example, under 'Major uses of pesticides', lists in Word format can be downloaded of Insecticides, Fungicides, Herbicides, Plant Growth Regulators, and Biopesticides (Figure 3.2). The document for Insecticides is analysed here, to understand how information is provided to the public.

Figure 3.2: Screenshot of the CIBRC's webpage providing details on approved uses of pesticides



The Word file is titled 'Major uses of pesticides' which itself is a vague title that seems to imply that the pesticides can be used for purposes other than those stated. The document is updated only to 30th June 2016. On the cover page it has a disclaimer that reads:

> The document has been compiled on the basis of available information for guidance and not for legal purposes.

If this is so, then one wonders where a farmer, input dealer, or concerned citizen can find information on the tolerance limits for insecticides, residues, and the minimum intervals between the application of insecticides and harvest in respect of various crops. After all, article 3.c of the Insecticides Rules 1971 states this is a function of the Central Insecticides Board.

As an example, Figure 3.3 shows that Acephate 75% SP is approved for use on three crops – cotton, safflower, and rice – and has a waiting period of 15 days between application and harvest.

[49] See http://cibrc.nic.in/mup.htm

Figure 3.3: Screenshot of the top of the first page of the CIBRC's Word document 'Insecticides'

APPROVED USES OF REGISTERED INSECTICIDES

Agricultural use **(AS ON 22.04.2016)**

ACEPHATE 75% SP					
Crop	**Common name of the pest**	**Dosage / ha**			**Waiting Period (days)**
		a.i (gm)	**Formulation (gm/ml)**	**Dilution in Water (Liter)**	
Cotton	Jassids Boll Worms	292 584	390 780	500-1000 500-1000	15
Safflower	Aphids	584	780	500-1000	15
Rice	Stem Borer, Leaf Folder, Plant Hoppers, Green Leaf Hopper	500-750	666-1000	300-500	15

These lists of approved uses also appear to be quite carelessly maintained. For example, the list of fungicides is incomplete, and does not include information for all the combination fungicides, such as for 'Tricyclazole 18% + Mancozeb 62% WP'.[50]

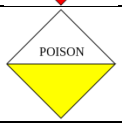
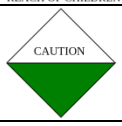
The remaining part of article 18 in the Insecticides Rules 1971, 'Leaflet to be contained in a package', i.e. 18.1.b-g, is clear and is being followed by pesticide manufacturers.

b. particulars regarding chemicals harmful to human beings, animals and wild life, warning and cautionary statements including the symptoms of poisoning suitable and adequate safety measures and emergency first-aid treatment where necessary;
c. … [cont.] …

For example, the use of toxicity labels is followed by all the manufacturers (Table 3.1). It is unclear why the CIBRC does not mention the toxicity of approved pesticides, e.g. extremely (red), highly (yellow) etc, anywhere on its website. One wonders, also, how many farmers understand the colour-coded toxicity labels.[51]

[50] See Fungicides list at http://cibrc.nic.in/mup.htm which is incomplete (cuts off at the end)
[51] http://www.tribuneindia.com/2003/20030331/agro.htm#2

Table 3.1: Toxicity labels used on pesticides 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)

Chapter VIII of the Insecticides Rules 1971 is titled 'Provisions regarding protective clothing…' Under article 37 on 'Medical Examination', article 37.1 states:

> All persons who are engaged in the work of handling, dealing or otherwise coming in contact with the insecticides during manufacture/formulation of insecticides or ***being engaged during spraying operation*** shall be examined medically before their employment and at least quarterly in the case of those engaged in manufacturing / formulation units and ***yearly in any other cases including operators*** while in service by a qualified doctor who is aware of risks to which such persons are exposed. Particulars of all such persons, including the particulars of their medical examination, shall be entered in a register in Form XVII. Where the insecticide in question is an organo phosphorous compound or a carbonate compound, the blood cholinesterase's level shall be measured at least once a month of all persons working in the manufacturing units. The blood residue estimation shall be done once in a year in the case of persons working with organo chlorine group of insecticides in a manufacturing / formulation unit. In the case of spraying people working with the pest-control operators, the estimation of cholinesterase level (if working with organo phosphorous or carbonate compounds) and blood residue (if working with organo chlorine group) shall be conducted as and when advised by the doctor as part of the general medical test [bold and italics added for emphasis].

This means, that if a large farmer employs a worker to spray pesticides, it is the responsibility of that large farmer to have his worker(s) medically examined. Article 39, titled 'Protective clothing' says:

1. Persons handling insecticides during its manufacture, formulation, transport, distribution or application, shall be adequately protected with appropriate clothing
2. The protective clothing shall be used wherever necessary, in conjunction with respiratory devices as laid down in rule 40.

[52] Source: The WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 2009.

3. The protective clothing shall be made of materials which prevent or resist the penetration of any form of insecticides formulations. The materials shall also be washable so that the toxic elements may be removed after each use.
4. A complete suit of protective clothing shall consist of the following dresses, namely :
    a. protective outer garment/overalls/hood/hat
    b. rubber gloves or such other protective gloves extending half-way up to the fore-arm, made of materials impermeable to liquid
    c. dust-proof goggles
    d. boots

Under article 40, titled 'Respiratory devices', it says:

> For preventing inhalation of toxic dusts, vapours of gases, the workers shall use any of the following types of respirators or gas-masks suitable for the purpose, namely:
> a. chemical Cartridge Respirator
> b. supplied-air Respirator
> c. demand flow type respirator
> d. full-face or half-face gas-masks with canister.

Therefore, according to law, such protective clothing should be available with input dealers, and should be provided to farm labourers engaged in pesticide use by large farmers. It is the duty of the state government's concerned agencies to ensure such protective clothing is on sale and thus accessible to farmers, and to provide training to ensure farmers are aware of these specified norms.

3.2 Pesticides registered for sale and use in India

The CIBRC website provides several lists of the insecticides registered in India. Firstly, under the link 'Insecticides in Schedule'[53], a list of 901 pesticides is provided, giving for each the date on which it was added to the schedule. The list was last updated on 30 October 2016, and refers to the sub-clauses (e) (i) and (ii) of Section 3 of the Insecticides Act, 1968. Another list contains insecticides (pesticides) registered under Section 9(3) of the Insecticides Act, 1968.[54] Last updated almost seven years ago, it lists 230 pesticides.

At the bottom of this same webpage one finds several links. One wonders why this information is buried in such a way. Three links are given to three separate documents, two of which are of relevance:

[53] http://cibrc.nic.in/schedulelist.pdf
[54] http://cibrc.gov.in/reg_products.htm

Pesticides and formulations registered for use in the country under the Insecticides Act, 1968

This document[55] lists a total of 384 pesticides, including 268 pesticides and 116 combination pesticides. For the 268 individual pesticides, information is provided about the formulations registered and the total number of formulations registered. For example, 5 formulations of Chlorpyrifos are listed: 20% EC, 10% GR, 1.5% DP, 50% EC and 2% RTU. It also lists 116 approved formulations of combination pesticides. Under Insecticides, 45 such combinations are registered: e.g. Chlorpyrifos 16% + Alphacypermethrin 1% EC under the Company name M/s Acco Industries Ltd, Mumbai, and Chlorpyrifos 50% + Cypermethrin 5% EC, under the Company name M/s De-Nocil, Mumbai. Under Fungicides another 45 combinations are registered, under Herbicides 24 are listed, and 2 combinations of Insecticide + Fungicide are given.

Compendium of registered pesticides, source of supply and list of manufacturers under section 9(3) of the Insecticides Act, 1968

This important document[56] is dated 30th November 2016. For no apparent reason (it must be a mistake), the Word document's filename is called biopesticides. It lists 306 chemicals (it labels them insecticides). This document, however, is not the latest version. The Directorate of Plant Protection, Quarantine and Storage (PPQS), on its website, host a more recent document called 'Source of Import and list of Indigenous Manufactures of Insecticides updated on 31st December 2017'.[57] This document lists 325 'molecules'.

Table 3.2 gives the example of the chemical Chlorpyrifos. We can see that technical grade chlorpyrifos is imported from the USA, UK, Israel and Denmark, and also that it is indigenously manufactured by 31 companies in India (whereas just 1 year and 1 month ago, 27 companies indigenously produced it, meaning that the business is booming).

[55] www.cibrc.nic.in/pesticides.doc
[56] www.cibrc.nic.in/biopesticides.doc
[57] http://ppqs.gov.in/divisions/insecticides-act/cib-rc/news-update

Table 3.2: Example of Chlorpyrifos chemical: Source of supply and indigenous manufacture

Common Name (IUPAC name)	Approved Source for Import (M/s)	Indigenous manufacturers (M/s)
Chlorpyriphos Technical 94% min. (215)	1. Dow Agro Sciences LLC, USA 2. Dow Agro Sciences LLC, UK 3. Mekhteshim Chemical Works, Beer Sheva, Israel 4. FMC Corporation, USA 5. Cheminova Denmark A/s, PO Box 9, DK-7620, Lemvig, Denmark.	1. De-NOCIL Crop Protection Ltd., Mumbai 2. Excel Crop Care Ltd. Ltd., Mumbai 3. Gharda Chemicals Ltd., Mumbai 4. Montari Industries Ltd., Delhi 5. Siris India Ltd., Hyderabad. 6. Vantech Industries Ltd., Hyderabad. 7. GSP Crop Science Ltd., Ahmedabad (RC 305) 8. Sabero Organics Gujrat Limited, 9. India Pesticide Ltd, Lucknow 10. Punjab Chemicals and Crop Protection Ltd, Chandigarh 11. Rotam India Limited, Mumbai 12. Heranba Industries Limited 13. Insecticides India Ltd., 14. Shivalik Rasayan Ltd., New Delhi 15. Bonagri Life Science Ltd, Hubli. 16. Coromandel International Ltd. 17. Hyderabad Chemical Products Pvt. Ltd. 18. Cheminova Inida Ltd., Gujarat 19. Netmatrix Ltd. Hyderabad 20. Megmani Organics Ltd., Ahmedabad 21. Bharat Rasayan Ltd., Delhi 22. Gujarat Insecticides Ltd. Ankleshwar 23. Sudarshan Chemical Industries Ltd., Pune 24. Bhagiratha Chemicals & Industries Ltd. 25. HPM Chemicals & Fertilizers Ltd., 26. Jubilent Life Sciences Ltd., Gajraula, Jyotiba Phule Nagar, UP 27. Best Crop Science LLP, Gajraula, UP 28. Hemani Industries Ltd., 94.0% min. 9(4) 29. Integrated Pesticides (P) Ltd., ., 94.0% min. 9(4) 30. **Sujanil Chemo Industries, Pune**., 94.0% min. 9(4) 31. Coromandel Agrico Pvt. Ltd., New Delhi, 94.0% min. 9(4)

Though all the blame cannot be laid on multinational corporations, for the job of issuing licenses and regulating the sector is that of the Government of India's, there is no doubt that the international trade in pesticides involves majorly unethical practices. Take the chemical Paraquat for example. According to the 'Compendium of registered pesticides' document hosted on the CIBRC website,[58] and the 'Source of Import and list of Indigenous Manufactures of Insecticides' document on the PPQS website, Paraquat dichloride 42% min. is imported from the UK (Syngenta) and Taiwan (Sinon Corporation) and indigenously manufactured by Syngenta in Mumbai too. Furthermore, Paraquat dichloride 40% min. is imported from Taiwan and indigenously produced by Crystal Phosphate Ltd, New Delhi and United Phosphorus Ltd, Mumbai (table 3.3). Paraquat dichloride features in the PAN

[58] www.cibrc.nic.in/biopesticides.doc

International List of Highly Hazardous Pesticides due to its classification as H330 which means, 'fatal if inhaled' according to GHS (Globally Harmonised System). Its health effects, which led to its ban in the EU since 2007, are multiple. Indeed, the EU banned it because even when agricultural workers wear personal protective equipment (and none do in India), the risk of exposure is too high. The effects of chronic exposure include reduced lung function, increased risk of developing Parkinson's disease, endocrine and immunotoxic effects, and increased incidence of leukaemia, lymphoma, skin and brain cancer. Furthermore, studies from South Korea have shown that suicides decreased significantly following a ban on Paraquat use.[59] Therefore, the fact that Syngenta is manufacturing this pesticide in the UK – where its use is banned – and exporting it to the rest of the world where there are weaker regulatory systems should be considered a human rights violation. The UK is not alone. For example, France exports Atrazine which is banned in the EU since 2004.

Table 3.3: Paraquat chemical: Source of supply and indigenous manufacture

Common Name (IUPAC name)	Approved Source for Import (M/s)	Indigenous manufacturers (M/s)
Paraquat dichloride Technical 40% min.	1. Comlets Chemical Industrial Co. Ltd., Taiwan	1. Crystal Phosphate Ltd., New Delhi 2. United Phosphorus Ltd., Mumbai
Paraquat dichloride Technical 42% min. (275)	2. Syngenta Limited, Huddersfield, West Yorkshire HD2 1FF, United Kingdom 3. Sinon Corporation, Regd. Office 1 FL., No. 23, Sec 1, Mei Chuan W. Rd., Taichung, Taiwan, ROC. (Factory address 101, Nanrong Rd., Ta Tu District, Taichung City, 43245, Taiwan, Taiwan (Supplier : Sinon Corporation, Taiuchung)	Syngenta India, Mumbai

The compendium lists the chemicals that are used to produce pesticides, not the pesticides themselves. There appears to be no readily obtainable information on the CIBRC website about the manufacturers of each and every pesticide. This would help a farmer, input dealer, or a concerned government official or citizen to understand which pesticides are genuine and which are spurious/fake.

The CIBRC website is irregularly updated. For example, state-wise data on consumption of pesticides is only provided up until 2004-05, meaning that the previous 12 years' data is not presented.[60] The website is also carelessly maintained. For example, certain links on the homepage do not work, e.g. Product Directory and Cropwise Directory. A cropwise directory, needless to say, would be of great help to farmers or input dealers.

[59] Isenring, R. 2017. *Poisoning and adverse health effects caused by paraquat among agricultural workers and the public – A bibliography of documented evidence*. Public Eye, PAN UK and PAN Asia-Pacific. https://www.publiceye.ch/fileadmin/files/documents/Syngenta/Paraquat/PE_Paraquat_2-17_def.pdf

[60] http://cibrc.nic.in/pestconsum.htm

3.3 Shortcomings of Pesticide Regulation in India

The Insecticides Act 1968 and Rules 1971 were established to promote or facilitate, and not to control, restrict or properly regulate pesticide manufacture, sale and use. Created 50 years ago, the Act and Rules are in desperate need of updating. Not only that, the above analysis shows that the CIBRC has failed to properly inform farmers and civil society about approved uses of pesticides, dosages to apply, and waiting periods to observe. This means that high levels of pesticide residues are more than likely to be found on most agricultural produce reaching the market and our plates.

The poor regulation of pesticides is not unique to India. The Special Rapporteur on the right to food writes that:

> Countries have established significant national laws and practices in an effort to reduce pesticide harm; however, policies and levels of protection vary significantly. For instance, there are often serious shortcomings in national registration processes prior to the sale of pesticide products. It is very difficult to assess the risk of pesticides submitted for registration, particularly as toxicity studies often do not analyse the many chronic health-related effects. Further, reviews may not take place frequently enough and regulatory authorities may be under strong pressure from the industry to prevent or reverse bans on hazardous pesticides. Without standardized, stringent regulations on the production, sale and acceptable levels of pesticide use, the burden of the negative effects of pesticides is felt by agricultural workers, children, the poor and other vulnerable communities, especially in countries that have weaker regulatory and enforcement systems.[61]

These weak regulatory and enforcement systems exist because of the huge pressure and lobbying efforts of vested interests. On the role of the private sector, the Special Rapporteur writes:

> The oligopoly of the chemical industry has enormous power. Recent mergers have resulted in just three powerful corporations: Monsanto and Bayer, Dow and Dupont, and Syngenta and ChemChina. They control more than 65 per cent of global pesticide sales. Serious conflicts of interest issues arise, as they also control almost 61 per cent of commercial seed sales. The pesticide industry's efforts to influence policymakers and regulators have obstructed reforms and paralysed global pesticide restrictions globally. When challenged, justifications for lobbying efforts include claims that companies comply with their own codes of conduct, or that they follow local laws.
>
> Companies often contest scientific evidence of the hazards related to their products, with some even standing accused of deliberately manufacturing evidence to infuse scientific uncertainty and delay restrictions. There are also serious claims of scientists being "bought" to restate industry talking points. Other egregious practices include infiltrating federal regulatory agencies via the "revolving door", with employees shifting between regulatory agencies and the pesticide industry. Pesticide manufacturers also cultivate strategic "public-private" partnerships that call into question their culpability or help bolster the companies' credibility. Companies also consistently donate to educational institutions that conduct

[61] Report of the Special Rapporteur on the Right to Food. 2017. Para. 70, p.16

research on pesticides, and such institutions are becoming dependent on industry owing to shrinking public funding.[62]

These insights explain why government scientists and the agencies responsible for regulating pesticide use are so reluctant to categorically state the crops for which pesticides are approved to be used on. By making this information inaccessible to the farmer, companies increase their sales.

There appears to be no scientific or governmental consensus at the Central level on approved uses of pesticides. Government scientists are not following the approved uses for pesticides as given on the CIBRC website. For example, the Central government's National Institute of Plant Health Management (NIPHM) – which comes under the Plant Protection Division – does not adhere to the CIBRC's list of approved uses. On its website it includes a link, FAQS, which gives examples of Kisan Call Centre responses to questions regarding the pesticides to be used on particular crops to control particular pests.[63] To cite just one example, on page 2, Sanjeev recommends Acephate 75 SP and DDVP 76 EC for midge fly in chilli, whereas according to CIBRC, Acephate 75 SP is approved only for cotton, safflower and rice (see figure 3.3 above); and Dichlorvos 76% EC is approved only for use on paddy, wheat, soybean, castor, groundnut, mustard, sunflower, cucurbit and cashew.

That government scientists do not follow the approved uses for pesticides is firmly established. "A 2013 CSE [Centre for Science and Environment] review of 11 important crops in India — wheat, paddy, apple, mango, potato, cauliflower, black pepper, cardamom, tea, sugarcane and cotton — showed that the pesticide recommendations made by state agriculture universities, agriculture departments and other boards for a crop do not adhere to the pesticides that the Central Insecticides Board and Registered Committee (CIBRC) has registered for those crops. The agriculture universities, departments and boards have recommended many pesticides that have not been registered for some crops. For example, in case of wheat the states of Punjab, Haryana and Madhya Pradesh recommended 11, 5 and 9 pesticides which were not registered by the CIBRC."[64]

A 2013 study on monitoring and risk assessment of pesticide residues in agricultural/horticultural commodities, carried out by scientists from the Food Corporation of India and Kerala Agricultural University, had similar findings. The study reveals that of 33 samples detected with pesticides, "22 samples showed presence of multiple pesticides and most … were not having label claim/approval for use in India by CIB&RC in that specific commodity. Chlorpyriphos was the most frequently detected insecticide followed by profenophos".[65] They found the "presence of pesticides like methyl parathion, profenophos and endosulphan in basmathi rice, cardamom, cumin seed, curry leaf, capsicum and okra samples tested which were banned for sale and use in Kerala state". The authors emphasised that "assessing the risk of pesticide residues in agricultural commodities intended for human consumption is necessary".

[62] Ibid. Paras. 86 and 87, pp. 18-19.
[63] http://niphm.gov.in/Training/FAQs.pdf
[64] http://www.cseindia.org/content/maharashtra-farmer-deaths-highlights-gross-negligence-pesticide-management-india
[65] http://entomon.in/index.php/Entomon/article/viewFile/28/19

3.4 The Anupam Verma Committee and the Government's Failure to Ban Pesticides

A 2017 press release by the Centre for Science and Environment, New Delhi stated that:

> India's abysmal management of pesticides has started taking a deadly toll… there are 18 class I [WHO] pesticides allowed to be used in the country. In 2015-16, of the 7,717 tonnes of pesticides (technical grade) used in the country, 2,254 tonnes were class I pesticides (about 30 per cent of total pesticides). As per the International Code of Conduct on Pesticide Management, jointly released by FAO and WHO, "pesticides whose handling and application require the use of personal protective equipment that is uncomfortable, expensive or not readily available should be avoided, especially in the case of small-scale users and farm workers in hot climates". All class I pesticides require the use of personal protective equipment that is impossible to use by small-scale farmers and farm workers in India. On this basis itself, class I pesticides should have been banned in India long ago.[66]

With regards to personal protective equipment, the Special Rapporteur writes:

> Personal protective equipment may be unsuitable for local working conditions, for example extreme heat and humidity, steep terrain and thick vegetation. Other factors may include pressure to work as fast as possible, lack of training on the health risks of exposure or trainings conducted in non-native languages, coupled with high turnover of workers.[67]

In 2013 an expert committee was constituted under Professor Anupam Verma to carry out a technical review of 66 pesticides that are banned, restricted or withdrawn in one or more countries, but continue to be registered in India. In late 2015 the committee recommended just 13 pesticides to be banned (from 1st January 2018), 27 to be reviewed in 2018, six to be phased out by 2020, a continuation of the ban on Fenitrothion, no assessment of Endosulfan,[68] and continued use of the remaining 18 pesticides (table 3.4).[69]

The recommendations of the Anupam Verma committee were surprising because they show little concern about the continued use, under extremely unsafe conditions, of highly hazardous pesticides, especially given the negative health impacts these pesticides are having on farmers and their families, and consumers more generally. According to a fact finding team headed by Kavitha Kuruganti of Alliance for Sustainable and Holistic Agriculture (ASHA) and Ananthooand Parthasarathy of Safe Food Alliance, there are allegations that the Committee was guided mainly by the pesticides industry in its review process. The Committee, they point out, was headed by an agriculture scientist and not a health expert, as were various other such review committees in the past. To begin with, they only listed 66 pesticides under the "bannable pesticides" category. Furthermore, while India has 18 Class I pesticides (WHO), this Committee reviewed only 11 of these 18.[70] The seven not

[66] http://cseindia.org/content/maharashtra-farmer-deaths-highlights-gross-negligence-pesticide-management-india

[67] Report of the Special Rapporteur on the Right to Food. 2017. p.17

[68] Contrary to popular understanding, Endosulfan has not been banned outright in India. According to the CIBRC, "Endosulfan has been banned by the Supreme Court of India w.e.f. 13-05-2011 for production, use & sale, all over India, till further orders vide ad-Interim order in the Writ Petition (Civil) No. 213 of 2011".

[69] http://pib.nic.in/newsite/mbErel.aspx?relid=147240

[70] Report of a civil society fact-finding visit to Perambalur district in Tamil Nadu to investigate into pesticide poisonings (Unpublished).

reviewed include the extremely hazardous (class Ia) Bromadiolene, and the highly hazardous (class Ib) Beta Cyfluthrin, Coumatetralyl, Cyfluthrin, Edifenphos, Oxydemeton-Methyl, and Propetamphos.

Table 3.4: Recommendation of the expert committee with respect to 66 pesticides (2016)

S. No.	Category	No. of Pesticides	Name of the Pesticides (**WHO class I pesticides in bold**)
1.	**I**- to be continued	18	Aluminium phosphide, Bifenthrin, Carbosulfan, Chlorfenapyr, Chlorothalonil, Dazomet, Diflubenzuron, Ethofenprox, Fenpropathrin, Iprodione, Kasugamycin, Mepiquat chloride, Metaldehyde, Paraquat dichloride, Pretilachlor, Propargite, Propineb and **Zinc phosphide**
2.	**II**- to be reviewed again in 2018, after completion of the recommended studies	27	Acephate, Atrazine, Benfuracarb, Butachlor, Captan, Carbendazim, **Carbofuran**, Chlorpyriphos, Deltamethrin, Dicofol, Dimethoate, Dinocap, Diuron, 2,4-D, Malathion, Mancozeb, **Methomyl**, **Monocrotophos**, Oxyfluorfen, Pendimethalin, Quinalphos, Sulfosulfuron, Thiodicarb, Thiophanate methyl, Thiram, Zineb, Ziram
3.	**III**- to be phased out by 2020	6	Alachlor, **Dichlorvos**, **Phorate**, **Phosphamidon**, **Triazophos**, Trichlorfon
4.	**IV**- ban to be continued	1	Fenitrothion
5.	**V**- to be banned (from 2018)	13	Benomyl, Carbaryl, DDT, Diazinon, Fenarimol, Fenthion, Linuron, MEMC, **Methyl Parathion**, **Sodium Cyanide**, **Thiometon**, Tridemorph, Trifluralin
6.	**VI**- not reviewed as it is sub-judice	1	Endosulfan

The recommendation of the Anupam Verma Committee was to ban three of the 11 reviewed Class I pesticides from 1st January 2018 (Methyl Parathion, Sodium Cyanide, Thiometon), and to phase out another four from 2021 (Dichlorvos, Phorate, Phosphamidon, Triazophos). As the civil society representatives said, there are at least 93 “bannable” pesticides that the Government should have reviewed, including some herbicides like Glyphosate and Paraquat.[71]

The Ministry of Agriculture and Farmers Welfare published a draft notification,[72] the Banning of Pesticides Order, 2016 in The Gazette of India on 28th December 2016. It states that the Central government and the Registration Committee in its 361st special meeting (held in December 2015)[73] deliberated over the report of the Anupam Verma committee. They accepted the need for immediate action, and as such created the Draft Order which mentions 18 pesticides – all those listed in rows 3 and 5 of the above table, except for DDT.[74] According to the Draft Order, from 1st January 2018 the registration, import, manufacture and use of the pesticides listed in row 5 are to be completely banned, and from 31st December 2020 the registration, import, manufacture and use of the pesticides listed in row 3 are to be completely banned.

[71] Ibid.

[72] http://agricoop.nic.in/sites/default/files/banning%20of%20pesticides.pdf

[73] See http://www.cibrc.nic.in/361rc2015.pdf

[74] It is unfortunate that the Central government does not wish to ban DDT. DDT is currently approved for use only in Public Health, mainly to deal with mosquitoes. However it is being carelessly distributed in rural areas and there are reports from Odisha and Jharkhand that it is being used in potato and cauliflower cultivation.

PAN-India welcomed the draft Banning of Pesticides Order, 2016 with reservations. The Director, C. Jayakumar said that the exclusion of the remaining 48 of 66 pesticides from the ban needs to be re-examined immediately. Jayakumar is quoted as saying, "it is unfair and a failure of governance that Indian government allows the use of hazardous pesticides that are either banned or restricted in other countries over health and environmental impacts." C. Jayakumar and Dr Reddy of PAN-India gave the examples of Paraquat and Glyphosate as pesticides that need to be banned. In Switzerland, the home country of Syngenta, Paraquat is banned since 1989 due to its toxicity from humans, yet Syngenta continues to be the main producer of Paraquat and sells it in India and elsewhere.

The 1st January 2018 passed without a notification or order by the government to ban the 12 pesticides as listed in the Draft Order. According to Kavitha Kuruganti of ASHA, the order has been put in abeyance because of the 108 comments received on the draft order. Another committee has been set up to study that feedback and to recommended final action; and its report is several months overdue.

3.5 Pesticide Bans in Punjab, Sikkim, and Kerala

Though the central government appears reluctant to take action to phase out highly hazardous pesticides by use of a progressive ban, several state governments have made progress in this regard. The first to do so was the Government of Kerala whose efforts began with a prohibition of use of Endosulfan in 2006. In 2010, the use of all pesticides having a high toxicity level (red and yellow label) was banned in Kasargodu district. Then, in 2011, the government passed an order to ban the manufacture, sale and use of 14 extremely and highly toxic pesticides (table 3.5). In 2015, a further two pesticides were banned, and 7 classified under restricted category.[75]

Sikkim, a small Indian state of just over 6 lakh population (2011), began its process of going organic in 2003, when the state legislative assembly passed a resolution to transform the state into an organic farming state. By 2005, it stopped receiving its chemical fertiliser quota from the Government of India. In 2010 the Sikkim Organic Mission was launched. In 2014 the 'Sikkim Agricultural, Horticultural Inputs and Livestock Feed Regulation Act, 2014' was passed,[76] which bans/prohibits the import of any chemical inputs for agriculture and horticulture, and as such constitutes a total ban on chemical pesticides sale and use in the state.[77] Among other achievements, Sikkim established a seed and soil testing laboratory, and included a chapter on organic farming in the 5th standard course curriculum of government schools.

[75] Cannot locate this circular.
[76] https://darpg.gov.in/sites/default/files/Agrotourism-Presentation-Ver.1-180816.pdf
[77] http://www.lawsofindia.org/pdf/sikkim/2014/2014Sikkim10.pdf or https://www.sikkim.gov.in/stateportal/UsefulLinks/1-13.pdf

Table 3.5: Pesticides banned in Kerala (in 2011) and Punjab (in 2018)

	Pesticides	PAN Hazard Ranking (March 2018)	WHO class	Banned in Kerala in 2011	Banned in Punjab in 2018	Anupam Verma committee recommend.
1	Phosphamidon	3 (WHO Ia + Bees + PIC)	Ia		Yes	Phase out by 2020
2	Tricholorofon	3 (EDC + Bees + PIC)	II		Yes	Phase out by 2020
3	Benfuracarb	1 (Bees)	II		Yes	Review in 2018
4	Dicofol	1 (POP)	II		Yes	Review in 2018
5	Methomyl	2 (WHO Ib + Bees)	Ib		Yes	NL
6	Thiophanate Methyl	1 (EPA Carc)	U		Yes	Review in 2018
7	Endosulfan	2 (H330 + PIC + POP)	II		Yes	Not review
8	Bifenthrin	2 (EDC + Bees)	II		Yes	Continue
9	Carbosulfan	3 (H330 + Bees + PIC)	II		Yes	Continue
10	Chlorfenapyr	1 (Bees)	II		Yes	Continue
11	Dazomet	NL	II		Yes	Continue
12	Diflubenzuron	NL	III		Yes	Continue
13	Fenitrothion	2 (EDC + Bees)	II		Yes	Ban to continue
14	Metaldehyde	Removed in Nov 2013	II		Yes	Continue
15	Kasugamycin *	NL	U		Yes	Continue
16	Ethofenprox (Etofenprox)	1 (Persist + Aq. Orgs + Bees)	U		Yes	Continue
17	Phorate	2 (WHO Ia + Bees)	Ia	Yes	Yes	Phase out by 2020
18	Triazophos	1 (WHO Ib)	Ib	Yes	Yes	Phase out by 2020
19	Alachlor	2 (EDC + PIC)	II		Yes	Phase out by 2020
20	Monocrotophos **	3 (WHO Ib + H330 + PIC + Bees)	Ib	Yes	Yes	Review in 2018
21	Carbofuran	3 (WHO Ib + H330 + Bees + PIC)	Ib	Yes		Review in 2018
22	Methyl Parathion ***	2 (WHO Ia + H330 + PIC)	Ia	Yes		Ban in 2018
23	Methyl Dementon ****	2 (WHO Ib + Bees)	Ib	Yes		NL
24	Profenophos	1 (Bees)	II	Yes		NL
25	Ediphenphos	1 (WHO Ib)	Ib	Yes		NL
26	Tricyclazone	Removed in Nov 2013	II	Yes		NL
27	Oxithioquinox	NL	NL	Yes		NL
28	Anilophos	NL	II	Yes		NL
29	Paraquat (dichloride)	2 (H330 + PIC)	II	Yes		Continue
30	Thiobencarb	NL	II	Yes		NL
31	Atrazine	1 (EDC)	III	Yes		Review in 2018

Note: 1-24 are insecticides, 25-27 are fungicides, and 28-31 are herbicides

Key to list of pesticides:

* Kasugamycin is listed as a bio-pesticide in the Bio-Pesticides Database.[78]

** Monocrotophos is banned for use on vegetables. (S.O.1482 (E) dated 10th Oct, 2005).

*** Also, Parathion-methyl. Methyl Parathion 50 % EC and 2% DP formulations are banned for use on fruits and vegetables. (S.O.680 (E) dated 17th July, 2001). The use of Methyl Parathion is permitted only on those crops approved by the Registration Committee where honeybees are not acting as pollinators. (S.O.658 (E) dated 04th Sep., 1992.)

**** Also known as Demeton-S-methyl

Key to PAN Hazard ranking:

Acute toxicity: 'WHO Ia' means 'Extremely hazardous'; 'WHO Ib' means 'Highly Hazardous'; 'H330' means 'fatal if inhaled' according to GHS (Globally Harmonised System); Long Term Effects: 'EPA Carc' means 'probable/likely to be carcinogenic' according to the EPA (the US Environmental Protection Agency); 'EDC' means 'Endocrine Disruptor or potential endocrine disruptor' according to the European Union (EU); Environmental Toxicity: 'Persist' means 'Very persistent in water, soils, or sediments'; 'Aq. Orgs' means 'Very toxic to aquatic organisms'; 'Bees' means 'Highly toxic to bees'; Conventions: 'PIC' means 'Listed in Annex III of the Rotterdam Convention'; POP means 'Listed in Annex III of the Stockholm Convention'. Source: PAN International List of Highly Hazardous Pesticides (HHPs), March 2018.[79]

Key to World Health Organisation (WHO) Hazard ranking:

Ia Extremely hazardous, Ib Highly hazardous, II Moderately hazardous, III Slightly hazardous, U Unlikely to present an acute hazard, NL Not listed. Source: Pesticides Properties Database (PPDB), University of Hertfordshire.[80]

Punjab's Special Secretary, Agriculture, on 30th January 2018 issued a notice[81] with the subject heading: Regulation of sale of insecticides in Punjab. It states that the Punjab Agricultural University (PAU), Ludhiana and the Punjab State Farmer's Commission (PSFC) have brought to the attention of the state government, that 20 insecticides have a harmful affect on human beings, environmental sustainability, and economic viability. Therefore, it recommends the 20 insecticides should be discontinued in the state immediately. The pesticides banned in Kerala in 2011 and Punjab in 2018 are listed in table 3.5 along with their PAN and WHO classifications and reference to the Anupam Verma committee recommendations.

Some states have taken innovative steps to improve the safety of their farmers (and consumers). In 2016 the Government of Kerala released a circular declaring a state-wide campaign against the distribution, sale and exhibition for sale of banned pesticides and for regulating the use of restricted pesticides.[82] In 2018 the Government of Telangana decided to implement the 'prescription system' on the lines of a doctor's prescription for medicines. Now, for an input dealer to sell a pesticide to a farmer, the farmer must get a prescription from an Agriculture Officer (AO).[83]

[78] http://sitem.herts.ac.uk/aeru/bpdb/Reports/2195.htm

[79] http://www.pan-germany.org/download/PAN_HHP_List.pdf

[80] http://sitem.herts.ac.uk/aeru/ppdb/en/atoz.htm

[81] Memo No. 15/5/16-Agri2(6)/1670, dated Chandigarh 30/1/2018

[82] Circular no. TQ(1) 35006/16, dated 16.06.2016, and issued on 22.08.2016 by Directorate of Agriculture Development & Farmers Welfare Department, Vikas Bhavan, Thiruvananthapuram.

[83] http://www.newindianexpress.com/states/telangana/2018/mar/10/telangana-to-have-prescription-system-for-pesticides-1784812.html; https://timesofindia.indiatimes.com/city/hyderabad/now-farmers-need-prescription-slips-from-agriculture-officers-to-buy-pesticides/articleshow/63769194.cms

3.6 The Proposed Pesticides Management Bill 2017

In 2008 a Pesticides Management Bill was introduced into Parliament however it was allowed to lapse.[84] Back then, the Alliance for Sustainable & Holistic Agriculture (ASHA) raised several important issues with the framing of the Bill, including that "any new statute on pesticides management should adopt the precautionary principle and get into registering of pesticides only if there are no alternatives are available". Moreover, ASHA makes the valid point "that the regulatory body should not be under the administrative control of the Ministry of Agriculture, which constitutes an objectionable conflict of interest".[85] ASHA had sought amendments to the Pesticides Management Bill 2008.[86]

C. Jayakumar and Dr Narasimha Reddy Donthi of PAN India said in October 2017 that the Insecticides Act of 1968 is not designed to protect the crop, the farmer or the environment. They highlight that the FAO's *International Code of Conduct on the Distribution and Use of Pesticides* includes provisions such that if the weather is hot and unfavourable, alternatives to pesticides should be used, and that the FAO/WHO's *International Code of Conduct on Pesticide Management* shows that if available, a farmer should use an alternative to a hazardous pesticide. They feel that the Pesticides Management Bill under discussion is only concerned with managing pesticides, whereas it has no provisions for registration, labelling, packaging, risk assessment, contamination, licensing; and therefore will not protect farmers or the environment.[87]

On 19th December 2017, the Ministry of Agriculture and Farmers Welfare called a meeting of stakeholders to discuss issues related to the Pesticides Management Bill, 2017.[88] The meeting took place on the 11th January 2018 and its minutes were posted on the Agricultural Ministry's website for a short period afterwards. What stands out most about this stakeholders meeting was that the invitees included representatives of just five Farmers Associations alongside eight Pesticide Associations, one Retailers Association, the multinationals United Phosphorus Limited, Syngenta and Dow Agro-Sciences, and 12 state governments. The comments by the stakeholders made public in the Minutes reveal that very few of the participants were concerned about the health of farmers and consumers.

Following the 11th January meeting, in mid-February the Joint Secretary (Plant Protection) issued a public notice inviting feedback on the draft Bill up till the 5th March 2018. To coincide with the deadline, the Bharat Krishak Samaj, one of the farmers groups invited to the meeting, organised a conference on 5th March to discuss the draft Bill. In their statement, they said the Bill will not serve its purpose, not least because it seeks to put liability for any incidents on the dealers and farmers and not the manufacturers; and encourages pesticide use instead of a decrease in use and phasing out. CSE's Amit Khurana made a similar comment, ""This doesn't talk about minimising pesticides' use". Kavitha Kuruganti of ASHA had commented, "Farmers and farm workers are actually the

[84] http://www.prsindia.org/billtrack/the-pesticide-management-bill-2008-169/
[85] http://www.kisanswaraj.in/2013/12/13/pesticides-management-bill-2008-issues/
[86] http://www.kisanswaraj.in/?attachment_id=1580
[87] http://www.firstpost.com/india/yavatmal-farmer-deaths-experts-say-insecticide-act-1968-needs-overhaul-as-it-is-designed-to-protect-pesticides-not-farmers-4166407.html
[88] http://agricoop.nic.in/sites/default/files/meeting%20on%2011.01.18_updt1.pdf

victims of an aggressive promotion of pesticides industry and making any provisions to penalise them would not be justifiable."[89]

Two prominent farmer-environmental groups, namely PAN-India and ASHA, responded to the call for public feedback. In ASHA's response, which includes comments and suggestions from dozens of farmers', environmental and consumer groups from across India, ASHA conveyed that 1) consultations and collection of feedback was incomplete, 2) biosafety should be at the core of the statute, 3) long-pending regulatory improvements have not been included, 4) state governments should be empowered, 5) there should be no penalisation of farmers, and 6) farmers and farm workers need to be protected. Full details are given in the weblink.[90]

PAN-India responded to the call for public feedback by demanding a transparent and comprehensive consultation process before the bill is passed. PAN-India complained that the draft Pesticides Management Bill, 2017 is not comprehensive enough – it is too rudimentary without serious content to address regulatory concerns and challenges. Dr Reddy points out that the draft Bill 2017 is similar to the 2008 version which was rejected by farmers groups. He notes that the core principle of active regulation is missing in the draft. Furthermore, PAN India drew public attention to the non-transparent manner in which the government has developed the bill. For example, intimation about the 11th January consultation was not widely circulated.[91] It is particularly noteworthy that PAN-India itself was not invited given that the very mandate of the organisation is to work for improved regulation of the pesticide industry.

C. Jayakumar of PAN-India aptly commented that the "Pesticide Management Bill 2017 is not inclusive and does not take cognizance of horrible experiences of Indian farmers and general people who are impacted by the toxicity, which is growing in tandem with the profits. Indian government representation in international conventions such as Rotterdam and Stockholm is at best based on adhocism. The proposed Central Pesticides Board does not have any function that links it to this process". He notes that the draft bill's content "does not address the alarming scenario of pesticide use in India. It rather seems to promote or legalize various industry practices. PAN India in its research has established that pesticides use approved by CIB&RC and recommended by State Agriculture Departments or Universities as well as Commodity boards is not compliance with the specific use a particular pesticide is approved for. There is wide gap in registered purpose, recommended usage, package of practices and field applications."[92]

In Jharkhand, SPWD responded to the call for feedback as part of a coalition of civil society organisations that had in recent months come together, alarmed by the rise in pesticide use in the state. In its letter to the Joint Secretary (Plant Protection), SPWD flagged the short timeframe and lack of transparency in framing the bill and calling for feedback, and noted that the Bill needs to focus more on the primary users (farmers) and secondary users (consumers).

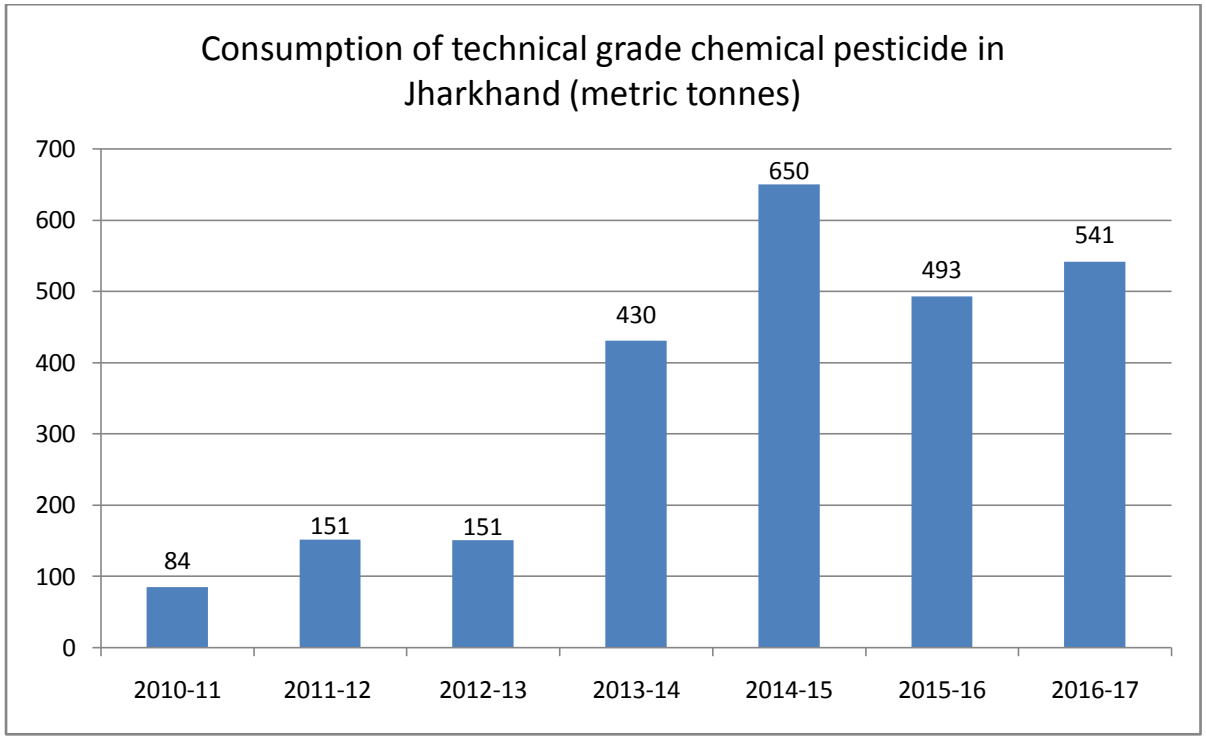
[89] http://www.downtoearth.org.in/news/draft-pesticides-management-bill-2017-makes-farm-workers-and-dealers-responsible-for-spurious-pesticides-use-59851
[90] http://www.kisanswaraj.in/2018/03/05/withdraw-pesticides-management-bill-2017-if-the-objective-is-not-right/
[91] http://www.pan-india.org/toxicity-watchdog-organisations-complain-draft-pesticide-management-bill-2017-not-comprehensive-enough-to-address-issues-on-pesticides-in-india/
[92] Ibid.

4. Macro-level Scenario in Jharkhand vis-à-vis Other States

4.1 Pesticide use in Jharkhand and the policy environment

At the time of its formation in 2000 much of Jharkhand state – aside from certain pockets – was almost organic by default. Use of pesticide by farmers has increased in recent years for two reasons. On the one hand pesticides have been promoted by government policies and programmes, and by certain NGOs through projects. On the other hand, the lack of support provided to farmers (e.g. in Integrated Pesticide Management (IPM) or other agro-ecological techniques) has left them to rely solely on the private sector for advice and inputs. In the past 6 years, there has been a 6-fold increase in consumption of pesticide in Jharkhand, from 84 to 541 metric tonnes (Chart 3.1).

Chart 3.1: Pesticide consumption in Jharkhand (2010-11 to 2016-17)



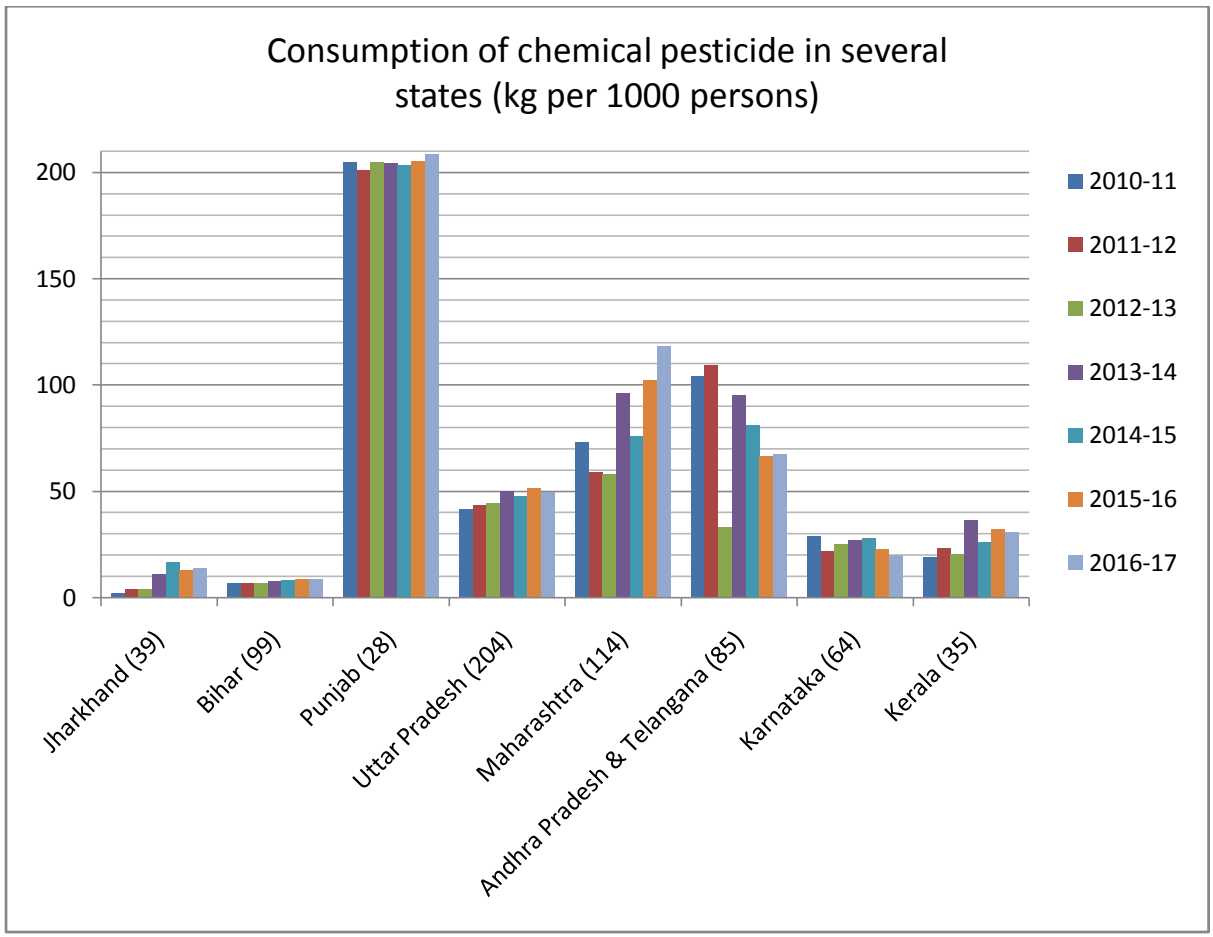
Source: Directorate of Plant Protection, Quarantine and Storage (2016-17 figures are provisional) http://ppqs.gov.in/divisions/pesticides-monitoring-documentation

A 2017 study of 493 farming households located across the state showed that 75% use chemical pesticides.[93] An analysis of average pesticide consumption (in kg per 1000 persons, using 2012 population census data)[94], shows that in Jharkhand, consumption has risen from 2.2 to 13.9 kg per 1000 persons over the past 6 years (Chart 3.2). During this period it has overtaken per capita consumption in Bihar, which marginally increased from 6.8 to 8.5 kg/1000 persons over the same period. Positively, average consumption in Jharkhand is far below that of Punjab, which is relatively stable at 205 to 209 kg/1000 persons. Across many states, pesticide consumption is rising, i.e. in Jharkhand, Bihar, Punjab, Uttar Pradesh and Maharashtra. Some southern states show decreasing trends in overall consumption, e.g. Andhra Pradesh and Telangana (now separated) from 104 to 67 kg/1000 persons, and Karnataka from 29 to 20 kg/1000 persons. In Kerala, surprising given the

[93] Hill, J. 2017. Agrarian crisis in Jharkhand: Results of a farmer survey. Ranchi: BIRSA MMC.
[94] Though not precise, this gives an impression of the pesticide load being handled by the average population.

initiatives taken by the government and civil society, consumption of pesticides has risen from 19 to 31 kg/1000 persons.

Chart 3.2: Pesticide consumption in several states (2010-11 to 2016-17)



Source: Directorate of Plant Protection, Quarantine and Storage (2016-17 figures are provisional) http://ppqs.gov.in/divisions/pesticides-monitoring-documentation

On 9th December 2017 at a seminar at Birsa Agricultural University, Jharkhand's Agricultural Minister Shri Randhir Kumar Singh announced that Jharkhand will go fully organic by 2025. The department has also announced that organic agriculture will be promoted in several of Jharkhand's districts. The question of how the government envisages or conceptualises a transition to organic is presently unclear. **Jharkhand does not have an Agricultural Policy or an Organic Farming Policy** unlike states like Sikkim, Uttarakhand, Karnataka, Kerala, MP, Bihar and Maharashtra that have announced their own organic farming policies[95]. With the support of the state governments, in Karnataka and Andhra Pradesh Zero Budget Natural Farming (ZBNF) has picked up in a big way which might well explain these states' downward trend in consumption of chemical pesticide (Chart 3.2). Karnataka's 2017 Organic Farming Policy[96] states that it aims to bring the net sown area under organic cultivation from 1% to 10% by 2022. Yet Karnataka's organic policy doesn't mention anything about the remaining 90% of net sown area in the state, neither does it express, for example, any desire to regulate the hazardous chemical pesticide trade.

[95] Alvares, C. (2017). *Who's the most organic country of them all?* 19th IFOAM Organic World Congress, 9-11 November 2017, Souvenir and Guide pp. 38-43.

[96] http://organics-millets.in/wp-content/uploads/2017/05/Organic-Policy-Book-English-Final.pdf

In Jharkhand two Central government programmes are supportive of organic farming. The Mahila Kisan Shashaktikaran Pariyojana (MKSP), under the Ministry of Rural Development's National Rural Livelihood Mission (NRLM), is implemented by the Jharkhand State Livelihood Promotion Society (JSLPS) and NGOs including SPWD. The Paramparagat Krishi Vikas Yojana (PKVY), under the Ministry of Agriculture's National Mission for Sustainable Agriculture (NMSA), promotes the Participatory Guarantee System (PGS) model for organic certification. Some 181 PGS groups have been formed in Jharkhand till date, the majority having 50 members (in total around 9,000 farmers). 102 of the PGS groups are registered with the 'Regional Council' Eko Guarantee Division of Encon (Maharashtra), 73 are registered with Biocert International Pvt. Ltd. (Indore, Madhya Pradesh), and the remaining few with regional councils from Bangalore, Delhi, West Bengal, and Madhya Pradesh. As yet, **Jharkhand does not have even one regional council**.[97] By contrast, Kerala has 229 of its own Regional Councils.

At the central level the Department of Agriculture Cooperation and Farmers Welfare (DAC) is organised into 27 Divisions. For example, 'Crops' overseas the programme Bringing the Green Revolution to Eastern India (BGREI), a programme that focuses on the introduction and use of hybrid seed and chemical fertiliser and pesticides by farmers in the eastern Indian states. Another division is called 'Plant Protection'.[98] The Directorate of Plant Protection, Quarantine and Storage itself has four divisions: Integrated Pest Management (IPM), Plant Quarantine, Insecticides Act, and Locust Control.[99] This division is thus charged with both promoting alternatives to pesticides and approving licenses and regulating the safe use of pesticides. According to information on the website, Jharkhand has 43 Pesticide Inspectors (through 2011-12 to 2016-17) monitoring 887 sale points (input dealers). Jharkhand also a Central Integrated Pest Management Centre (one of 35 in India), located at the Krishi Bhawan in Ranchi, with a mandate to conduct Farmers Field Schools (FFSs) to sensitize farmers on Integrated Pest Management (IPM) approach, and safe and judicious use of chemical pesticides *as a last resort* as per approved labels and leaflets.

In 2003 the National Institute of Agricultural Extension Management (MANAGE) launched a self-financed "One-year Diploma in Agricultural Extension Services for Input Dealers (DAESI) Program". Due to its positive impact, the Ministry of Agriculture & Farmers' Welfare decided to implement this programme for input dealers in all the states of the country. According to its website, MANAGE has so far covered practicing input dealers of Andhra Pradesh, Telangana, Tamil Nadu, Maharashtra, Orissa, Jharkhand, and West Bengal. Data for Jharkhand shows that 59 candidates completed the programme in Jharkhand in 2014-15 (two courses ran that year), none completed the programme in 2015-16, just 42 candidates completed the programme in 2016-17 (just one course ran that year), and in 2017-18, 154 candidates completed the programme (four courses were run).[100] Under ongoing courses, Jharkhand is listed to be running 15 programmes in 2017-18, eight by CSPS and seven self-financed, with 600 candidates registered.[101] The course content of this programme, seen at the Krishi Bhawan, includes four modules on pest management, none of which include information on safety equipment to be used, approved uses, waiting periods, etc.

[97] http://pgsindia-ncof.gov.in/RcList.aspx
[98] http://agricoop.nic.in/divisions
[99] http://ppqs.gov.in/
[100] Note: this data was sourced in 2017, so it doesn't make sense that the 2017-18 course is recorded as complete. See http://www.manage.gov.in/daesi/completed.pdf
[101] http://www.manage.gov.in/daesi/ongoing.pdf

5. Study Methodology

In August-September 2017 PAN-India requested Society for Promotion of Wastelands Development (SPWD) to undertake the Jharkhand-level field research for a larger multi-state study it was conducting on five pesticides, namely Chlorpyrifos and Fipronil (both insecticides), Glyphosate, Atrazine and Paraquat (herbicides). The formats prepared by PAN-India were piloted and accordingly slight revisions incorporated which included a more detailed question regarding all the pesticides used by the farmer, including the brand, chemical composition, and crops applied to. This report uses this data and other qualitative and anecdotal material in its analysis and presentation of results. PAN-India's study can be referred to for a detailed analysis of the five above-mentioned pesticides. This report is published as a reference for farmers, government agencies and NGOs in Jharkhand.

SPWD decided to conduct the study in Bero block, Ranchi district, which is one of its working areas. Along with its partner Asian Institute for Sustainable Development (AISD), SPWD is implementing the Mahila Kisan Shashaktikaran Pariyojana (MKSP), a sub-component of the Government of India's National Rural Livelihoods Mission in Bero block since 2014. The research into pesticide use was considered complementary to the project's objective of enhancing farming families' food and nutritional security, because it would help the field staff and farmers reflect upon their use of pesticides and understand better the dangers entailed when using these harmful chemicals.

Bero block was selected as it forms a part of Jharkhand's major vegetable growing belt, supplying fresh produce to cities like Ranchi and Kolkata, and having probably the longest experience with chemical-input farming in the state. For each of the five pesticides we attempted to find at least 10 farmers. For this reason, we only interviewed farmers who use pesticides; and the sample cannot be considered random. The sample includes farmers from six gram panchayats in Bero block, and towards the end of the study, in our search for Glyphosate-using farmers, we strayed across the border into a gram panchayat in Lohardaga district where we interviewed three farmers.

24 farmers, four farm labourers, and four input dealers were interviewed. To conduct the study in an ethical manner, the lead researcher (Joe Hill) and a colleague (much of the time, Nishant), were fully transparent about our background, organisation and the purpose of the study. A letter from PAN-India was shown to the respondents, and a copy given to those who requested it (two of the input dealers). After informing the potential interviewee of these details, they were informed that the information they provided would be treated confidentially, i.e. their name wouldn't be revealed.

With farmers and farm labourers it was relatively easier to establish rapport. When farmers were asked to list all the pesticides they used and the crops they applied them to, most could not give the names. The vast majority throw away empty bottles and packets on their farm, and could not remember the names of the pesticides they'd used. Therefore, to document the pesticides used, we had to rely on examining the bottles and packets kept at the farmers' houses. This means that the total number of pesticides recorded is probably an underestimate.

Photo 5.1: A farmer displays the pesticides he's applied over the past few years

The interviews with farm labourers highlighted that the labourers are more vulnerable than the farmers, partly because they do not themselves purchase the pesticides they use, and so have less information regarding the dangers and the precautions to take. In this sense it was a sombre experience interviewing them and their family members, because we knew better than them the risks from exposure they faced.

With the input dealers we had to make special efforts to build rapport: two of the dealers were quite open to discussion, whereas another became less open on repeated visits, and the fourth was not particularly happy to talk with us; we suspect because he didn't have the license required to sell pesticides. In a rural area on the border of Bero block and Lohardaga district we tried to question three more input dealers, two of which didn't appear to have licenses – needless to say, the dealers were unwilling to talk. Informal interviews were also conducted with input dealers in Ranchi, who act as wholesalers supplying to input dealers from the districts and blocks of the state.

As part of the study, an interview was conducted with the Block Agricultural Extension Officer (BAEO), who is actually the Block Technical Officer but doubles up as the BAEO. Attempts to interview officers at the district level were unsuccessful.

6. Chemical Pesticide Misuse in Bero Block, Ranchi District

6.1 Farmers' Usage of Pesticides (Insecticides, Herbicides, Fungicides, Rodenticides)

The 24 farming households, with an average household size of seven, grow a range of crops through the kharif, rabi and summer seasons. In the kharif paddy, maize, maduwa (millet), gongra (sponge gourd), urad (black gram), kurthi (horse gram), arhar (pigeon pea), khesari (grass pea), mustard, groundnut, soy bean, potato, chilli, bodi (string bean), ginger, pea, tomato, green beans, okra, cucumber, kerala, loki, cabbage, cauliflower, brinjal. In the rabi season, the same crops may be grown (but not paddy or maduwa), and in addition wheat, barley, chana (chickpea), sargunja (niger), tisi (linseed), til (sesame), lotni, simbi, garlic, onion, shimla mircha. In the summer aside from groundnut, only vegetables are grown, namely beans, chilli, brinjal, kaddu (bottle gourd), shimla mircha, cucumber, cauliflower, cabbage, tomato, okra, onion and garlic.

On average the 24 farmers owned 2.45 acres and leased in an extra 2.9 acres. Land cultivated averaged 5.3 acres per farmer, ranging from 1.1 to 15 acres. The farmers had been using pesticides for an average of 19 years, with five farmers estimating they had used pesticides for 30 or more years, and just three farmers saying they had used pesticides for less than 10 years.

The sampled farmers were found to have used a total of 42 insecticides, eight herbicides, and eight fungicides (Appendices 1, 2, 3). Of these, just four of the insecticides, three of the herbicides, and one of the fungicides had been used on approved crops, i.e. applied to crops for which approval is given by the Central Insecticides Board and Registration Committee (CIBRC), Government of India. This means that 38 insecticides, five herbicides and seven fungicides are being illegally/wrongly used by the sampled farmers for non-approved uses. Non-approved use, we should keep in mind, means that no dosage or waiting period is specified. Empty packets of the rodenticide Roban were observed in a farmer's field, which contains the pesticide Bromadiolone, classified as extremely hazardous (class Ia) by the WHO.

Photo 6.1: Discarded packets of a rodenticide in a farmer's field

Extremely and highly hazardous pesticides (according to WHO) used by the sampled farmers

The sampled farmers were found to be using five insecticides and one rodenticide classified as extremely or highly hazardous (class Ia or Ib) by the WHO, and banned in other countries (Table 6.1). Besides their classification by the WHO as being extremely or highly hazardous, the acute toxicity of four of the six pesticides is also measured by their classification as 'fatal if inhaled' by the Globally Harmonised System (GHS). Both Methyl Parathion and Monocrotophos were listed in Annex III of the Rotterdam Convention, and Bromadiolone is 'known or presumed' to be a human reproductive toxicant. Lastly, three of the six pesticides are classified as highly toxic to bees. Notably, Methyl Parathion, Phorate, Monocrotophos and Triazophos are banned in 37 or more countries of the world; all of them in the EU. Farmers have no idea about any of the above-mention classification systems or bans.

Table 6.1: Summary table on pesticides classified by WHO as extremely or highly hazardous

No.	Pesticide name	WHO class	Other class. systems *	No. of countries banned[102]	Status in India	Use on non-approved crops by farmers
1	Bromadiolone	Ia	H330; Repro	2	-	Peas
2	Methyl Parathion	Ia	H330; PIC	59 (inc. 28 EU countries)	Only allowed on crops where honey bees do not act as pollinators since 1992, banned for use on fruits and vegetables since 2001; to be banned in 2018	Maize
3	Phorate	Ia	Bees	37 (inc. 28 EU countries)	To be banned in 2021	- (no waiting period given by CIBRC)
4	Betacyfluthrin (Betacyfluthrin 8.5% + Imidacloprid 21%)	Ib	H330; Bees	1	-	Capsicum
5	Monocrotophos	Ib	H330; PIC; Bees	60 (inc. 28 EU countries)	Banned for use on vegetables since 2005[103]; to be reviewed in 2018	Chilli, capsicum, cucumber
6	Triazophos (Triazophos 40% EC, Deltamethrin 1% + Triazophos 35%)	Ib	-	40 (inc. 28 EU countries)	To be banned in 2021	Brinjal, beans, chilli, paddy, other vegetables

Note: * 'H330' means 'fatal if inhaled' according to Globally Harmonised System (GHS); 'Repro' means 'known or presumed human reproductive toxicant' according to EU GHS; 'PIC' means 'Listed in Annex III of the Rotterdam Convention'; 'Bees' means 'Highly toxic to bees'. Source: PAN.

[102] http://pan-international.org/pan-international-consolidated-list-of-banned-pesticides/ as of April 2017.
[103] S.O.1482 (E) dated 10th Oct, 2005, See http://cibrc.nic.in/list_pest_bann.htm

All the pesticides were found to be used on non-approved crops. Most worryingly, Monocrotophos, which is banned for use on vegetables in India since 2005, was used by farmers on chilli, capsicum, and cucumber. Phorate, which has a long list of approved crops (see Appendix 1), is widely used by the farmers. Surprisingly (and worryingly), given that its acute toxicity is classified as extremely hazardous, no waiting periods have been established for Phorate by the CIBRC.

Substance groupings and hazard classifications of the insecticides used by the sampled farmers

The insecticides can be divided into groups based upon their substance grouping (Table 6.2). In the below table, the Long Term Effects and Environmental Toxicity as given by PAN International are given for the insecticides organised into their substance groupings. Note that the acute toxicity classifications of the class I (WHO) pesticides, mentioned in Table 6.1, are not repeated here.

Table 6.2: Substance groupings and hazard classifications of insecticides used by farmers

No.	Substance grouping	Name of pesticide	Classifications as mentioned in PAN International's HHP list	Other notes
1	Plants of plant origin	Azadirachtin	NL	
2	Derived from micro-organisms	Emamectin Benzoate	Highly toxic to bees, very toxic to aquatic organisms, and very persistent in water, soil or sediment	This was added to the PAN list of HHPs in March 2018
3	Synthetic pyrethroids	Alpha-cypermethrin, Betacyfluthrin, Bifenthrin, Cypermethrin, Deltamethrin, Ethofenoprox (Etofenprox), Fenvalerate	All are classified highly toxic to bees; Bifenthrin and Deltamethrin classified as 'Endocrine Disruptor or potential endocrine disruptor' by the EU; Ethofenoprox as 'very persistent in water, soils, or sediments' and 'very toxic to aquatic organisms'	High activity against insects, low mammalian toxicity, effectiveness at low dosages, rapid action, degradation to innocuous residues. Earlier, considered safe
4	Organo-phosphates	Acephate, Chlorpyrifos, Dimethoate, Ethion, Methyl Parathion, Monocrotophos, Phenthoate, Phorate, Profenofos, Quinalphos, Triazophos	All (except Ethion, Methyl Parathion) are classified highly toxic to bees; Quinalphos is classified as 'Endocrine Disruptor or potential endocrine disruptor' by the EU	Many are extremely or highly toxic, and as such have been banned for use on vegetables (see Table 5.1)
5	Chlorinated hydrocarbons	Endosulfan (* earlier used by farmers, banned by Supreme Court in India since 2011)	H330, PIC, and Persistent Organic Pollutant according to Stockholm Convention	Persist for a long time in plants, soil, and accumulate in the body fat of birds, fish and mammals
6	Neonics (neonicotinoids)	Acetamiprid, Imidacloprid, Thiacloprid,	Imidacloprid, Thiamethoxam are classified highly toxic to bees; Thiacloprid as	Restricted for use in the EU since 2013. A total ban in the EU is

		Thiamethoxam	probable/likely to be carcinogenic by the US EPA and a 'known or presumed human reproductive toxicant' according to EU GHS; Acetamiprid is not listed	likely soon, due to their harmful effects on bees/pollinators
7	Phenlypyrazoles	Ethiprole, Fipronil	Fipronil classified highly toxic to bees; Ethioprole removed from PAN's HHP list in 2013	Effective against insects resistant to carbamate, organophosphate and pyrethroid insecticides
8	Miscellaneous, e.g. Unclassified, Pyridine, Benzoylurea, Pyrazolium	Cartap hydrochloride (CH), Flonicamid, Novaluron, Fenpyroximate	CH and Novaluron are not listed; Fenpyroximate classified as H330; Flonicamid removed from PAN's HHP list in 2013	-

Substance groupings and hazard classifications of the herbicides used by the sampled farmers

The eight identified herbicides do not fall into substance groupings. The older herbicides include the selective pre-plant and pre-emergence herbicide Butachlor, listed as probable/likely to be carcinogenic by the US EPA; and the commonly used Paraquat dichloride, a broad spectrum herbicide classified as 'fatal if inhaled' by the Globally Harmonised System, i.e. (H330) and listed in Annex III of the Rotterdam Convention. Oxyflurofen is also listed as probable/likely to be carcinogenic by the US EPA. Atrazine (a Triazine) and Metribuzin (a Triazinone) are both classified as endocrine disruptors or potential endocrine disruptors by the EU. Glyphosate is considered a probable carcinogen by the International Agency for Research on Cancer (IARC).

Substance groupings and hazard classifications of the fungicides used by the sampled farmers

Several of the fungicides found to be used by the sampled farmers have been classified as highly hazardous. The carbamates include Carbendazim, Mancozeb, Metiram and Propineb. Of these, Carbendazim, according to the EU GHS, is known to induce heritable mutations in the germ cells of humans. Both Mancozeb and Metiram are classified as probable/likely to be carcinogenic by the EPA and as endocrine disruptors/potential endocrine disruptors by the EU. Other fungicides have not been listed as highly hazardous, like Copper Oxychloride, Propineb, and Pyraclostrobin, or removed from the HHP list in 2013, like Hexaconazole, Tebuconazole and Tricyclazole.

Pesticides approved for use on cotton only used by the sampled farmers

One of the study's shocking revelations is the open sale of insecticides approved for use by the CIBRC on cotton only. Though cotton was grown by farmers in Bero block three decades ago, nowadays farmers do not grow cotton. Of the 38 insecticides found to be illegally used, six are approved for use on cotton only (Table 6.3). For example, Acephate 50% + Imidacloprid 1.8% SP, sold under the trade name Lancer Gold, is manufactured by the Indian multinational United Phosphorus Limited. This pesticide was released in the cotton growing state of Andhra Pradesh in 2006 to be

used on cotton[104], the General Manager of UPL boasting at the time that it was a first-of-its-kind product available anywhere in the world. His boast is true in the sense that it is even available in Bero block where cotton is not grown. This pesticide formulation has a waiting period of 40 days from application to harvest, whereas one of the sampled farmers was found to have applied it to chilli – he would not have waited 40 days before harvesting it and taking it to the market.

Table 6.3: Summary table on pesticides approved for use only on cotton

No.	Pesticide name	Brand name	Manufacturer	Waiting period when used on cotton (days)	Use on non-approved crops by farmers
1	Acephate 50% + Imidacloprid 1.8% SP	Lancer Gold	United Phosphorus Limited	40	Chilli
2	Alphacypermethrin 10% EC	Alpha Plus	Anu Products[105]	7	Bodi (long beans), bottle gourd, chilli, mango tree
3	Chlorpyrifos 16% + 1% Alphacypermethrin EC	Dangal, Anth Super,	Ichiban Crop Science[106] Krishi Rasayan Exports[107]	15	Cucumber, tomato, capsicum, potato, cauliflower, paddy, brinjal, peas, beans
4	Emamectin Benzoate 1.9% EC	Billo	Crystal Crop Protection[108]	15	Brinjal
5	Ethion 40% + Cypermethrin 5%	Spider, Ananda	- -	15	Okra, brinjal, tomato, cauliflower
6	Profenofos 40% + Cypermethrin 4% EC	License 99, Minister, Panther, Terror Super, Maxcron Super	- - - - Vimax Crop Science[109]	14	Cabbage, paddy, cauliflower, beans

The insecticide Profenofos 40% + Cypermethrin 4% EC sold under five different brand names (Table 6.3), was found at the homes of three of the 24 sampled farmers. One farmer used 'License 99' on cabbage, cauliflower and beans. Another farmer showed us three different brands of the same product, Profenofos 40% + Cypermethrin 4% EC, called 'Minister', 'Panther' and 'Terror Super', which he applied to paddy. The third farmer showed us a bottle of 'Maxcron Super', manufactured by Vimax Crop Science Ltd, which he said he'd applied to beans. The picture on the bottle's label

[104] http://www.thehindu.com/todays-paper/tp-national/tp-andhrapradesh/new-varieties-of-pests-attacking-cotton-plants/article3124430.ece
[105] https://www.tradeindia.com/fp2994193/ALPHA-PLUS.html
[106] http://www.ichiban.net.in/insecticides.html The manufacturer does not show this product on its website.
[107] http://www.krishirasayan.com/new/formulated.php
[108] https://www.youtube.com/watch?v=wsX-r1mIZH4
[109] http://www.vimaxcropscience.com/insecticide.html

clearly shows cotton, and on its back contains information in English and Hindi but does not mention it is to be used only on cotton, nor that a 14 days waiting period is to be observed before harvest.

Insecticides applied to vegetables but approved for use only on grains/oilseeds/pulses/cotton

Besides the six above-mentioned insecticides, which are approved for use only on cotton, many of the other insecticides found to be used by the sampled farmers on vegetables are indeed only approved for use on grains, oilseeds and pulses, e.g. paddy, safflower, groundnut (and sometimes cotton). Table 6.4 provides a summary, and highlights the manufacturers behind this misuse.

Table 6.4: Summary table on pesticides applied to vegetables but approved for use on grains etc.

No.	Pesticide name	Brand name	Manufacturer	Approved use by CIBRC (waiting period in days)	Use on non-approved crops by farmers
1	Acephate 75% SP	Acephate, Nagraj	JU Khublal	Cotton, paddy, safflower (15)	Pea, brinjal
2	Bifenthrin 10% EC	Highlight, Super Star	Isagro Asia, -	Cotton (15), paddy (21), sugarcane (10 months)	Beans, chilli
3	Chlorpyrifos 50% EC	Bouncer, Nagraja 505, Transformer, Anth 50	Anmol, HCP, Ichiban, Krishi Rasayan Exports	Paddy (15), cotton (30)	Bodi, okra, potato, french bean, chilli, brinjal, pea, tomato, cucumber
4	Chlorpyrifos 50% + Cypermethrin 5% EC	Yorker, Transformer, Turbo, Ulka 505, Tagban, Blaster 505, Noorani 505, Combo Plus, Anth 505	Anmol, Ichiban, Matrix, MS Biostadt, -, Khublal, Anu, Vimax, Krishi Rasayan Exports	Cotton (15), paddy (15)	Pea, tomato, cucumber, Simbi, Jhingi, Gongra, beans, brinjal, potato, Cauliflower, cabbage, maize, chilli, french beans
5	Ethiprole 40% + Imidacloprid 40% WG	Glamore	Bayer	Paddy (15d)	Capsicum, beans
6	Ethofenoprox 10% EC (Etofenprox)	Primo		Paddy (15d)	Chilli
7	Fipronil 0.3% GR	Regent, Janbaaz, Fipronil	Bayer, -, JU	Paddy (32d), Sugarcane (9d)	Maize, paddy, pea, ginger, potato, brinjal, okra, bodi, cauliflower, chilli, tomato, radish, capsicum, tita mircha, cucumber
8	Flonicamid 50% WG	Ulala	UPL	Paddy (36d), cotton (25d)	Brinjal, cucumber
9	Phenthoate 50%	Jahar,	-,	Paddy, Groundnut	Vegetables

	EC	Kohram	-		
10	Profenofos 50% EC	Carina, Current	-, Plant Remedies	Cotton (15d), Soybean (40d)	Paddy, vegetables
11	Triazophos 40% EC	Kaal, Triazo Plus	Khublal, Plant Remedies	Cotton (21d), paddy (40), soybean (30d)	Brinjal, all vegetables

Misuse of herbicides and fungicides

Atrazine was found to be used only for its intended use, i.e. on maize, and the same for Butachlor and Pretilachlor, i.e. on paddy fields. However the other five herbicides used by the sampled farmers are all being wrongly used. Glyphosate – a particularly dangerous pesticide – is approved for use on tea plantations and non-cropped areas, yet farmers use it to kill grasses while readying their fields for sowing with pea, cauliflower, beans, eggplant, potato, and wheat. Metribuzin approved for use on soybean and wheat fields, is used on tomato and potato fields. Similarly, Paraquat dichloride and Quizalofop ethyl are approved for use on the fields of certain crops only, yet are widely used on the fields of all crop types (see Appendix 2). The same can be said for the fungicides (see Appendix 3).

An example of accidental use of an herbicide was found in a remote village in Bero block, close to the Lohardaga border. Here we came across an input dealer without a license to sell pesticides, who stocks and sells Glyphosate even though he doesn't know anything about the herbicide. For example, after applying Glyphosate to a field, a farmer should wait 20-25 days before sowing their crop. When asked of the names of any farmers who have used Glyphosate, the input dealer recommended we speak to his neighbour, also a Sahu. The previous year, i.e. 2016, the farmer had bought several pesticides including Glyphosate. On a large farm plot he had cultivated cauliflower, and by the time it was almost ready for harvest, he had expended 1 lakh rupees. The farmer asked his son to apply an insecticide to the cauliflower crop, and by mistake, the son had sprayed the entire crop with Glyphosate, killing all the cauliflower. The farmer lost his 1 lakh rupees investment.

6.2 Unsafe Practices of Pesticide Storage, Usage and Application by Farmers

All 24 sampled farmers buy their pesticides direct from an input dealer. Whereas 19 farmers believed the input dealer to be knowledgeable, five of the farmers had little faith in the input dealer. All 24 farmers admitted they had had no training on pesticide application. Nine of the farmers said they did not read the instructions that accompany the pesticides – either the label or the leaflet that should accompany the pesticide at the point of sale. Eight said that were unable to read or understand what was written on the label/leaflet. A staggering 21 farmers (88%) said they do not follow the instructions given on the labels/leaflets. Were they to, they would know something about the dangers of pesticides and how to store them.

Storage of pesticides

For example, one Mahto farmer in Sardar Bero keeps his stock of chemical pesticides hanging on the wall in the hallway between a few rooms, next to the house's courtyard. When he opened the bags to show us the pesticides, we could see that the pesticides were leaking within the bags. As he showed us a bottle of Fipronil (Bayer company), it leaked on the floor and on his fingers. He wasn't concerned to clean up the spilt pesticide, and smeared it into the ground with his shoe; even though his toddler-aged child was close-by. His and his brother's spray machines were seen on the floor in

another corner of the courtyard. The toddler had been seen walking around on his own when we arrived to interview this farmer. This same farmer told us that his family use the old pesticide bottles, after washing them thoroughly, to store masala in the kitchen.

Besides unsafe storage practices in the house, we interviewed a young Mahto farmer whose family lease in land by the roadside to cultivate. They had a makeshift shelter next to their fields, where they spend much of their time (Photo 6.2). We went to sit in the shelter to undertake the interview. It contained piles of maize and groundnut. The young farmer could not name the pesticides he uses, and so he searched around and found several different pesticide bottles or packages which had been carelessly left in the shelter, or if empty, flung outside the shelter. Though a Matric pass, he does not read all of the information on the pesticide packaging.

Photo 6.2: Temporary shelter storing maize, groundnuts, alongside pesticides

During another interview with a Sahu farmer, we observed that several bottles of herbicide were lying on their side on top of the water tank used by the household. His wife and mother were more interested to discuss the issue of pesticides than the husband, and we instructed them to safely store the pesticides.

The most horrifying story told to us was that of a 12 year old Oraon girl, who accidently drank the pesticide Phorate 10% CG (classified as Extremely Hazardous, see table 6.1). The pesticide had been left in a steel cup, and she had added tea to the cup and drank it. She vomited and convulsed, and was rushed to the Bero government hospital. Luckily she survived.

<u>Lack of knowledge about approved uses and waiting periods</u>

92% of the farmers (22 farmers) do not follow the guidelines as given on the leaflet as to which crops the pesticide can be used on. This means that they also do not see that for each crop, a waiting period is recommended.

For example, the Sahu farmer whose son mistakenly applied Glyphosate to cauliflower uses Maxcron Super (Profenofos 40% + Cypermethrin 4% EC), approved for use on cotton, on beans, and Current (Profenofos 50% EC), approved for use on cotton and soybean, on paddy.

While visiting a Koiri Mahto hamlet close to the Lohardaga border, a group of young men came over to us to see what we were doing. Two of them boasted that this year (2017), in the summer season, they had spent 80,000 rupees on pesticides for a cauliflower crop, which they sold to Ranchi's fresh vegetable markets. They said they go to Ranchi in the hot season and grow vegetables on the land of tribals just outside of the city. They said the landowners don't mind them using their land, because it's otherwise idle, and as remuneration the Mahtos let the tribals eat the vegetables, and they also give them rice beer.

Unsafe use/application of pesticides – no use of protective clothing or face masks

After mixing a pesticide with water and other products liking wetting agents, spraying is the most common way of application to crops. 17 of the farmers have a battery powered backpack sprayer, and seven farmers have a manually operated backpack sprayer. None of the farmers use personal protective equipment, including gloves and a face mask when spraying pesticides. Just one farmer said that he uses gloves when applying granular pesticide. Just five of the farmers, instead of a mask, use a piece of cloth tied over their mouth. Just three of the farmers said they wear full clothing when spraying pesticides; the remainder go bare foot in half pant and vest most of the time. 10 of the farmers said they do not change clothes after applying pesticides, and many do not wash after spraying; some even sleep the night without bathing.

Just 10 of the farmers said that protective clothing is available at the input shop. But when asked further, eight of these said that they didn't know if it was affordable, meaning that they had actually never asked or bought such equipment. During the interviews with the four input dealers, we found that none of the dealers sell such protective clothing or masks. In fact, 23 of the 24 farmers said they had never asked for any item of protective clothing while purchasing pesticides. As mentioned above, all 24 farmers admitted they had had no training on pesticide application, and neither had any of the 24 received any training or instruction on the need to use protective equipment.

One Oraon farmer, who lives in Sardar Bero, had no idea about the dangers of pesticides. For example, when mixing pesticides with water before loading his spray machine, he said that he sometimes uses the same bucket with which water is drawn from a well for drinking and other domestic purposes. "If the bucket is cleaned after mixing the pesticides", he said "after 24 hours it can be used to collect drinking water".

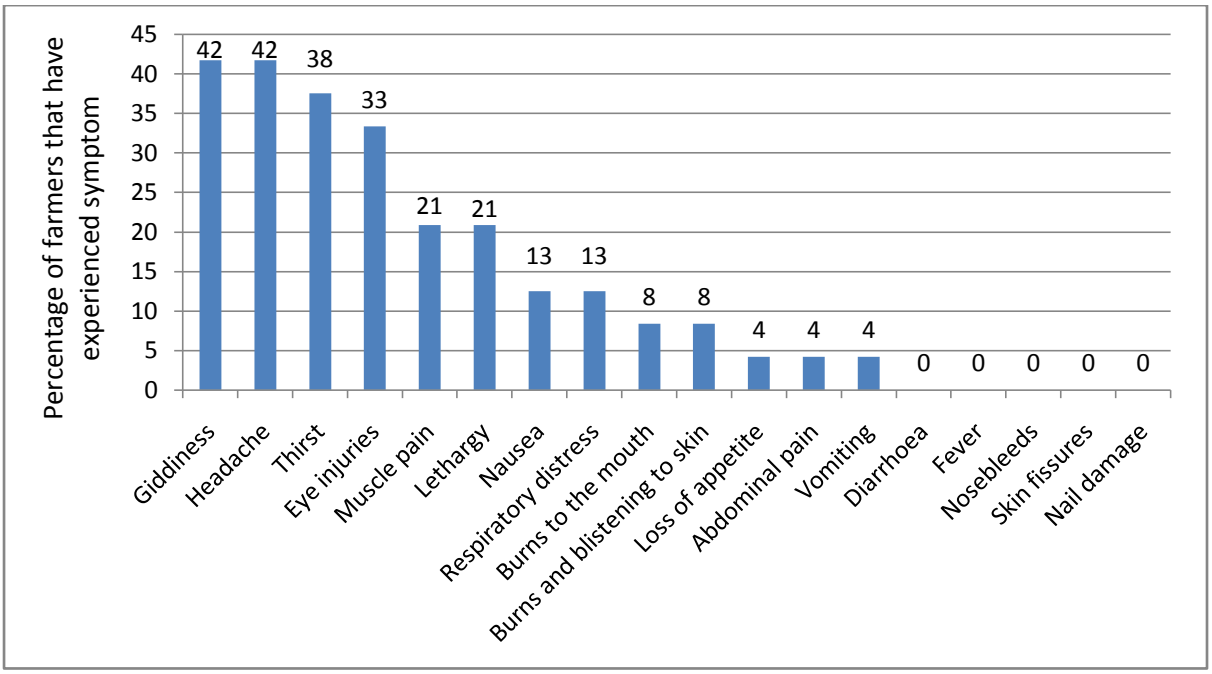
Exposure of farmers to pesticides while spraying

17 of the 24 farmers (70%) said they have suffered health effects from being exposed to pesticides. Such health effects are experienced in three ways: 1) the pesticide spills on their hands and sometimes other body parts when preparing/mixing the pesticide and loading it into the sprayer, 2) while operating the sprayer it leaks, especially on the hands but also down the legs, and 3) while spraying the wind blows the vapour on to their body, face and into their eyes.

Figure 6.1 shows the proportion (as %) of the sampled farmers that have experienced different symptoms due to spraying/applying pesticides. The most common health effects are giddiness, headache, and thirst, experienced by two-fifths of the farmers, followed by eye injuries as

experienced by one-third of the farmers. For example, one farmer told us of a labourer who one month back had got pesticide in his eye – the eye swelled up and was temporarily damaged. One-fifth of respondents have experienced lethargy and muscle pain, and 13% of the farmers have felt nauseous or experienced respiratory distress (difficulty breathing). Two farmers (8%) had experienced burns to the mouth, and another two (8%) burns and blistering of the skin. Just one farmer each had experienced loss of appetite, abdominal pain or had vomited. None of the farmers said they had had diarrhoea, fever, nosebleeds, skin fissures or nail damage.

Figure 6.1: Percentage of farmers that have experienced health effects due to spraying (n=24)



One Oraon farmer told us that on purchasing a new battery-operated backpack sprayer, he was excited to use it. He had come home alone, his wife staying on at the market. On an empty stomach he went out to his fields and sprayed many loads of pesticide on his paddy and okra crops, without taking rest. After a while he felt unwell, and he went home and sat alone quietly feeling very intoxicated. When his wife arrived at their home in the evening she found him in such a state.

One Mahto farmer, living along the roadside near Karanji village, is indebted to the tune of 35,000 rupees to his input dealer. He said that he is exposed to pesticides on his hands when mixing, and in his face when spraying. He told us of one Mahto farmer from his village who, with an open leg wound, had gone into his fields to spray pesticides on his crops. Shortly afterwards his leg stopped functioning, and for 15 days he couldn't walk.

Some of the farmers bragged that they have never felt any effects. For example, one Mahto farmer said that he can spray for five hours and suffers no ill health effects. One farmer even suggested that only weak people are affected. The Mahto farmer was under the impression that Endosulfan, which they used to use, was 'heavy' and killed fish, but nowadays the pesticides are not so heavy, which is evident because the fish have returned to the fields in the monsoon period.

Seven of the farmers said they go into the fields directly after spraying, meaning that they do not understand the hazardous nature of pesticides. Another 13 said they go into the field the next day, three farmers, two days later, and just one said that he waits a week to re-enter his field.

Farmers' understanding about how the chemicals break down, about residues and food safety

Overall the interviews highlighted that farmers do not understand the hazardous nature of pesticides. Due to this, the majority simply throw empty bottles and packets in the field. Indeed, only two farmers said they dispose of empty bottles and packets as instructed, e.g. by burying or burning them. One Mahto family's members seemed a bit smarter than others we interviewed, and gave the impression they were careful when handling and using pesticides. Yet they thought that pesticide chemicals break down within 24 hours of application, making vegetables safe to eat after just 24 hours. One Sahu farmer, who throws away all of his empty pesticide bottles and packets and so could not tell us which pesticides he had used in past, believed that if a vegetable is washed it is okay to cook and eat, even if the gap between application and eating it just 1-2 hours!

Farmer suicide

Seven of the 24 sampled farmers told us of cases of suicide (in one case an attempt) by pesticide consumption in their village or a nearby village. Almost all the households in Bero block have a bag or two of pesticides hanging in their home, which means that a person can easily commit suicide should they suddenly, in the heat of the moment, decide to do so. The seven suicides are as follows:

1. One man drank Endocil (Endosulfan) after arguing with his family.
2. One Oraon farmer consumed pesticide after arguing with his wife.
3. A 16 or 17 year old Oraon boy, a student, committed suicide.
4. One Oraon man, who was drunk, drank Carbendazine and killed himself.
5. A Sahu boy, between the age of 10 and 14, who lived with his maternal grandparents, went off to the farm to apply pesticide, and instead consumed it and died.
6. A 12-year boy (no more details).
7. A mother of 3 children attempted suicide after arguing with her husband. Luckily, after going to Bero hospital, and then being admitted in another, she recovered – though had to pay back 10,000 rupees in hospital charges.

6.3 Farm Labourers: An Especially Vulnerable Group

We interviewed just four farm labourers but the findings are quite shocking. Farm labourers are an invisible category of people, easy to overlook. They receive just 200 rupees plus a meal at lunchtime for a day's work, and their farm work includes mixing and spraying pesticides without any protective equipment (masks, trousers, gloves) provided by the employer.

In our search for labourers towards the end of the field research, we asked several farmers and input dealers to provide the names of large farmers, who we visited to request the names and addresses of farm labourers. On our arrival at the farm of five Mahto brothers, one of the brothers was spraying a field with pesticide. He came to meet us, and told us of his pesticide use including recent use of Glyphosate on a plot where he dumps cow manure. He gave us the names of several Yadav, Gope and Oraon labourers from a neighbouring village. Visiting that village, we found and interviewed three Oraon and one Gope farm labourers.

We first interviewed a Gope man, who was at his home with his wife and son. He didn't look or seem to be very healthy. He said he'd worked for 20-25 years in agricultural fields of large farmers. His work involves applying fertilisers, insecticides and herbicides, as well as harvesting produce. He recognised the brand names of herbicides like Glyphosate and Paraquat, and insecticides like Chlorpyrifos. He had had no training on handling pesticides, on using protective equipment like a face mask or gloves, and knew nothing of the hazards of the chemicals. He had never been provided with protective equipment by his employers, nor had he used such protective gear. He had been exposed to pesticides, by the pesticide spilling on his hands while mixing. He did not use soap to wash it off. Nevertheless, he said he washes and changes his clothes immediately after spraying. He said he knew of a labourer who had become sick – drunk like – after spraying pesticides.

We interviewed a young Oraon husband and wife. The man was evidently careless with pesticides and knew nothing about their hazardous nature. He said he is exposed to pesticides because he uses his hand to mix the pesticide into 45 litres of water in a drum, which is then used to fill the sprayer three times. The symptoms he suffers include nausea, headache, eye problems, and feeling of drunkenness ('nasha'). He recognised the brand names of the insecticide Regent (Fipronil) and herbicide Gramozone (Paraquat). As with the first farmer, he had had no training on handling pesticides, and had never been provided with protective equipment. He said re-enters fields the day after applying pesticides.

Photo 6.3: An Oraon labourer, who sustained injuries while mixing pesticides

The third labourer we interviewed, an Oraon, showed injuries sustained in June-July 2017 while mixing a pesticide with water to apply to chilli and brinjal. He accidentally spilt pesticide on his arm and leg and didn't wash it off immediately, instead going to the field to apply the pesticide (Photo 6.3). Returning from the field, he found that the areas where the pesticide had spilt were itching and later, open wounds developed. For two weeks he lost the ability to swing and use his lower arm. He visited the doctor and was given an injection and tablets, costing just 500 rupees. The Mahto employer paid these fees. This man has worked as a farm labourer for just six years. Though he's not

had training on handling pesticides or the need for use of protective gear, he said he knows the hazards of exposure to pesticides due to firsthand experience: “the first time I used pesticides”, he said, “I was so ‘drunk’ I couldn’t tell east from west”. He has never used protective equipment, neither has his employer ever provided him with protective gear to wear while handling pesticides.

The fourth man we interviewed has been a farm labourer for 15-20 years, since his childhood when he was sent to work as a servant in a well-to-do house. He could not recognise the names of the pesticides he applies, and neither had he used any protective equipment while spraying or received training regarding the necessity to do so. He has been exposed to pesticides when they occasionally spill on his leg, which causes a burning sensation. He said he feels tired and gets a headache after working with pesticides.

6.4 Input Dealers (Shopkeepers)

Bero town has around 22-25 agricultural input shops which trade in seed, fertiliser, pesticide and other inputs (Map 6.1 shows the location of 18 of the input dealers). The input dealers are supposed to have separate licenses to sell seed, fertiliser and pesticide. Four input dealers were formally interviewed during the study, and another four were encountered in a remote area, 20 km from Bero. One of the four input dealers in Bero did not, most likely, have a license to sell pesticides; neither did three of the four remotely located dealers. In the latter three cases, pesticides were kept hidden in the back room of the shop with just one or two bottles on display at the counter. One of these input dealers was away when we called by, and his wife naively told us that they did not have a license to sell pesticides.

Map 6.1: Location of input dealers in Bero, the headquarters of Bero block

All the interviewed input dealers were unaware (or feigned ignorance) of the approved uses and waiting periods of the various pesticides. In this regards, we were interested to know the impact of

the Diploma in Agricultural Extension Services for Input Dealers (DAESI)[110] course which is running in Jharkhand for several years now. If an input dealer does not have a degree in Chemistry, he must attend the DAESI course to keep his license.

Of the four input dealers formally interviewed in Bero, one had completed the DAESI course in 2013-14. Yet he was still found to be selling pesticides to farmers to use on non-approved crops, had no safety equipment for sale in his shops (except for some flimsy plastic gloves), and had no idea about the concept of waiting period. When asked if the DAESI course had covered approved uses, waiting periods, protective equipment etc, he said that he had "missed a few classes". It was puzzling to understand why he showed so little care in this regard. He told us that he had suffered ill health effects from working so closely with pesticides. He believed his immune system to be low, such that when he was prescribed medicines they had had no effect. Due to this he attended a course and now practises yoga daily which helps him to maintain his health. Over several visits, the sales representatives of Syngenta and other Indian companies were found sitting with him inside his shop.

The son of one of the other three interviewed input dealers, of Khatri (Punjabi) caste, was attending the DAESI course, having recently started at the time of interview, in August 2017. The dealer with the oldest agricultural inputs business – 30 years old – had registered to begin the course in Ranchi in August 2018. The fourth input dealer, who likely didn't have a license to sell pesticides, said that he'd gone to Khunti to try to sign up for the course, but could not get a seat.

Of the four informally interviewed input dealers located in the remote areas, some 20km from Bero, one said that he had gone to Krishi Bhawan at Kanke Road, Ranchi to register and was asked to give 5000 rupees in cash to secure a place, after which he would have to pay the 20,000 rupees course fee[111]. This dealer was stocking Glyphosate – both liquid and granular – but kept it in a back room and knew nothing about its properties or specified uses. Another of the four informally interviewed dealers was not present in his shop when we called by – he was attending the DAESI course in Ranchi. His father and brother were manning the shop, and on questioning, it was clear they knew next to nothing about the chemicals they stock and sell. Several formulations of Glyphosate were seen among at least 50 different pesticides on the shelves.

None of the four interviewed input dealers in Bero were found to stock any protective equipment, including face masks, gloves, boots, or clothing. All the input dealers claimed to purchase their stock from wholesalers in Ranchi, though the older shop's proprietor – a Koiri Mahto – said that he also purchases from salespersons. One shop's owner, a Bengali Brahmin who says he's the sixth generation living in Bero, said that he has a contract with Bayer since 2013.

6.5 The Pesticide Manufacturers

The pesticide manufacturers are not acting responsibly. This is where and why the government needs to step in to play the role of regulator. For example, approved uses, doses to be applied and waiting periods to be observed are not written on the labels of pesticides bottles or packets. The labels on the bottles or packets state that an accompanying leaflet should be consulted; however the majority of pesticides are sold to farmers without the accompanying leaflet. One reason for this

[110] http://www.manage.gov.in/daesi/structure.asp

[111] According to the MANAGE website, as of August-November 2017, the government provided 10,000 rupees subsidy and the input dealer should pay the other 10,000 rupees.

is that most of the manufacturers (except, notably, Bayer company) do not attach the leaflet to the individual bottles when boxing up the bottles to be sent in bulk. Rather they put a handful of leaflets into a box containing 12 or more bottles. The wholesalers and input dealers, when unpacking the boxes, do not attach the leaflets to the bottles, because they claim, 'the farmers will anyway not read them'. Therefore, the chain of responsibility is broken: the manufacturer is fulfilling its minimum responsibility but without government regulation the input dealer fails to attach the leaflet to the bottle or to inform the farmer that he/she should read the information on the leaflet.

Most of the manufacturers do not provide this vital information (i.e. approved uses, dosages, waiting periods) on their websites either. The salesmen of the companies visit the input dealers directly and, it appears, inform them that pesticides can be used on all crops. Many pesticide manufacturers do not maintain their own websites and instead advertise their products on websites like indiamart.com and tradeindia.com. The company JU Pesticides and Chemicals Pvt. Ltd, which produces the pesticide 'Minister' (Profenofos 40% + Cypermethrin 4% EC), advertises its products on tradeindia.com, where it is stated that Minister can be used on "cotton, groundnut, brinjal, bhindi, gram, cabbage, cauliflower, tomato, sunflower, soyabean, sugarcane, etc."[112] This false information shows blatant disregard for the rule of law in India, as these are not approved uses.

In India there are two preparations of Profenofos that are approved for use: Profenofos 40% + Cypermethrin 4% EC, approved for use only on cotton, and Profenofos 50% EC approved for use on cotton and soybean. Two of the 24 sampled farmers had applied Profenofos 50% EC to vegetables and paddy. One of the farmers had used the product 'Current' (Profenofos 50% EC), produced by the company Plant Remedies Pvt. Ltd, which started up in Bihar in the year 2000. On the backside of the bottle, information is provided in English, Hindi and two other languages, and it is clearly stated that the pesticide is to be used on cotton. On its website[113] it is stated that "Current is a versatile insecticides and acaracide which control a number of insect like Aphids, jassids, thrips, whiteflies, bollworm complex, Hispa, Leaf Roller, Gall Midge, Stem borer, Pod borer, Cut worm, Black bug," - but the sentence cuts out where it should mention the approved uses of the product.

6.6 The Government's Role as Regulator

The block agriculture extension officer, who was also the block technical manager, was unaware of the sale of certain popular pesticides. When asked the crops popularly grown in the block, he turned to the group of well-to-do men sitting in his office, some of whom were large farmers, to ask their opinion. He asserted, when asked about the five pesticides that were the focus of the PAN-India study, that Glyphosate and Paraquat dichloride were not being used in the block. As we discovered during the research, however, Paraquat dichloride is an extremely commonly used herbicide, and that Glyphosate is being used too.

The block agriculture extension officer said that the agriculture department distributes pesticides to farmers with 100% subsidy, and stated that the department provides advice to farmers on the need to wear personal protective equipment. However he admitted that the agriculture department does not provide farmers with protective equipment or facilitate the provision of such essential protective

[112] https://www.tradeindia.com/fp2024619/MINISTER-PROFENOFOS-40-CYPERMETHRIN-4-EC-.html This company may have since rebranded this pesticide, see http://www.jupesticides.com/insecticides/profeno-cyper.php

[113] http://plantremedies.in/productdetail.php?pid=10

gear. He was of the view that such equipment can be purchased from input dealers. He also claimed that the department provides training to farmers regarding the use of pesticides. Yet none of the farmers we interviewed had received training or advice on pesticide use from the government, and none had purchased or used personal protective equipment.

When asked the best alternative to most of the popular insecticides or herbicides, the block agriculture extension officer could only give the names of other chemical pesticides. He did admit, however, that farmers are slow to adopt non chemical pest management because of the slower action of such alternatives, e.g. bio-pesticides. Notably, he was unaware of any farmers who had suffered health effects from using pesticides, and claimed to have not seen or to be aware of any ill-effects on people or the environment through use of the five pesticides in focus.

The absence of government officers on the ground leaves the regulation of pesticide sales to the Pesticide Inspectors. Though the PPQS website shows that Jharkhand has 43 Pesticide Inspectors, in the course of this research several agricultural department officers told us that there were actually none.

The lack of government resources devoted to pesticide regulation on the ground leaves farmers entirely at the mercy of input dealers and company representatives, who it is not unfair to say, are driven by their pursuit for profit and not the welfare of farmers, consumers or the environment. In this context it is clear that the Diploma in Agricultural Extension Services for Input Dealers (DAESI) course, running for several years in Jharkhand, is of great importance. Does it instil a sense of ethics in the input dealers, and moreover, does it furnish input dealers with the information they require to competently and safely prescribe pesticides to farmers? No is the resounding answer. As stated in the previous section, most input dealers have signed up or are attending the weekly classes, but even the input dealer who had completed the course was still found to be selling non-approved pesticides to farmers. None of the input dealers stocked personal protective equipment, and none were aware of the concepts of approved use, or waiting period. The Diploma is a step in the right direction, but as noted, this is a family business such that the training of one family member, even if done properly, does not ensure that all the family members will gain sufficient knowledge.

7. Conclusion and Recommendations

7.1 Why is the Misuse of Pesticides so Prevalent?

The study's findings indicate that farmers and farm labourers know little to nothing about the pesticides they use. Indeed, farmers have been taught to refer to pesticides as 'davai', which translates as 'medicine' in English, when in actual fact they are 'jahar' (poison). Farmers are almost entirely reliant on information received from the input dealers from whom they purchase the pesticides; and occasionally on information given to them by manufacturer/company representatives. The farmers apply the pesticide in a dose recommended by the input dealer, not the manufacturer/CIBRC. Farmers do not know about approved uses of the pesticides, e.g. on which crops the pesticides are approved for use by the CIBRC. Therefore, the farmers know nothing about the concept of waiting period, i.e. the length of time to observe between application of pesticide and harvest of crop. This leads to the scenario by which, shortly after vegetables or crops are sprayed with non-approved pesticides, they are harvested and taken to the market – and that same day or the next, reach consumers' plates.

Farmers are also unaware of the chemical groupings of pesticides, their rankings by the World Health Organisation and PAN International, and the various established health effects of different pesticides. This information is not made available to farmers in any way whatsoever.

On purchase of pesticides, most farmers do not read the labels which contain information in Hindi language. Even if the farmer was illiterate, he/she could ask his son/daughter or a neighbour to read the label. Most farmers are unaware that a leaflet should accompany each pesticide. While preparing and applying pesticides on their crops, none of the farmers or labourers use protective equipment such as face masks or gloves. **None of the surveyed farmers had received training or information regarding safe and proper pesticide use from any government agency**; and therefore had not been told that they should wear personal protective clothing. Most farmers, therefore, underestimate the dangers of pesticides. In their understanding, pesticides are dangerous if drunk/consumed, and cause a feeling of drunkenness, headaches and eye problems during and after spraying, but other than that pose little threat to their health in the longer term. Due to their poor understanding of pesticides, farmers are careless when handling pesticides, in the storage of pesticides at their home or farm, and when disposing of empty packets and bottles.

The interviews with the input dealers were illuminating if not because we came to understand the human face of the middlemen who profit from passing the pesticides from manufacturer to farmer. Outside of Bero, and in one case in Bero itself, we found input dealers who were selling pesticides without a license. All the input dealers were unaware (or feigned ignorance) of the approved uses and waiting periods of the various pesticides. **It appears that Pesticide Inspectors do not concern themselves with checking which pesticides are being sold to farmers to be used on which crops**.

Those input dealers who had already completed or who were attending the Diploma in Agricultural Extension Services for Input Dealers (DAESI) had not received information on approved uses and waiting periods during the course. **The DAESI course content should most certainly include a specific module of this topic**. After all, the safe and correct use of pesticides is of utmost importance for it affects consumers' (including farming families') health and well-being.

The pesticide manufacturers do not inform input dealers about approved uses and waiting periods for each specific pesticide, and do not instruct them to attach the leaflet that accompanies each pesticide to the pesticide bottle or packet on its sale. In this way, the manufacturers/companies increase their sales by 1) telling the input dealer that the pesticide can be applied to all crops, and 2) by not providing the information to farmers such that they will never know that the concepts of approved use and waiting period even exist. This explains why it is so important that a strong legislation be passed and implemented that improves upon the outdated and inadequate Insecticides Act 1968 and Insecticides Rules 1971. The Pesticides Management Bill 2017, if and when passed, must contain provisions to ensure that Pesticide Inspectors and other officials working under the Department of Agriculture properly regulate the sale of pesticides (without interference by the pesticide companies and manufacturers).

The UN Special Rapporteur on the right to food has spelled out, very clearly, the enormous power of the chemical industry. As quoted, its efforts to influence policymakers and regulators have obstructed reforms and paralysed efforts to restrict pesticides across the globe, India included. Companies use a variety of strategies to this end, including contesting scientific evidence, manufacturing evidence, the 'buying' of government scientists, use of 'revolving door' practice by which employees shift between regulatory agencies and the pesticide industry, cultivation of 'public-private' relationships, and donations to government educational institutions e.g. state agricultural universities. Finally, scientists who expose health and environment risks have faced threats to their reputations and even to themselves.[114]

The present-day overuse and misuse of pesticides, and the resulting negative effects on human health and the environment, one can safely say, is taking place because of greed for money. The industry is a multi-crore rupees business that generates sufficient money for everyone involved to receive a share. In the earlier Green Revolution period scientists and policymakers believed in the necessity of chemical usage. Yet this is no longer the case. For example, farming with less pesticide is well-proven to be not only feasible but more viable. Recent research on 946 farms in France showed that 94% of farms would lose no production if they cut pesticides and two-fifths would actually produce more. For insecticides specifically (and keep in mind that India's share of insecticide use is extremely high compared to the world average), lower usage would result in more production in 86% of farms, and no farms at all would lose production.[115]

Moreover, farming without pesticides is proven to be feasible. The International Assessment of Agricultural Knowledge, Science and Technology for Development's *Agriculture at a Crossroads*, provides evidence of studies that indicate that agroecology is capable of delivering sufficient yields to feed the entire world population and ensure they are adequately nourished.[116] It is therefore misleading and inaccurate to assert, as does the agrochemical industry, that pesticides are necessary to achieve food security.[117] The Oakland Institute has published 33 case studies from Africa, demonstrating the potential of agroecological approaches to farming that yield immense economic,

[114] Report of the Special Rapporteur on the Right to Food. 2017. Paras. 86-89, pp. 18-19.
[115] Lechenet, M., Dessaint, F., Py, G., Makowski, D., & Munier-Jolain, N. 2017. Reducing pesticide use while preserving crop productivity and profitability on arable farms. *Nature Plants* 3. doi:10.1038/nplants.2017.8
[116] International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD). 2009. *Agriculture at a crossroads: Synthesis report.*
[117] Report of the Special Rapporteur on the Right to Food. 2017.

social and food security benefits while also fighting climate change and restoring the soil and environment. Agricultural production and productivity is increased, inputs expenses reduced, income sources diversified, and the resilience of local farmers improved. A win-win situation![118]

In a recent paper on the system of crop intensification (SCI), the authors show that most efforts to promote SCI have come from the bottom up, mostly initiated by farmers, and that there has been a slow response from policymakers – because of their preferences for Green Revolution agricultural technologies.[119] In most policy and agribusiness circles the fact that SCI does not require new varieties and does not depend much on purchased inputs is seen as aberrant and even threatening. Yet in India, the central government's National Rural Livelihood Mission and the National Bank for Agriculture and Rural Development (NABARD) have become supporters of SCI having recognised its potential in reducing poverty and hunger. Broadly stated, the main elements of SCI include high quality seed and seedlings (not to be confused with industry produced hybrid seed), provision of optimal spacing of plants, maintaining aeration in the topsoil around plants, sparing use of irrigation, addition of organic matter to the soil, and reducing and ultimately eliminating reliance on inorganic fertiliser and pesticides (through production of alternatives, e.g. bio-inputs).[120]

It's evident that the transition from input-intensive farming to agroecological farming at the state level in India – for example in Jharkhand – will not come about easily. For example, though organic agriculture is proposed as a promising approach to achieving sustainable food systems, some point out that it can only be feasible when organic crop production is complemented by addressing human consumption patterns, waste management, and crop-grass-livestock interdependencies.[121] The debate on what constitutes 'organic' needs elaboration too: a narrowly defined organic agriculture can be a market-based individualist approach to farming in which the farmer buys inputs and aims to sell produce on the market. Indeed, in recent years the multinationals have developed bio-fertilisers and bio-pesticides, and government is procuring these products to supply them to farmers. In its broader and truest sense however, organic agriculture is agroecological farming, in which the community is united (e.g. to overcome free-grazing), external inputs do not need to be bought, and the overarching philosophy is one of living and farming in harmony with nature. It is up to farmers, civil society and concerned officials and scientists to lobby for the truer form.

7.2 Recommendations to the Jharkhand State Government

The Jharkhand state government's Agricultural Minister, Shri Randhir Kumar Singh, announced in December 2017 that Jharkhand will go fully organic by 2025. To honour this pledge, the state government and its agencies concerned with agriculture need to prepare a roadmap to work towards this goal. Considering the experience of Kerala, whereby pesticides banned in the state were found being smuggled into the state through its porous borders with Tamil Nadu, it will be wise

[118] https://www.oaklandinstitute.org/agroecology-case-studies

[119] Adhikari, P., Araya, H., Aruna, G. Balamatti, A., Banerjee, S. Baskaran, P. Barah, B.C., Behera, D., Berhe, T., Boruah, P. Dhar, S., Edwards, S., Fulford, M., Gujja, B., Ibrahim, H., Kabir, H., Kassam, A, Khadka, R.B., Koma, Y.S., Natarajan, U.S., Perez, R., Sen, D., Sharif, A., Singh, G., Styger, E., Thakur, A.K., Tiwari, A., Uphoff, N., & Verma, A. 2018. System of crop intensification for more productive, resource-conserving, climate-resilient, and sustainable agriculture: experience with diverse crops in varying agroecologies*, International Journal of Agricultural Sustainability*, 16:1, 1-28, DOI: 10.1080/14735903.2017.1402504

[120] Ibid.

[121] https://www.nature.com/articles/s41467-017-01410-w

for Jharkhand to have phased out use of all pesticides prior to 2025 and to have put in place checks to ensure the illegal import of pesticides doesn't occur. In short, there is a momentous task ahead of the Jharkhand state government, if it is to fulfil its 2025 organic pledge.

Agriculture is a state subject, and the present legislation, the Insecticides Act 1968, allows for state governments to take unilateral action to regulate pesticide use; including to ban certain pesticides. Our recommendations to the Jharkhand state government are as follows:

1. Form a state-level committee comprising the concerned agencies of the State government such as Plant Protection and BAU scientists, input dealer associations, farmer groups (unions) and civil society organisations (working in the field of agriculture and agroecology, food safety etc.), to ensure proper regulation of pesticide sale and use in Jharkhand, and to plan Jharkhand's transition to an organic state.
2. Develop a comprehensive state level action plan that includes incentives to support alternatives to hazardous pesticides, and to initiate binding and measurable reduction targets (including bans) for specific chemical pesticides, with specified time limits. This should include:
    a. No new licenses to be given for the sale of pesticides proven to be highly hazardous. A date can be set for a ban on their sale and use. These pesticides include;
        i. The 18 class I (WHO class Ia and Ib) pesticides currently approved for use in India: Bromadiolene, Methyl Parathion, Phorate, Phosphamidon (all Class Ia), Beta Cyfluthrin, Carbofuran, Coumatetralyl, Cyfluthrin, Dichlorvos (DDVP), Edifenphos, Methomyl, Monocrotophos, Oxydemeton-Methyl, Propetamphos, Sodium Cyanide, Thiometon, Triazophos, Zinc Phosphide (all class Ib).
        ii. The 13 pesticides that the Anupam Verma committee recommended to be banned in India from 1st January 2018: Benomyl, Carbaryl, DDT, Diazinon, Fenarimol, Fenthion, Linuron, MEMC, Tridemorph, Trifluralin (and Methyl Parathion, Sodium Cyanide, Thiometon included in the above list). Note that the central government more recently decided to drop inclusion of DDT; however it has come to the attention of civil society groups that DDT provided by the Public Health department is being used by farmers in agriculture, e.g. on cauliflower.
        iii. The other two pesticides the Anupam Verma committee recommended be banned in 2020, namely Alachlor and Trichlorfon.
        iv. Other pesticides in the PAN International list of highly hazardous pesticides, such as Paraquat Dichloride.
    b. The sale and use of pesticides not approved for use can be banned in Jharkhand with immediate effect. These include:
        i. The six pesticides identified in this study to be approved for use only on cotton, but used on vegetables etc., namely: Acephate 50% + Imidacloprid 1.8% SP, Alphacypermethrin 10% EC, Chlorpyrifos 16% + Alphacypermethrin 1% EC, Emamectin Benzoate 1.9% EC, Ethion 40% + Cypermethrin 5% EC, and Profenofos 40% + Cypermethrin 4% EC.
        ii. Glyphosate, which is approved for use on tea gardens and non-crop (barren) area.
    c. Plan the collection and safe disposal of the obsolete chemicals. Input dealers should be refunded the amount they have paid for stock to prevent illicit sales. This will ensure that input dealers have no incentive to sell the highly hazardous pesticides in the interim

period between the non-issuing of new licenses and ban of sale and use. Strict action must be taken for those selling and/or recommending banned pesticides.

   d. The Directorate of Plant Protection, Quarantine and Storage's Integrated Pest Management (IPM) division which promotes alternatives to pesticides, and the Central Integrated Pest Management Centre located at the Krishi Bhawan, can prepare crop-specific lists of suitable alternatives to the above-named pesticides. This information can be provided to farmers in advance of the ban. This will allow farmers to take an informed decision as to what to use in place of the banned pesticides, e.g. less hazardous pesticide, bio-pesticide, or non-pesticidal management techniques. Alternatives to pesticides need to be made available and demonstrated widely over different crops so that the belief in sustainable farming practices is reinforced.

3. Notify all concerned government officials from state, district, block, to village level of the dangerous and illegal misuse of pesticides in Jharkhand. Provision of information on the dangers of pesticides, the correct (approved) use of pesticides, and alternatives to chemical pesticides, will allow officials to develop a healthy concern for the status-quo.
4. Fill vacant posts (e.g. 43 Pesticide Inspectors (?)), and end the practice of giving multiple posts to one officer (e.g. an officer who is both block technical manager and block agricultural extension officer will obviously be unable to fulfil his duties). Provide information to the public (on website) showing the names, qualifications and contact details of the Pesticide Inspectors and other relevant officers.
5. Establish a panel of medical specialists, including neurosurgeons, to examine the medical treatment protocols to be followed in cases of intentional (attempted suicide), unintentional (occupational exposure) and accidental exposure to pesticides. At each block Sardar Hospital at least one on-call doctor should be trained to treat the symptoms of pesticide exposure and consumption and the medical equipment and resources to do so should be made available. Medical rehabilitation ought to include provision of the correct medication and special diet. Private hospitals and doctors should also be legally-bound to be updated in this regard. Data should be collected and made public in regards to pesticide exposure cases.
6. Review the effectiveness of DDT in Indoor Residual Spray (IRS). Strict monitoring of DDT leakages is required, and awareness of the same.
7. Make it compulsory for pesticide companies/manufacturers to mention the approved uses, dosages and waiting periods of each pesticide for each crop on the labels/leaflets of pesticides to be sold in Jharkhand state. According to the current guidelines issued by CIBRC, pesticide manufacturers do not have to provide complete information about approved use of pesticide, dose to be applied or waiting period to be observed on the labels of bottles/packets or leaflets. This can be enforced and failure to do so can be sanctioned, e.g. monetary fines.
8. Implement a prescription system, as the Government of Telangana has done in 2018. For an input dealer to sell a pesticide to a farmer, the farmer must first get a prescription from an Agriculture Officer (AO). To this end, AOs will need training and sensitisation.
9. Provide written information in Hindi to all input dealers regarding approved uses, doses to be applied, and waiting periods for all pesticides. Input dealers should be instructed to verbally provide this information to farmers (alongside provision of leaflet which contains this same information). This can be enforced and failure to do so can be sanctioned, e.g. monetary fines.
10. Update the DAESI course to ensure a module is devoted to discussing approved uses, dosages and waiting periods, to sensitise input dealers about the illegality of non-approved pesticides

sales, and to discuss the risk of pesticide exposure and the need for use of personal protective equipment. Civil society groups can be invited to comment upon and contribute to the curriculum of DAESI.

11. Procure good quality masks, gloves and other light-weight personal protective equipment and issue these to farmers' free-of-cost (or for a nominal cost). This can be done through the block office. It can be made a condition that for a farmer to purchase pesticides he/she must demonstrate that he/she has received such personal protective equipment.
12. Extend support to farmers and farm labourers who are routinely exposed to pesticides by way of an annual medical examination to be provided free-of-cost at the Sardar Hospital (block-level). The costs for this can be covered by the tax revenues generated by pesticides sales, and if necessary, by an extra levy on the pesticide manufacturers/companies.
13. Conduct Farmers Field Schools (FFSs) to promote agro-ecological sustainable farming systems on a regular basis in each block in the state. The Central Integrated Pest Management Centre located at the Krishi Bhawan in Ranchi has the mandate to conduct FFSs to sensitize farmers on Integrated Pest Management (IPM). The FFSs should not be used as opportunities to promote the use of chemical pesticides. Wherever possible and proven, non-chemical alternatives to pesticides should be promoted. Jharkhand's CIPMC can consider the need for a conceptual switch from IPM to Non-Pesticidal Management (NPM).
14. Provide information regarding the dangers and negative health effects of pesticides to farmers. This can be disseminated by panchayat offices, kisan mitras, other village-level functionaries, and through the use of large billboards at block offices (such billboards are noted to be used by certain government offices to promote public health e.g. the need to bury animal carcasses). Information can also be provided in the newspapers and through TV channels.
15. Regularly sample and test farm produce for pesticide residues across the state, and openly and widely publish the results in the newspapers and on TV. Food testing needs to be made easy and affordable.
16. Create buffer zones around schools and homes located in rural areas, to reduce pesticide exposure risk to children and the public.
17. Provide incentives to producers of organic food through subsidies, and financial and technical assistance, as well as by using public procurement. Ongoing programmes like PKVY and RKVY can be utilised to this end. The products need to be promoted and made widely available.
18. Strengthen and nurture consumer forums towards awareness, food testing and direct linkages with farmer groups in line with the Participatory Guarantee System.
19. If possible, initiate pesticide taxes and pesticide-use fees and eliminate pesticide subsidies, and use the money generated to invest in the above.

It is important to recognise that on its own, the Jharkhand state government will be unable to achieve the goal of going organic by 2025. In a democracy, needless to say, civil society plays an active and vibrant role in the development of society. The UN Special Rapporteur on the right to food concluded his 2017 report by stating that:

> While efforts to ban and appropriately regulate the use of pesticides are a necessary step in the right direction, the most effective, long-term method to reduce exposure to these toxic chemicals is to move away from industrial agriculture.

> Civil society should inform the general public about adverse impact of pesticides on human health and environmental damage, as well as organizing training programmes on agroecology.[122]

We therefore call on the general public – farmers, civil society organisations, concerned individuals, scientists and public servants – to work together to discuss and demand a chemical pesticide-free Jharkhand. 2025 is the target set by the government. Let us work together to achieve this dream.

[122] Report of the Special Rapporteur on the Right to Food. 2017. Paras 104 and 108, pp.22, 24.

Appendix 1: Insecticides used by farmers, showing hazard ranking, approved use, and non-approved use (i.e. misuse)

SN	Insecticide Chemical Formulation	Substance grouping	WHO Hazard Ranking	PAN Hazard Ranking (March 2018)	Brand (Manufacturer)	Approved use according to CIBRC (waiting period in days)	Non-approved use by surveyed farmers	Approved use by surveyed farmers
1	Acephate 50% + Imidacloprid 1.8% SP	Organo-phosphate + Neonicotinoid	II + II	1 (Bees) + 1 (Bees)	Lancer Gold (UPL)	Cotton (40d)	Chilli	
2	Acephate 75% SP	Organo-phosphate	II	1 (Bees)	Acephate (JU), Nagraj (Khublal)	Cotton, paddy, safflower (15d)	Pea, Brinjal	
3	Acetamiprid 20% SP	Neonicotinoid	II	NL	Tag Ride, Stona (Vimax), Action, Venus (JU), Action, Magic (Anu)	Cotton (15d), cabbage (7d), okra (3d), chilli (3d), paddy (7d)	Brinjal, khora, beans, kaddu, cucumber, capsicum, jinga, cauliflower	Okra
4	Alphacypermethrin 10% EC	Pyrethroid	II	1 (Bees)	Alpha Plus	Cotton (7d)	Bodi, kaddu, chilli, mango, all crops	
5	Azadirachtin 1% EC	Plant derived (Bio-pesticide)	NL	NL	Neem Plus	Tea (1d), tomato (3d), brinjal (3d)	Block office says 'any crops'	
6	Betacyfluthrin 8.5% + Imidacloprid 21%	Pyrethroid + Neonicotinoid	Ib + II	2 (WHO Ib + H330 + Bees) + 1 (Bees)	Solomon (Bayer)	Brinjal (7d)	Capsicum	
7	Bifenthrin 10% EC	Pyrethroid	II	2 (EDC + Bees)	Highlight (Isagro Asia), Super Star	Cotton (15d), Paddy (21d), Sugarcane (10m)	Beans, chilli	
8	Cartap Hydrochloride 50% SP (Cartap)	Unclassified	II	NL	Nidan (Crystal)	Paddy (-)	None	Paddy
9	Cartap Hydrochloride 4% GR (Cartap)	Unclassified	II	NL	Kartap (Anmol)	Paddy (-)	Ginger, input dealers say 'any crops'	
10	Chlorpyrifos 20% EC	Organo-phosphate	II	1 (Bees)	Clear Out (Anu), Nagpyrifos (Multiplex)	Paddy, beans, gram, sugarcane, groundnut, mustard, brinjal, cabbage, onion, cotton, apple, etc.	Bodi, okra, potato, french bean, chilli, maduwa	

11	Chlorpyrifos 50% EC	Organo-phosphate	II	1 (Bees)	Bouncer (Anmol), Nagraja 505 (HCP), Transformer (Ichiban), Anth 50 (Krishi Rasayan Exports)	Paddy (15), cotton (30)	Bodi, okra, potato, french bean, chilli, brinjal, pea, tomato, cucumber	Paddy
12	Chlorpyrifos 50% + Cypermethrin 5% EC	Organo-phosphate + Pyrethroid	II + II	1 (Bees) + 1 (Bees)	Yorker (Anmol), Transformer (Ichiban), Turbo (Matrix), Ulka 505 (MS Biostadt), Tagban, Blaster 505 (Khublal), Noorani 505 (Anu), Combo Plus (Vimax), Anth 505 (Krishi Rasayan Exports)	Cotton (15), paddy (15)	Pea, tomato, cucumber, Simbi, Jhingi, Gongra, beans, brinjal, potato, Cauliflower, cabbage, maize, chilli, french beans	Paddy
13	Chlorpyrifos 16% + Alphacypermethrin 1% EC	Organo-phosphate + Pyrethroid	II + II	1 (Bees) + 1 (Bees)	Dangal, Anth Super (Krishi Rasayan Exports)	Cotton (15)	Cucumber, tomato, paddy, capsicum, potato, cauliflower, brinjal, beans, pea	
14	Cypermethrin 10% EC	Pyrethroid	II	1 (Bees)	Cyper 10, Ustaad (UPL), Anumite	Cotton (7d), Cabbage (7d), Okra (3d), Brinjal (3d), wheat (14d), sunflower (14d)	Maize, pea, all vegetables	Brinjal
15	Cypermethrin 25% EC	Pyrethroid	II	1 (Bees)	Super Killer 25 (Dhanuka), Anukil (Anu), Super Cyprin (Plant Rem), Auzan, Super Killer 25 (Dhanuka), RDX	Cotton (-), Okra (3d), Brinjal (1d)	Beans, paddy, cucumber, all vegetables	Brinjal
16	Deltamethrin 1% + Triazophos 35% ****	Pyrethroid + Organo-phosphate	II + Ib	2 (EDC + Bees) + 1 (WHO Ib)	Trilok, Move (Anu), Delta, Fullstop 4 (Shreeji Pesticide)	Cotton (21d), Brinjal (3d)	Beans, chilli, paddy, cereals, vegetables	Brinjal

17	Dimethoate 30% EC	Organo-phosphate	II	1 (Bees)	Rogor (Tata Chemicals), Tafgor (Rallis, Tata), Anugor (Anu), - (Khublal)	Bajra, Maize, Sorghum, Castor,Mustard, Safflower, Okra, Brinjal,Cabbage, Cauliflower, Chilli, Onion, Potato, Tomato, Apple etc.	Paddy, pea, french beans, all crops	Maize, chilli
18	Emamectin Benzoate 1.9% EC	Micro-organism derived (Bio-pesticide)	NL	1 (Persist + Aq. Orgs + Bees)	Billo (Crystal)	Cotton (15d)	Brinjal	
19	Emamectin Benzoate 5% SG	Micro-organism derived (Bio-pesticide)	NL	1 (Persist + Aq. Orgs + Bees)	Missile (Crystal)	Cotton (10d), Okra (5d), Cabbage, Chilli, Brinjal (3d), Red gram, Chickpea (14d), Grapes (5d), Tea	Tomato, cauliflower, mustard, all crops	Brinjal
20	Ethion 40% + Cypermethrin 5% EC	Organo-phosphate + Pyrethroid	II + II	NL + 1 (Bees)	Spider, Ananda (Anu)	Cotton (15d)	Okra, Brinjal, tomato, cauliflower	
21	Ethiprole 40% + Imidacloprid 40% WG	Phenyl-pyrazole + Neonicotinoid	NL + II	Removed 2013 + 1 (Bees)	Glamore (Bayer)	Paddy (15d)	Capsicum, beans	
22	Ethofenoprox 10% EC (Etofenprox)	Pyrethroid	U	1 (Persist + Aq. Orgs + Bees)	Primo	Paddy (15d)	Chilli	
23	Fenpyroximate 5% EC	Pyrazolium	II	1 (H330)	Mitigate	Tea (7d), chilli (7d), coconut	Brinjal	
24	Fenvalerate 20% EC	Pyrethroid	II	1 (Bees)	Fenvan, Challange (Khublal)	Cauliflower, Cotton, Okra (7d), Brinjal (5d)	Paddy, all vegetables	
25	Fipronil 0.3% GR	Phenyl-pyrazole	II	1 (Bees)	Regent (Bayer), Janbaaz, Fipronil (JU)	Paddy (32d), Sugarcane (9d)	Maize, paddy, ginger, potato, brinjal,pea,okra, cauliflower, tomato, radish, capsicum, tita mircha, bodi, cucumber, chilli	Paddy
26	Fipronil 5% SC	Phenyl-pyrazole	II	1 (Bees)	Regent (Bayer)	Paddy (32d), Cabbage, Chilli, Cotton (7d), Sugarcane (9m)	Brinjal, tomato, french beans, pea, capsicum	Chilli

27	Fipronil 80% WG	Phenyl-pyrazole	II	1 (Bees)	Jump (Bayer)	Paddy (19d), grapes (10), onion, cabbage (15)	French beans, brinjal, okra	
28	Flonicamid 50% WG	Pyridine compound	NL	Removed 2013	Ulala (UPL)	Paddy (36d), cotton (25d)	Brinjal, cucumber	
29	Imidacloprid 70% WG	Neonicotinoid	II	1 (Bees)	Josh (Krishi Rasayan)	Cotton, Paddy (7d), okra (3), cucumber (5)	Capsicum, tita mircha	
30	Imidacloprid 17.8% SL	Neonicotinoid	II	1 (Bees)	Media (Dhanuka), Admit (Isagro Asia)	Cotton, paddy, chilli, groundnut (40d), mango, sugarcane(45d), sunflower (30d), okra, tomato(3), citrus (15), grapes (32)	Bodi, simbi, cauliflower	
31	Methyl Parathion 2% DP *	Organo-phosphate	Ia	2 (WHO Ia + H330 + PIC)	Mid-on (Saga Pesticide), Cobra (Khublal)	Paddy, cotton, black gram, green gram, mustard	Maize	
32	Monocrotophos 36% SL **	Organo-phosphate	Ib	3 (WHO Ib + H330 + PIC + Bees)	Monocil (Dhanuka), Monocil (Insecticides India), Monodhan 36	Paddy, maize, cotton, black gram, green gram, red gram, pea, sugarcane, citrus, mango, coconut, coffee, cardamon	Chilli, capsicum, cucumber	
33	Novaluron 10% EC	Benzoylurea	U	NL	Kim On (Indofil)	Cotton (40), cabbage (5), tomato, chilli (3), bengal gram (7)	Cauliflower	Tomato
34	Phenthoate 50% EC	Organo-phosphate	II	1 (Bees)	Jahar, Kohram	Paddy, Groundnut	Vegetables	Paddy
35	Phorate 10% CG ***	Organo-phosphate	Ia	2 (WHO Ia + Bees)	Top 10G, Ichimet (Ichiban)	Bajra, Barley, Maize, Paddy, sorghum, wheat, Black gram, green gram, pigeon pea, soybean, cotton, sugarcane, groundnut, mustard, chilli, sesamum, brinjal, potato, tomato, cauliflower, etc.	None recorded as yet, but likely	Maize

36	Profenofos 40% + Cypermethrin 4% EC	Organo-phosphate + Pyrethroid	II + II	1 (Bees) + 1 (Bees)	License 99, Terror Super, Minister (JU), Panther, Maxcron Super (Vimax), Roket (PI Industries)	Cotton (14d)	Cauliflower, Beans, Cabbage, Paddy	
37	Profenofos 50% EC	Organo-phosphate	II	1 (Bees)	Carina, Current (Plant Remedies)	Cotton (15d), Soybean (40d)	Paddy, vegetables	
38	Quinalphos 25% EC	Organo-phosphate	II	2 (EDC + Bees)	Anuphos (API)	Paddy (40), sorghum,wheat, bengal gram, black gram, french bean, red gram (30d), soybean, citrus, groundnut (30), mustard, okra, sesamum, cauliflower, chilli, tomato, etc.	All crops	
39	Thiacloprid 21.7% EC	Neonicotinoid	II	1 (EPA Carc + Repro)	Alanto	Cotton (52), Paddy, Apple (30d), Chilli, brinjal (5), tea (7), soybean (17)	Vegetables, beans	Chilli
40	Thiamethoxam 25% WG	Neonicotinoid	NL	1 (Bees)	Tagxone	Paddy (14), Cotton, wheat, mustard (21), okra, tomato (5), mango (30), brinjal (3), tea (7), potato (77), citrus (20)	None	Brinjal
41	Thiamethoxam 30% FS	Neonicotinoid	NL	1 (Bees)	Sudoku (Ichiban)	Cotton, sorghum, wheat, soybean, chilli, okra, maize, sunflower	None	Chilli
42	Triazophos 40% EC ****	Organo-phosphate	Ib	1 (WHO Ib)	Triazo Plus (Plant Remedies), Kaal (Khublal)	Cotton (21d), paddy (40), soybean (30d)	Brinjal, all vegetables	Paddy

* Methyl Parathion. Methyl Parathion 50 % EC and 2% DP formulations are banned for use on fruits and vegetables. (S.O.680 (E) dated 17thJuly, 2001). The use of Methyl Parathion is permitted only on those crops approved by the Registration Committee where honeybees are not acting as pollinators. (S.O.658 (E) dated 04th Sep., 1992.) To be banned in India in 2018. Banned in 59 countries including the 28 EU countries.

** Monocrotophos is banned for use on vegetables (S.O.1482 (E) dated 10thOct, 2005). To be reviewed in India in 2018. Banned in 60 countries inc. the 28 EU countries.

*** Phorate. To be banned in India in 2021. Banned in 37 countries including the 28 EU countries.

**** Triazophos. To be banned in India in 2021. Banned in 40 countries including the 28 EU countries.

Appendix 2: Herbicides used by farmers, showing hazard ranking, approved use, and non-approved use (i.e. misuse)

SN	Herbicide Chemical Formulation	Substance grouping	WHO Hazard Ranking	PAN Hazard Ranking (March 2018)	Brand (Manufacturer)	Approved use according to CIBRC (waiting period in days)	Non-approved use by surveyed farmers	Approved use by surveyed farmers
1	Atrazine 50% WP	Triazine	III	1 (EDC)	Shriram (Shriram Fertilisers and Chemicals), Attari (Plant Remedies), Dhanuzine (Dhanuka), Attorney (Ichiban)	Maize	None	Maize
2	Butachlor 50% EC	Chloro-acetamide	III	1 (EPA Carc)	Machete (Sinochem India), Buta Power (Shriram)	Paddy	None	Paddy
3	Glyphosate 41% SL	Phosphono-glycine	III	1 (IARC Carc)	No Weed (Dhanuka), All Kill (Krishi Rasayan Exports), Brake Up (Plant Remedies), Glycocin (Maharashtra Bio Fertiliser), Safal (Tropical Agrosystems)	Tea and non cropped area	Peas, cauliflower, beans, baigan, potato, wheat	
4	Metribuzin 70% WP	Triazinone	II	1 (EDC)	Sencor (Bayer)	Soybean (30d), Wheat (120d)	Potato, tomato	
5	Oxyflurofen 23.5% EC	Diphenyl ether	U	1 (EPA Carc)	Oxykill (Dhanuka), Oxygold (Indofil)	Paddy, Tea (15d), Onion, Potato, Groundnut	All crops	
6	Paraquat dichloride 24% SL	Quarternary ammonium compound	II	2 (H330 + PIC)	Gramoxone (Syngenta), Ozone (Dhanuka), Crezil (Vimax Crop Science), Ginny (Anu Products), Clear (Plant Remedies), Para Flame (Khublal Agro Chemicals)	Tea, Paddy, Wheat, Maize, Potato, Cotton, Rubber, Coffee, Sugarcane, Sunflower, Grapes, Apple, Aquatic Weed Control	Beans, ol, mustard, pea, brinjal, ginger, bodi, chilli, mustard, cauliflower, cabbage, cucumber, kadu, onion, okra, non-cropped area	Potato, wheat, maize
7	Pretilachlor 50% EC	Chloro-acetamide	U	NL	Preeti (Anu Products)	Paddy	None	Paddy

8	Quizalofop Ethyl 5% EC	Aryloxyphen-oxypropionate	II	NL, but related Quizalofop-p-tefuryl is listed as 1 (Repro)	Hakama (Insecticides India), Targa Super (Dhanuka)	Soybean (95d), Cotton (94), Groundnut (89), Black gram (52), Onion (7)	Pea, coriander, cucumber, beans, potato, ginger, brinjal, chilli, rahar, sawa grass	Groundnut

Appendix 3: Fungicide used by farmers, showing hazard ranking, approved use, and non-approved use (i.e. misuse)

SN	Fungicide Chemical Formulation	Substance grouping	WHO Hazard Ranking	PAN Hazard Ranking (March 2018)	Brand (Manufacturer)	Approved use according to CIBRC (waiting period in days)	Non-approved use by surveyed farmers	Approved use by surveyed farmers
1	Carbendazim 46.27% SC	Benzimi-dazole	U	1 (Muta + Repro)	Barista	Grape (30), Mango (15)	Paddy	
2	Carbendazim 12% + Mancozeb 63% WP	Benzimi-dazole + Carbamate	U + U	1 (Muta + Repro) + 1 (EPA Carc + EDC)	Sixer (Dhanuka), Bendaco, Riper	Badam (72), Paddy (57), Tea, grape, mango (7), potato	Call vitamin and use on all crops	
3	Copper Oxychloride 50% WP	Inorganic compound	II	NL	Raze, Blue Copper (Syngenta), Blitoc 50W	Citrus, cardamon, chilli, betel, banana, coffee, potato, tobacco, tomato, grapes, coconut	French bean	
4	Hexaconazole 5% EC	Triazole	III	Removed 2013	Comfort, Raunak, Karaoke, Contaf (Rallis India Ltd)	Paddy (40d), groundnut, mango, soybean, apple (30d), tea (7), grapes (14)	Pea	Paddy
5	Metiram 55% + Pyraclostrobin 5% WG	Carbamate + Strobilurin	U + NL	1 (EPA Carc + EDC) + NL	Clutch (PI Industries)	Tomato, chilli (5d), Potato (15), Onion (16), Grape (34), cotton (45), green gram (18), apple (12), groundnut (42), pomegranate (67)	Pea	
6	Propineb 70% WP	Carbamate	U	NL	Antracol (Bayer)	Apple (30), pomegranate, chilli, tomato (10), potato (15), grapes (40), paddy	Pea, all vegetables	Potato, Paddy

7	Tebuconazole 250 EC (25.9% WW)	Triazole	II	Removed 2013	Folicur (Bayer)	Paddy (10d), groundnut (49), chilli (5), onion (21)	Capsicum, Bodi, Okra	Chilli
8	Tricyclazole 18% + Mancozeb 62% WP	Triazoloben-zothiazole + Carbamate	II + U	Removed 2013 + 1 (EPA Carc + EDC)	Merger (Indofil)	Paddy	None	Paddy

Appendix 4: Rodenticide used by farmers, showing hazard rank, approved use, and misuse

SN	Fungicide Chemical Formulation	Substance grouping	WHO Hazard Ranking	PAN Hazard Ranking (March 2018)	Brand (Manufacturer)	Approved use according to CIBRC (waiting period in days)	Non-approved use by surveyed farmers	Approved use by surveyed farmers
1	Bromadiolone 0.005% RB	Coumarin anticoagulant	Ia	2 (WHO Ia + H330 + Repro)	Roban (PCI)	Paddy, wheat, gram, groundnut, sugarcane, coconut, bamboo	Peas	

Key to World Health Organisation (WHO) Hazard ranking: Ia Extremely hazardous, Ib Highly hazardous, II Moderately hazardous, III Slightly hazardous, U Unlikely to present an acute hazard, NL Not listed. Source: Pesticides Properties Database (PPDB), University of Hertfordshire, at http://sitem.herts.ac.uk/aeru/ppdb/en/atoz.htm

Key to PAN Hazard ranking: Acute toxicity: 'WHO Ia' means 'Extremely hazardous'; 'WHO Ib' means 'Highly Hazardous'; 'H330' means 'fatal if inhaled' according to GHS (Globally Harmonised System); Long Term Effects: 'EPA Carc' means 'probable/likely to be carcinogenic' according to the EPA (the US Environmental Protection Agency); 'IARC Carc' means 'probable carcinogen according to the International Agency for Research on Cancer (IARC); 'EDC' means 'Endocrine Disruptor or potential endocrine disruptor' according to the European Union (EU); 'Muta' means 'known to induce heritable mutations in the germ cells of humans' according to EU GHS; 'Repro' means 'known or presumed human reproductive toxicant' according to EU GHS; Environmental Toxicity: 'Persist' means 'Very persistent in water, soils, or sediments'; 'Aq. Orgs' means 'Very toxic to aquatic organisms'; 'Bees' means 'Highly toxic to bees'; Conventions: 'PIC' means 'Listed in Annex III of the Rotterdam Convention'. Source: PAN International List of Highly Hazardous Pesticides (PAN List of HHPs), March 2018, at http://www.pan-germany.org/download/PAN_HHP_List.pdf