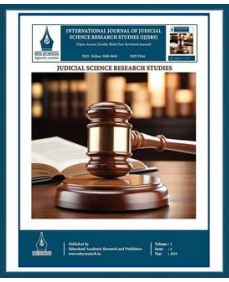
INTERNATIONAL JOURNAL OF JUDICIAL SCIENCE RESEARCH STUDIES (IJJSRS)

(Open Access, Double-Blind Peer Reviewed Journal)

ISSN Online: 3049-0618 ISSN Print: 3108-2785



Cultivating Compliance: The Legal Architecture of Sustainable Pesticide Management in India

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Article information

Received: 11th February 2026
Received in revised form: 13th March 2026
Accepted: 15th April 2026
Available online: 21st May 2026

Volume: 3
Issue: 2
DOI: https://doi.org/10.63090/IJJSRS/3049.0618.0043

Abstract

India operates one of the world's largest pesticide markets, yet its principal governing statute, the Insecticides Act, 1968, was enacted before the long-term toxicity, ecological persistence, and occupational hazards of agrochemicals were understood. This article asks whether India's legal framework can deliver sustainable pesticide management across the full life cycle of a pesticide, measured against three normative demands drawn from the precautionary principle, the polluter-pays principle, and the right to a clean environment under Article 21 of the Constitution: anticipatory regulation, life-cycle stewardship, and accountability. Situating the problem in the chemical intensification of the Green Revolution, the article examines the fragmented statutory architecture and the constitutional distribution of competence between the Union and the States, the constitutional and precautionary jurisprudence that culminated in the endosulfan litigation, and the largely invisible public-health burden of acute poisoning and pesticide self-harm. It tests Indian law against the country's obligations under the Stockholm and Rotterdam Conventions and the FAO Code of Conduct on Pesticide Management, diagnoses the problem of regulatory capture revealed by the record of bans and reviews, and draws comparative lessons from the European Union's hazard-based, substitution-oriented model, the periodic registration review mandated under the United States' FIFRA, and the cautionary example of recent deregulation in Brazil. Using the Kasaragod endosulfan case study and the Anupam Verma review saga, the article argues that India's central failure is one of institutional design rather than of regulatory norms: permanent registration, a dilatory and capture-prone review process, weak federal devolution, and a near-total absence of poisoning surveillance and enforceable liability. It concludes by assessing the Pesticides Management Bill, 2025, and advancing a reform agenda built on renewable registration, integrated pest management and agroecology, a national poisoning-surveillance system, enforceable liability financed on a polluter-pays basis, the phase-out of highly hazardous pesticides, cooperative federalism, and transparency.

Keywords:- Pesticide Regulation, Sustainable Development, Precautionary Principle, Regulatory Capture, Insecticides Act 1968, Pesticides Management Bill 2025, Highly Hazardous Pesticides, Pesticide Self-Poisoning, Endosulfan, Integrated Pest Management, Environmental Law In India.

I. INTRODUCTION

Few tools of modern farming illustrate the dilemma between production and safety as clearly as the pesticide. While it is the chemical that protects a standing crop from pests, it is also the one that can build up in soil and water, poison the farmer or farm worker who has no protection, and migrate up the food chain to the person eating the harvest without ever setting foot on the land. This paradox has its epicentre in India. The country is one of the largest producers, exporters, and users of pesticides in the world, and agriculture remains the livelihood of a substantial share of its population (Divan & Rosencranz, 2002). The legal question this article pursues is whether the Indian legal order, as it stands and as it is poised to change, can deliver sustainable pesticide management, that is, a regime that secures crop protection without sacrificing the health of present and future generations or the integrity of the environment.

That question has acquired fresh urgency. On 7 January 2026 the Union Ministry of Agriculture and Farmers Welfare released a fresh draft of the Pesticides Management Bill, 2025, for public consultation, the latest in a line of attempts (after abortive drafts in 2008, 2017, and 2020) to repeal the more-than-half-century-old Insecticides Act, 1968 (Pesticides Management Bill, 2025; Press Information Bureau, 2026). The persistence of this reform effort across successive governments is itself evidence that the existing framework is widely regarded as obsolete. The repeated failure to carry reform through, and the limited aspirations of the 2025 draft, together reveal that India's problem is not simply a shortage of legislation, but rather a shortage of institutional design and of the political will to implement alternatives.

The contribution of this article is to bring together strands that are usually treated in isolation, namely the constitutional jurisprudence of environmental rights, the doctrinal content of the precautionary and polluter-pays principles, the public-health evidence on pesticide poisoning, the comparative regulatory experience of other jurisdictions, and the specific text of the pending Bill, and to read them against a single normative benchmark. The method is doctrinal and comparative: it interprets the governing statutes and leading judgments, situates them within India's international obligations, and tests them against the design features of more mature regulatory systems.

The argument proceeds in thirteen further parts. Part II situates the problem in the chemical intensification of the Green Revolution. Part III sets out the conceptual framework, articulating what sustainability demands of pesticide law. Part IV maps the existing statutory architecture and the constitutional distribution of competence, and Part V locates the regime within the constitutional and precautionary jurisprudence. Part VI examines the Kasaragod endosulfan litigation as a case study in regulatory failure. Part VII turns to the public-health burden of poisoning and self-harm and the surveillance deficit that conceals it. Part VIII assesses India's international obligations and the trade in hazardous pesticides. Part IX examines the practice of bans and reviews and the problem of regulatory capture. Part X draws comparative lessons from the European Union, the United States, and Brazil. Part XI considers alternatives and the promotion of safer pest management. Part XII evaluates the Pesticides Management Bill, 2025. Part XIII advances a reform agenda, and Part XIV concludes.

II. THE GREEN REVOLUTION AND INDIA'S PESTICIDE DEPENDENCE

India's dependence on chemical pesticides is in large part a legacy of the Green Revolution of the late 1960s and 1970s, when high-yielding seed varieties, assured irrigation, and heavy chemical inputs were promoted together as a single package designed to secure national food self-sufficiency (Divan & Rosencranz, 2002). The Insecticides Act, 1968, was enacted at precisely this moment of chemical optimism, when the dominant policy concern was to guarantee the quality and availability of insecticides rather than to guard against their long-term toxicity. The statute's very title, addressed to "insecticides," reflects an era in which the paradigmatic agrochemical was a compound such as DDT, valued for its efficacy against vector-borne disease and crop pests and only later understood to be a persistent organic pollutant with grave ecological consequences.

The scale of the resulting dependence is now considerable. India is among the largest producers, consumers, and exporters of pesticides in the world, and a substantial share of its workforce remains engaged in agriculture, much of it as smallholders and landless labourers who apply chemicals by hand and with minimal protection. This structural profile magnifies the stakes of regulatory design, because the population most exposed to pesticide hazard, namely farmers and farm workers, is also the population least equipped to absorb the costs of exposure or to navigate the formal machinery of redress. A statute conceived to promote and standardise chemical use, rather than to anticipate and contain its harms, is poorly matched to this reality.

The statute has proved remarkably durable, and remarkably difficult to replace. Successive attempts at comprehensive reform, in the form of draft Pesticide Management Bills introduced or circulated in 2008, 2017, and 2020, each foundered before enactment, whether for want of parliamentary time, resistance from affected interests, or unresolved disagreement over the balance between central and State authority (Pesticide Management Bill, 2020; Pesticides Management Bill, 2025). The 2025 draft is thus the fourth serious attempt in less than two decades. That the Insecticides Act, 1968, has survived every one of them is testimony less to its adequacy than to the political difficulty of dislodging an entrenched regulatory settlement, and it lends the present reform moment a significance that the modest ambitions of the draft do not, on their own, convey.

The remainder of this article proceeds from a single premise: that the deficiencies of Indian pesticide law are not, in the main, deficiencies of principle. India's courts have developed one of the most expansive bodies of environmental-rights jurisprudence anywhere in the world, and the country is a party to the major international instruments governing hazardous chemicals. The difficulty lies in the translation of these principles into operative regulatory institutions capable of anticipating harm, monitoring exposure, and enforcing accountability across the pesticide life cycle.

III. CONCEPTUAL FRAMEWORK: WHAT SUSTAINABILITY DEMANDS OF PESTICIDE LAW

3.1. Sustainable development as a binding legal principle

"Sustainable development" entered the mainstream of international environmental discourse with the Brundtland Commission's formulation of development that meets present needs without compromising the ability of future generations to meet their own (World Commission on Environment and Development, 1987). In the Indian context, the Supreme Court has treated sustainable development not as an aspiration but as a binding legal principle, holding that the precautionary principle and the polluter-pays principle are its "essential features" and form part of the law of the land (Vellore Citizens' Welfare Forum v. Union of India, 1996). Translated to pesticides, these principles impose three distinct demands on the legal order.

3.2. The three demands: anticipation, life-cycle stewardship, and accountability

The first is anticipatory regulation. The precautionary principle requires that where an activity threatens serious or irreversible harm, the absence of full scientific certainty must not be used to postpone protective measures, and the burden of proving environmental benignity shifts to the proponent of the activity (Vellore Citizens' Welfare Forum v. Union of India,

1996; Sands & Peel, 2018). For pesticide law this means that registration cannot be a one-time clearance frozen at the moment of approval; it must be a continuing, evidence-responsive licence subject to periodic re-evaluation as toxicological knowledge advances.

The second demand is life-cycle stewardship. A pesticide presents some level of hazard at each phase of its cycle: manufacture, transportation, storage, labelling, sale, use, and ultimately the disposal or waste management of residue and packaging materials. The FAO International Code of Conduct on Pesticide Management was developed with exactly this cycle in mind; it establishes continual obligations to minimise risk rather than obligations confined to the pre-market process (Food and Agriculture Organization & World Health Organization, 2014). A regulatory law that provides detailed rules for registration but no rules for application, worker exposure, and waste management is therefore structurally incomplete.

The third demand is accountability and redress. The polluter-pays principle treats the liability of the actor who introduces a hazardous substance as extending beyond compensation to the immediate victim to the cost of restoring the degraded environment (Indian Council for Enviro-Legal Action v. Union of India, 1996; Leelakrishnan, 2016). Sustainable pesticide law therefore needs a credible liability regime, one that attaches consequences to manufacturers and distributors for poisoning, mislabelling, and environmental harm, together with a surveillance system capable of detecting harm in the first place. These three demands, namely anticipation, life-cycle stewardship, and accountability, form the benchmark against which the remainder of this article evaluates Indian law.

3.3. The precautionary principle in international law

The precautionary principle that Indian courts have domesticated has deep roots in international environmental law. It is most familiarly expressed in Principle 15 of the Rio Declaration on Environment and Development, which provides that a lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation where there are threats of serious or irreversible harm (Rio Declaration, 1992). Although scholars continue to debate whether the principle has crystallised into a rule of customary international law, its normative force is now widely accepted, and it informs a growing body of treaty practice and judicial reasoning (Sands & Peel, 2018). The significance for present purposes is that the principle India applies is not an idiosyncratic domestic invention but a shared international standard, which strengthens the case for embedding it in the operative machinery of pesticide registration rather than leaving it to episodic judicial enforcement.

IV. THE EXISTING STATUTORY ARCHITECTURE

4.1. The Insecticides Act, 1968, and its institutions

The Indian government regulates pesticides through an assortment of statutes administered separately by different departments. The base of this regulation is the Insecticides Act of 1968 and the Insecticides Rules of 1971 (Insecticides Act, 1968; Insecticides Rules, 1971). The defining characteristic of the Act is its registration process: all pesticides, whether manufactured within the country or imported into it, must be registered before they may be sold. The term “insecticides” as used in the legislation refers specifically to chemicals that kill insects, a category considerably narrower than the herbicides, fungicides, rodenticides, and biopesticides that make up most of the modern pesticide industry.

The institutional machinery under the Act is concentrated at the centre. The Central Insecticides Board advises the Government on scientific and technical questions; the Registration Committee registers insecticides after scrutinising their safety and efficacy; and the Central Insecticides Laboratory provides analytical support (Insecticides Act, 1968; Singh, 2016). Day-to-day enforcement, by contrast, is devolved to the States, which license manufacturers and dealers, appoint insecticide inspectors and analysts, and prosecute contraventions. In practice this division leaves the single most consequential decision, whether a molecule may enter the market at all, with a central committee, while the front-line tasks of inspection, sampling, and enforcement fall to State agriculture departments that are frequently under-resourced. The result is a system that is strong on paper at the point of registration and weak in the field, where exposure actually occurs.

4.2. Three structural flaws

Three structural flaws in the 1968 framework bear on its sustainability. The first concerns registration. Registration under the Act generally amounts to a permanent clearance, since the statute makes no provision for mandatory evaluation at regular intervals in the light of evolving toxicology, which is exactly what the precautionary principle requires (Divan & Rosencranz, 2002). The second concerns the distribution of power: the authority to prohibit a pesticide is concentrated in the Central Government under Section 27, leaving the States, which confront poisoning outbreaks first and administer agriculture as a State subject in practice, with attenuated authority to act on local conditions (Insecticides Act, 1968). The third concerns enforcement: the Act’s penal provisions are weak and seldom invoked against manufacturers, so the deterrent and compensatory functions demanded by the polluter-pays principle are largely absent in practice.

4.3. The wider regulatory field

The 1968 Act does not exhaust the field. Pesticide residues in food are governed by the Food Safety and Standards Act, 2006, under which the Food Safety and Standards Authority of India fixes maximum residue limits and enforces them in articles of food (Food Safety and Standards Act, 2006). Persistent organic pollutants, a category that includes several organochlorine pesticides, are controlled separately under the Environment (Protection) Act, 1986, through the Regulation of Persistent Organic Pollutants Rules, 2018, which give domestic effect to India’s obligations under the Stockholm Convention (Environment (Protection) Act, 1986; Regulation of Persistent Organic Pollutants Rules, 2018). This fragmentation, with the agriculture, health, and environment ministries each holding a portion of the regulatory whole, diffuses responsibility and makes a coherent, life-cycle approach difficult to achieve.

4.4. Constitutional competence and the federalism tension

The distribution of legislative competence deepens the difficulty. Under the Seventh Schedule to the Constitution, agriculture is a State subject, falling within Entry 14 of the State List, so that the cultivation practices in which pesticides are actually used lie within the primary domain of the States (Constitution of India, 1950). The regulation of pesticides themselves, however, is generally traced to Entry 19 of the Concurrent List, which covers drugs and poisons, and the Insecticides Act, 1968, is a central enactment occupying this field (Constitution of India, 1950; Singh, 2016). The consequence is a structural mismatch: the States administer agriculture and confront the human consequences of poisoning first, yet the decisive powers of registration and prohibition are exercised centrally, and by operation of Article 254 a State law repugnant to the central Act would ordinarily yield. This allocation leaves the level of government closest to the harm with the least authority to prevent it, a point to which the reform discussion in Part XIII returns.

V. CONSTITUTIONAL FOUNDATIONS AND PRECAUTIONARY JURISPRUDENCE

5.1. Article 21 and the environmental-rights jurisprudence

Whatever the gaps in statute, Indian pesticide regulation is overlaid by a powerful constitutional jurisprudence. The Supreme Court has long read the right to life under Article 21 to include the right to live in a pollution-free environment conducive to health (Subhash Kumar v. State of Bihar, 1991). This reading is reinforced by Article 48A, which directs the State to protect and improve the environment, and Article 51A(g), which makes it a fundamental duty of every citizen to protect the natural environment (Constitution of India, 1950; Leelakrishnan, 2016). More recently the Court has recognised a distinct right against the adverse effects of climate change as embedded in Articles 14 and 21, signalling the continuing expansion of this jurisprudence (M.K. Ranjitsinh v. Union of India, 2024).

5.2. The precautionary and polluter-pays principles in the courts

In Vellore Citizens' Welfare Forum the Court held that the precautionary and polluter-pays principles form part of the environmental law of the land, and in A.P. Pollution Control Board v. Prof. M.V. Nayudu it elaborated the principle's implications for scientific uncertainty, holding that where knowledge is inconclusive the burden lies on the developer or industrialist to show that the activity is environmentally benign (A.P. Pollution Control Board v. Prof. M.V. Nayudu, 1999; Vellore Citizens' Welfare Forum v. Union of India, 1996). These holdings supply the doctrinal foundation for treating registration as a conditional, revisable licence rather than a vested and permanent entitlement.

5.3. Absolute liability and the industrial-hazard cases

The second doctrinal strand is the rule of absolute liability, formulated in M.C. Mehta v. Union of India after the oleum gas leak and applied in the industrial-pollution context in Indian Council for Enviro-Legal Action: an enterprise engaged in a hazardous activity is strictly and absolutely liable for the harm it causes, without the exceptions that qualify the older English rule (Indian Council for Enviro-Legal Action v. Union of India, 1996; M.C. Mehta v. Union of India, 1987). Read together with the precautionary and polluter-pays principles, these doctrines supply the constitutional raw material for a preventive, polluter-funded model of pesticide regulation. What has been missing is their embedding in statute.

5.4. The National Green Tribunal and the limits of adjudication

The institutional response to environmental harm has been strengthened by the creation of the National Green Tribunal under the National Green Tribunal Act, 2010, a specialised forum empowered to hear environmental disputes and to apply the precautionary and polluter-pays principles and the principle of sustainable development in doing so (National Green Tribunal Act, 2010). Yet the Tribunal, like the constitutional courts before it, operates for the most part reactively, adjudicating harm after it has occurred. It is not a substitute for a front-line regulatory apparatus capable of preventing exposure in the first place, which is precisely what the pesticide regime lacks.

VI. THE ENDOSULFAN LITIGATION: A CASE STUDY IN REGULATORY FAILURE

Nowhere has the constitutional jurisprudence intersected with pesticide regulation more dramatically than in the litigation arising from Kasaragod district in Kerala, where the aerial spraying of endosulfan over cashew plantations for nearly two decades was linked in epidemiological studies to severe neurological, developmental, and reproductive disorders among residents (Centre for Science and Environment, 2011). The episode is worth examining in detail, because it exposes with unusual clarity the gap between principle and institutional capacity that is the theme of this article.

In Democratic Youth Federation of India v. Union of India, a three-judge bench led by Chief Justice Kapadia passed an ad-interim order on 13 May 2011 banning the manufacture, sale, and use of endosulfan throughout the country, expressly invoking the precautionary principle and the right to life under Article 21, and constituting a joint expert committee of the Indian Council of Medical Research and the Agriculture Commissioner to study the question (Democratic Youth Federation of India v. Union of India, 2011). The Court was willing to act on a precautionary basis without waiting for conclusive proof. As the Chief Justice is reported to have observed, he could not allow the use of endosulfan for even seven weeks, and the Court subordinated the manufacturers' commercial interest to the health of a single child (Centre for Science and Environment, 2011). It permitted the regulated export and disposal of existing stockpiles, consistently with India's phase-down commitments under the Stockholm Convention, and later directed the State of Kerala to pay compensation to victims of pesticide poisoning together with lifetime medical care (Democratic Youth Federation of India v. Union of India, 2017).

The case illustrates both the strength and the limits of judicial intervention. This remedial action resulted from a writ petition brought decades after the harms began, and only because of sustained mobilisation by civil society, which demonstrates

an obvious inadequacy in the front-line regulatory apparatus established by the Insecticides Act to forestall just such catastrophes. The endosulfan saga thus operates as a parable for the central thesis of this article: India does not lack environmental principles, for the precautionary and polluter-pays principles are constitutionally entrenched and judicially enforced, but it lacks the institutional capacity to operationalise them at the regulatory level, before harm crystallises and litigation becomes necessary.

VII. THE PUBLIC-HEALTH DIMENSION

7.1. Acute occupational poisoning

The human cost of India's pesticide regime is borne disproportionately at the level of the individual farmer and farm worker, and it is largely invisible to the regulatory system because the system does not systematically look for it. Acute occupational poisoning during mixing and spraying is recurrent. The deaths of scores of cotton farmers and labourers in Yavatmal district of Maharashtra in 2017, following inhalation exposure during the spraying of insecticide combinations, and the contamination of a school meal with an organophosphate that killed children in Bihar in 2013, are among the episodes that periodically force the issue into public view (Pesticide Action Network India, 2026). What such episodes share is that they surface through the media and litigation rather than through any routine mechanism of detection.

Chronic exposure is harder to see but no less serious. Long-term, low-dose contact with certain pesticides has been associated in the scientific literature with carcinogenic, endocrine-disrupting, neurodevelopmental, and reproductive effects, harms that manifest years after exposure and are difficult to trace to any single product or event. Because these effects are latent and diffuse, they are especially poorly captured by a regulatory system that reacts only to discrete and visible incidents. A framework genuinely committed to the precautionary principle would treat the mere plausibility of such long-latency harm, rather than conclusive proof of it in a particular case, as a trigger for protective action.

7.2. Pesticide self-poisoning and means restriction

Beyond acute occupational exposure lies a second, larger, and still less visible burden: pesticide self-poisoning. Systematic reviews have long identified the deliberate ingestion of pesticides as one of the most common methods of suicide worldwide, with the burden concentrated in the rural agricultural communities of South and East Asia, where highly hazardous compounds are cheap, potent, and readily to hand (Gunnell et al., 2007; Mew et al., 2017). The ready availability of acutely toxic molecules in the household and the field converts moments of transient crisis into fatal outcomes. This reframes pesticide regulation as a question of public health and of means restriction, and not merely one of agriculture or environment.

7.3. The Sri Lankan experience

The regulatory implication is striking, because it has been tested. Sri Lanka's phased prohibition of the most acutely toxic pesticides, pursued quietly over several decades, is associated with one of the largest documented declines in a national suicide rate achieved by any single public-health intervention, and it was achieved without a corresponding fall in agricultural output (Gunnell et al., 2017). Comparative reviews report substantial reductions in pesticide-related suicide following bans on highly hazardous pesticides across several Asian countries, including India itself (Gunnell et al., 2017). The lesson is that removing the most dangerous molecules from circulation saves lives directly, and that the regulatory choice of which molecules to register and retain is, quite literally, a choice about mortality.

7.4. Worker safety, protective equipment, and labelling

A further dimension of the problem concerns the conditions under which pesticides are actually applied. The safety architecture of Indian pesticide law rests heavily on the label: the Insecticides Rules, 1971, prescribe the information and warnings that must accompany a product, and the FAO Code elaborates good practice for packaging, labelling, and protective measures across the distribution chain (Food and Agriculture Organization & World Health Organization, 2014; Insecticides Rules, 1971). Label-based safety, however, presupposes a literate applicator equipped with protective clothing and able to read and act on technical instructions, frequently rendered in a language other than the applicator's own. In a workforce composed largely of smallholders and landless labourers, many of whom apply concentrated formulations by hand and without protection, these assumptions often fail, and women, who perform a substantial share of agricultural labour, bear a disproportionate and under-studied part of this exposure. A regime formally oriented toward safe use thus delivers, in practice, unsafe use, and the gap between the two is a regulatory failure rather than merely a behavioural one.

7.5. The surveillance deficit

India lacks a national system for the surveillance of pesticide poisoning. There is no comprehensive registry that records acute and chronic poisoning events, aggregates them, and feeds the resulting evidence back into decisions about registration and prohibition. Without such a feedback loop the regulator is structurally blind: it cannot know, in any systematic way, which registered products are causing harm in the field, and it therefore cannot discharge the anticipatory, evidence-responsive function that the precautionary principle demands. The surveillance deficit is thus not a peripheral administrative gap but a central defect in the design of the regime.

VIII. INDIA'S INTERNATIONAL OBLIGATIONS AND THE TRADE DIMENSION

8.1. The Stockholm and Rotterdam Conventions

India's pesticide law is also shaped by international commitments that the Constitution directs the State to honour. The Stockholm Convention on Persistent Organic Pollutants, which India ratified on 13 January 2006, obliges parties to eliminate

or restrict the production and use of listed persistent organic pollutants, a list dominated by organochlorine pesticides such as aldrin, dieldrin, DDT, and, since 2011, endosulfan (Stockholm Convention, 2001). India gave domestic effect to these obligations through the Regulation of Persistent Organic Pollutants Rules, 2018, although it has historically adopted an "opt-out" posture toward amendments adding new chemicals to the Convention's annexes (Regulation of Persistent Organic Pollutants Rules, 2018). The Rotterdam Convention on the Prior Informed Consent Procedure complements this by regulating the international trade in hazardous chemicals and pesticides: a chemical banned or severely restricted in multiple regions may be listed in Annex III, after which exporting parties must obtain the prior informed consent of the importing State (Rotterdam Convention, 1998).

8.2. The FAO Code and highly hazardous pesticides

The third instrument is the FAO International Code of Conduct on Pesticide Management, a voluntary but widely endorsed framework that articulates best practice across the pesticide life cycle and expressly promotes integrated pest management and the progressive phasing out of highly hazardous pesticides (Food and Agriculture Organization & World Health Organization, 2014). The FAO and WHO have jointly developed the concept of "highly hazardous pesticides," a category defined by acute or chronic toxicity and singled out for progressive phase-out, while the Globally Harmonized System of Classification and Labelling of Chemicals supplies a common grammar for communicating hazard across borders, and the Strategic Approach to International Chemicals Management presses states toward life-cycle risk reduction and the substitution of safer alternatives (Food and Agriculture Organization & World Health Organization, 2016). The Code's chief limitation, its voluntary character and the absence of any compliance mechanism, mirrors the deeper problem of Indian implementation: norms exist in abundance, but the machinery to enforce them lags behind. India participates in these frameworks, but it has not translated the highly-hazardous-pesticide concept into a systematic domestic programme of identification and phase-out.

8.3. The export "double standard"

The trade dimension exposes a further tension. India is simultaneously a large importer of pesticides and one of the world's major exporters, and this dual position places it on both sides of a contested ethical and legal question about the international movement of hazardous chemicals. In recent years the practice of manufacturing for export pesticides that are banned for domestic use, long criticised as a "double standard," has drawn condemnation from United Nations human-rights experts and prompted the first national prohibitions: France's law barring the manufacture, storage, and export of European-Union-banned pesticides took effect in 2022, followed by comparable measures elsewhere in Europe (Public Eye & Unearthed, 2020). For India the issue cuts both ways. As an importer, it is exposed to molecules restricted elsewhere; as an exporter, it faces the prospect that its own banned or highly hazardous products may travel to jurisdictions even less able to manage them. The point is not abstract for India. Independent monitoring of pesticide residues in food traded into the European Union has identified India as a leading source of samples bearing residues of substances banned in the Union, a finding that illustrates how domestically permitted or inadequately controlled molecules re-enter the global food chain (Pesticide Action Network Europe, 2024). A regime oriented toward sustainability cannot treat the export of hazard as beyond its concern, and the Rotterdam Convention's prior-informed-consent architecture, valuable though it is, regulates the flow of information rather than the underlying trade.

IX. BANS, REVIEWS, AND THE PROBLEM OF REGULATORY CAPTURE

9.1. The Anupam Verma review and the twenty-seven-pesticide episode

The clearest window onto the working of Indian pesticide regulation is the record of bans and reviews over the past decade. In 2013 the Department of Agriculture constituted an expert committee under Dr. Anupam Verma to review sixty-six pesticides that were banned, restricted, or withdrawn in other countries but remained registered for use in India (Press Information Bureau, 2023). The committee's recommendations led to the prohibition of eighteen pesticides in 2018, with the ban on several of them taking effect only at the end of 2020 (List of Banned and Restricted Pesticides in India, n.d.). In May 2020 the Ministry issued a draft order proposing to ban a further twenty-seven pesticides on the ground that their continued use was likely to involve risk to human beings and animals, many of them highly hazardous molecules associated with carcinogenicity, endocrine disruption, neurotoxicity, or toxicity to pollinators (Pesticide Action Network India, 2020). The industry response was immediate and forceful: manufacturers' associations challenged the scientific basis of the order, warned of severe damage to exports, and argued that bans abroad could not automatically justify bans in India given its distinct agro-climatic conditions (Deccan Herald, 2020). By 2023 the Government had retreated, formally prohibiting only three of the twenty-seven molecules through a fresh draft order, while the remainder continued in use or under review (Pesticide Action Network India, 2023).

9.2. The glyphosate episode

The glyphosate episode reinforces the point. Rather than banning the controversial herbicide, the Government in 2022 restricted its use to certified pest-control operators, a measure widely regarded as practically unenforceable given the millions of dispersed farmers who actually apply it (AgroPages, 2020). Even where prohibition is nominally achieved, the absence of restriction-of-use infrastructure, that is, licensed applicators, traceability, and surveillance, renders partial measures hollow.

9.3. Diagnosing capture

Taken together, the review record supports a diagnosis of regulatory capture. Capture theory describes the tendency of a regulator, over time, to serve the interests of the industry it is meant to control rather than the public interest, whether through informational dependence, the movement of personnel between regulator and regulated, or sustained political pressure. The

Indian pesticide-review process exhibits several of the classic symptoms: the regulator depends for its scientific evidence on studies generated or funded by the very manufacturers whose products are under review; the burden of proof in practice falls on the regulator to demonstrate harm rather than on the proponent to demonstrate safety, inverting the precautionary principle; and industry associations possess both the organisation and the economic stake to mount sustained resistance to prohibition, as the retreat from twenty-seven molecules to three vividly illustrates. Diffuse victims, by contrast, are poorly organised and rarely represented where decisions are taken. Understood in these terms, the reform problem is not merely to write better rules but to design institutions resistant to capture.

X. COMPARATIVE REGULATORY MODELS

10.1. Two regulatory philosophies: hazard-based and risk-based approaches

Comparative pesticide regulation is organised around a foundational choice between two philosophies. A risk-based approach permits a hazardous substance where exposure can be managed to an acceptable level, and therefore turns on modelling how, and how much, people and ecosystems are actually exposed. A hazard-based approach, by contrast, excludes substances possessing certain intrinsic properties, such as carcinogenicity or environmental persistence, regardless of projected exposure, on the view that exposure controls cannot be relied upon under real-world conditions. The distinction matters acutely for a country such as India, where the assumptions underpinning risk-based control, namely trained applicators, protective equipment, and enforceable use conditions, frequently do not hold. Where exposure cannot in practice be controlled, a hazard-based rule that removes the most dangerous molecules outright is both more protective and more administrable, and the comparative material that follows should be read with this choice in mind.

10.2. The European Union: hazard cut-offs, substitution, and reduction targets

Under the European Union's Plant Protection Products Regulation, the approval of an active substance is granted for a defined and renewable period rather than in perpetuity, and each renewal requires the applicant to demonstrate afresh, through current studies, that the substance satisfies the approval criteria (Regulation (EC) No 1107/2009, 2009). The Regulation is distinctive in two further respects. It incorporates hazard-based "cut-off" criteria, so that substances identified as, for example, carcinogenic, mutagenic, toxic to reproduction, or persistent and bioaccumulative are in principle excluded from approval irrespective of exposure modelling; and it introduces the mechanism of "candidates for substitution," under which more hazardous substances are flagged for comparative assessment against safer alternatives (Regulation (EC) No 1107/2009, 2009). This registration architecture is coupled with an explicit reduction agenda. The European Union's Farm to Fork Strategy sets targets to halve both the overall use and risk of chemical pesticides and the use of the more hazardous among them by 2030, and integrated pest management has been a legal obligation across the Union since 2014 under the Sustainable Use of Pesticides Directive (Directive 2009/128/EC, 2009; European Commission, 2020). The trajectory has not been smooth; the binding legislative vehicle intended to entrench these targets, the proposed Sustainable Use Regulation, was withdrawn in 2024 amid political resistance, a reminder that even mature systems struggle to convert ambition into enforceable law (European Commission, 2020).

10.3. The United States: periodic registration review under FIFRA

The United States' Federal Insecticide, Fungicide, and Rodenticide Act supplies a complementary lesson in the form of mandatory periodic re-evaluation. FIFRA requires the Environmental Protection Agency to conduct a registration review of every registered pesticide on a recurring cycle not exceeding fifteen years, so that products are re-examined against current scientific standards rather than grandfathered indefinitely on the strength of a decades-old approval (Federal Insecticide, Fungicide, and Rodenticide Act, 2018). Set against these models, India's de facto permanent registration is an outlier. The comparative evidence indicates that renewable, evidence-responsive registration is neither exotic nor incompatible with a productive agricultural economy, and that it is the natural statutory expression of the precautionary principle that Indian courts have already declared binding.

10.4. A cautionary comparison: deregulation in Brazil

A third comparison points in the opposite direction and serves as a cautionary tale. Brazil, already among the world's largest consumers and importers of pesticides, enacted in late 2023 a law popularly known as the "poison package," which shifted primary authority over pesticide approval to the Ministry of Agriculture, diminished the roles of the national health and environmental agencies, and created a fast-track mechanism permitting temporary registration before a substance's risks are fully assessed (Law No. 14,785, 2023). United Nations human-rights experts and independent observers warned that the reform would expose farmers, workers, and rural communities to hazardous substances and marked a retrograde step for the rights to health and to a healthy environment (Human Rights Watch, 2023). For India the Brazilian example is instructive precisely as a counter-model: it demonstrates how quickly a registration system can be hollowed out when the agency charged with promoting agricultural production is also placed in charge of policing its hazards, and it underscores the importance of preserving independent health and environmental scrutiny within any reformed Indian regime.

10.5. Lessons for India

The comparative frame yields three lessons. First, registration, hazard-based exclusion, substitution, and quantified reduction are most effective when treated as parts of a single, mutually reinforcing system rather than as isolated measures. Second, periodic re-evaluation on a fixed cycle is the ordinary international practice and the natural expression of the precautionary principle. Third, the location of regulatory authority matters: concentrating approval in an agency whose mission is to promote production, as Brazil has done, invites capture, whereas preserving independent health and environmental

scrutiny guards against it. The comparative material also underscores the trade dimension, for the same European systems that exclude the most hazardous substances from their own fields have until recently permitted their manufacture for export, a contradiction that national export bans have begun to address (Public Eye & Unearthed, 2020).

XI. ALTERNATIVES AND THE PROMOTION OF SAFER PEST MANAGEMENT

11.1. Integrated pest management and agroecology

The most important alternative to chemical-intensive pest control is integrated pest management, an approach that combines biological, cultural, mechanical, and, only as a last resort, chemical methods, and that the FAO Code expressly promotes (Food and Agriculture Organization & World Health Organization, 2014). Agroecological practice extends this logic to the design of the farming system as a whole. Domestic experience is encouraging: large-scale programmes of community-managed natural farming in Andhra Pradesh have demonstrated that agroecological methods can be scaled among hundreds of thousands of smallholders while maintaining yields and reducing input costs (Food and Agriculture Organization, n.d.). Crucially, the European Union has shown that such approaches need not remain voluntary, having made integrated pest management a legal obligation for professional users since 2014 (Directive 2009/128/EC, 2009). Indian law, by contrast, treats these methods as exhortation rather than requirement.

11.2. Biopesticides and the regulatory pathway for safer inputs

A related problem concerns the regulatory pathway for safer inputs. Biopesticides, products derived from natural materials such as micro-organisms, plant extracts, and biochemicals, generally present a lower hazard profile than synthetic chemicals, and their promotion is a natural corollary of a sustainability-oriented regime. Yet under the Insecticides Act, 1968, biological products are drawn into essentially the same registration architecture that was designed for synthetic molecules, so that the data requirements and procedural burdens fall disproportionately on lower-hazard alternatives (Insecticides Act, 1968). A regime serious about substitution would provide a proportionate, expedited pathway for genuinely low-risk biological inputs, of the kind that the 2025 Bill gestures toward but does not clearly deliver (Pesticides Management Bill, 2025).

11.3. Transparency, information, and public participation

Finally, the legitimacy and quality of pesticide decisions depend on transparency. Registration and review decisions in India are taken largely behind closed doors, with limited publication of the underlying safety data or the reasoning of the expert bodies, and limited opportunity for affected communities and independent scientists to participate. This opacity both weakens public trust and compounds the problem of capture, since it deprives the process of the external scrutiny that might counterbalance industry influence. A sustainable regime should treat the disclosure of safety data and the reasoned publication of registration and prohibition decisions as a default, subject only to genuine and narrowly defined claims of confidentiality, and should build in structured avenues for public participation.

XII. THE PESTICIDES MANAGEMENT BILL, 2025: PROMISE AND SHORTFALL

12.1. Advances over the 1968 Act

Against this backdrop, the Pesticides Management Bill, 2025, represents the latest attempt to modernise the regime. Like its 2020 predecessor, the Bill seeks to regulate the manufacture, import, packaging, labelling, storage, advertisement, sale, transport, distribution, use, and disposal of pesticides, and to replace the Insecticides Act, 1968, and the Rules of 1971 (Pesticides Management Bill, 2025; Pesticide Management Bill, 2020). The draft adopts a broad, modern definition of "pesticide" that captures substances of chemical or biological origin, contemplates a Central Pesticides Board for scientific and technical advice, and gestures toward transparency, traceability, and the promotion of biological and traditional-knowledge-based alternatives (Pesticides Management Bill, 2025). These are genuine advances over a 1968 statute drafted for the narrower category of "insecticides."

12.2. Measured against the three benchmarks

Yet the consensus among independent analysts is that the 2025 draft introduces only limited substantive change over the 2020 version, leaving the core deficiencies unaddressed. The number of clauses was reduced from sixty-five to fifty-five, but critics argue that the language was diluted rather than strengthened (Down to Earth, 2026; Pesticide Action Network India, 2026). The most criticised drafting choice is the Bill's stated object: it merely "strives to minimise risk" to human beings, animals, non-target organisms, and the environment, rather than committing to ensure or to minimise such risk, a softening that civil-society groups had specifically warned against in the 2020 consultations (Vajiram & Ravi, 2026). Measured against the three benchmarks of anticipation, life-cycle stewardship, and accountability, the Bill falls short on each. Anticipation is undercut by the absence of a mandatory, robust post-registration evaluation process that would make registrants responsible for proving that their product remains safe. Life-cycle stewardship is undermined by inadequate mechanisms for tracking and monitoring poisonings and by the absence of any requirement that integrated pest management be adopted across sectors. Accountability suffers because the Bill fails to establish clear criminal liability for the misuse of products, poisoning, and environmental contamination, and provides no adequate mechanism for compensation and redress to those who have been harmed (Pesticide Action Network India, 2026).

12.3. The federalism deficit

The federalism deficit is equally striking. State governments, which manage the public-health consequences of poisoning and possess intimate knowledge of local cropping patterns, have repeatedly demanded greater powers to prohibit or

restrict pesticides within their territories, together with price regulation and liability provisions. The 2025 draft, like its predecessor, largely declines to devolve such authority, perpetuating a centralised model ill-suited to a country of India's agro-ecological diversity (Down to Earth, 2026).

XIII. TOWARD A SUSTAINABLE REGIME: A REFORM AGENDA

If the diagnosis is that India suffers from a deficit of institutional design rather than of principle, the prescription must be institutional. Eight reforms, taken together, would align the regime with the demands of sustainability.

First, registration must be converted into a time-based, renewable licence rather than a permanent clearance. This would require registrants to prove continued safety on a fixed cycle, with the burden of demonstrating benignity resting on them, and it would give statutory effect to the precautionary principle that the Supreme Court has already declared binding law (Vellore Citizens' Welfare Forum v. Union of India, 1996).

Second, integrated pest management and agroecological approaches should become the default for crop-protection policy, with chemical pesticides reserved as a last resort. This is consistent both with the FAO Code and with domestic experience, and the European Union's decision to make integrated pest management a legal obligation offers a model for moving such approaches from exhortation to requirement (Directive 2009/128/EC, 2009; Food and Agriculture Organization & World Health Organization, 2014; Food and Agriculture Organization, n.d.).

Third, India needs a national surveillance system for pesticide poisoning, integrated with its public-health network, so that clusters of acute and chronic poisoning can be detected and fed back into the process of re-evaluation. This early-warning function was absent at Kasaragod, where the tragedy unfolded over nearly two decades (Pesticide Action Network India, 2026).

Fourth, a meaningful liability and compensation structure must be embedded in the regime, providing civil and criminal penalties against manufacturers and distributors responsible for mislabelling or environmental harm. A no-fault compensation fund, financed on a polluter-pays basis, would in addition relieve victims of the obvious cost and delay of protracted litigation (Indian Council for Enviro-Legal Action v. Union of India, 1996; Leelakrishnan, 2016).

Fifth, the framework must embrace cooperative federalism, giving State governments calibrated authority to limit or bar the use of pesticides in the light of local conditions, while maintaining an overall floor of nationwide protection. It is not feasible to regulate so vast and varied a population of agricultural producers optimally from a single central location, and it is neither economically nor socially fair to exclude the States, which stand at the first line in dealing with poisonings, from the power to prohibit (Constitution of India, 1950).

Sixth, India should adopt a systematic programme for identifying and phasing out highly hazardous pesticides, using the criteria developed jointly by the FAO and WHO and drawing on the substitution logic of the European model. The public-health case for this reform is unusually strong and unusually direct, since the international evidence establishes that removing the most acutely toxic molecules from circulation reduces deaths from both occupational poisoning and self-harm without sacrificing agricultural productivity (Gunnell et al., 2017).

Seventh, the regime should align its domestic registration standards with its export controls, so that molecules judged too hazardous for Indian fields are not manufactured for use in jurisdictions even less able to manage them. The recent European national bans on the export of prohibited pesticides indicate both the direction of international practice and the feasibility of such a measure (Public Eye & Unearthed, 2020).

Eighth, the regime should be rebuilt on a foundation of transparency and independent scientific review. Safety data and the reasons for registration and prohibition decisions should be published as a matter of course; expert committees should include members independent of the regulated industry; and structured avenues should exist for affected communities and independent scientists to participate. Openness of this kind is the most durable safeguard against the regulatory capture diagnosed in Part IX.

The objection that such rigour would burden a developing agrarian economy is overstated. Integrated pest management has repeatedly been shown to maintain yields while reducing chemical inputs and farmer costs, and the expense of regulatory diligence is modest beside the human and ecological cost of the next Kasaragod (Food and Agriculture Organization, n.d.). The real choice is not between agriculture and protection, but between anticipatory regulation that prevents harm and reactive litigation that can only respond to it after the fact.

XIV. CONCLUSION

The legal architecture of sustainable pesticide management in India presents a paradox. At the level of principle the regime is rich: the Constitution houses a robust right to a healthy environment, and the Supreme Court has woven the precautionary and polluter-pays principles into the fabric of the law, nowhere more vividly than in the endosulfan litigation. At the level of international commitment, India is a party to the Stockholm and Rotterdam Conventions and an endorser of the FAO Code. Yet at the level of operative regulation the country still relies on a 1968 statute conceived for a narrower problem in a less knowing age, administered through a fragmented institutional architecture, a constitutional allocation that leaves the States powerless where they are most needed, a dilatory and capture-prone review process, and a near-total absence of surveillance, liability, and redress.

The Pesticides Management Bill, 2025, offered the chance to fill this gap. On the current draft, however, with its softer language, weaker accountability measures, and centralised regulatory structure, the Bill does not do so. It leaves most of the structural shortcomings of the 1968 regime intact. The path to a truly sustainable pesticide regime lies not in renaming "insecticides" as "pesticides," but in building a new institutional framework: renewable registration, integrated pest management by default, surveillance of poisoning, enforceable liability, a phase-out of the most hazardous molecules, a cooperative-federal allocation of prohibition powers, and transparency in decision-making. Unless the statute incorporates these fundamentals, India's pesticide regime will continue to deal with crises only once they occur, and the lessons of Kasaragod and Yavatmal will continue to go unlearned.

There is, nevertheless, cause for cautious optimism. The constitutional structures are solid, the judicial precedents exist, the comparative models are available, and the internationally agreed obligations are clear; what remains is the comparatively straightforward task of drafting a statute that incorporates the elements set out above. A legislature willing to learn from Kasaragod and Yavatmal, and from nearly three decades of failed reform efforts, could accomplish all of this in a single, well-crafted piece of legislation. The Pesticides Management Bill is currently open for comment: it can either carry out this reform agenda or merely rename an unsustainable pesticide regulatory regime.

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