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Through the Eyes of a Farmer: Evaluating the Risks and Protective Measures for Farmers in Agriculture

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ABSTRACT

Farmers, especially organic farmers in Uttar Pradesh, face multiple occupational risks including exposure to agricultural chemicals, climate-related hazards, and poor usage of personal protective equipment (PPE). This literature-based review synthesizes scholarly and policy sources on these risks and evaluates existing protective measures (crop insurance, government schemes, training, and NGO support). We highlight major vulnerabilities – toxic pesticide exposure, climate-change impacts on crops and health, low PPE adoption, and related ailments – using global and Indian data [1][2]. Our review shows that schemes like Pradhan Mantri Fasal Bima Yojana (PMFBY) and organic farming support programs (e.g. Paramparagat Krishi Vikas Yojana) aim to help farmers, but uptake and implementation gaps limit effectiveness [4][9]. NGOs provide training, health camps, and insurance to farmers [7][6]. We emphasize that organic farmers benefit from healthier practices [10], but still face climate and market vulnerabilities. There is a pressing need for better awareness training, improved insurance delivery, and more support to protect rural farmers.

Keywords: Organic farming; Uttar Pradesh; pesticide exposure; climate change; personal protective equipment; crop insurance; PMFBY; NGO interventions; farmer health; sustainable agriculture.

Introduction

Agriculture in India is characterized by smallholder farms and intense labor, often under hazardous conditions [2][10]. Organic farmers in Uttar Pradesh adopt sustainable methods (no synthetic pesticides/fertilizers), but they remain exposed to environmental hazards and must often compete with conventional producers. Major risks include exposure to agrochemicals (pesticides, herbicides, fertilizers), adverse climate events (droughts, floods, heatwaves), limited use of PPE, and underlying health vulnerabilities [2][1]. For example, rising temperatures force more pesticide use and lower efficacy, pushing farmers to increase application rates [2]. An international review reported roughly 385 million cases of acute unintentional pesticide poisoning annually (about 11,000 deaths) globally, with an estimated 44% of South Asian farmers poisoned each year [2]. Many of these toxins are neurotoxic or carcinogenic. Farmers' low adoption of safety measures exacerbates health impacts: recent data show only about one-quarter of exposed Indian farmers used masks (27%), goggles (20%), or gloves (15%) during chemical application [1]. These exposures contribute to fatigue, musculoskeletal pain, skin lesions and respiratory issues among rural farmers [1][1].

India's pesticide consumption has surged in recent decades. Use per agricultural worker roughly doubled from 2005 (0.16 kg/worker) to 2021 (0.30 kg/worker) [2]. Imported chart data show that pesticide use in India quadrupled between 2008 and 2019, driven by more insect and disease outbreaks [2][2]. As pest pressures grow with warmer, wetter conditions, chemical inputs rise. At the same time, organic farming clusters promoted by schemes like PKVY are small: only about 2.78 million hectares (2% of cultivated land) were under organic production by 2021 [5][9]. This limited adoption reflects both market demand and inadequate support for alternatives, keeping many farmers reliant on chemicals despite the health trade-offs [10]. The net result is a high burden of occupational disease in farming communities.

Literature Review

Chemical Exposure Risks: Numerous studies document harmful exposures for Indian farmers. Rural workers in southern India frequently handle pesticides without gloves or masks [1][3]. In one Karnataka study, 22% mixed pesticides with bare hands and 26% wore no protective clothing [1]. A Lucknow survey found two-thirds of farmers were unaware that PPE is needed when handling pesticides [1]. Chronic exposures link to cancers, kidney disease, neurodegenerative conditions and reproductive problems [2][1]. For example, a Mumbai study linked agrochemical use to cognitive decline; another in Maharashtra found elevated rates of Parkinson's among exposed workers [2]. Even organic farmers can suffer if neighboring fields spray agrochemicals (drift) or if they occasionally use organic pesticides improperly. The literature emphasizes that training and PPE availability are critical to reducing poisonings [1][1].

Climate and Environmental Hazards: Climate change intensifies farming risks. In UP, unpredictable monsoons, floods, and heat waves have become more common, undermining crop yields and farmer incomes [8][8]. CSIS reporting notes that ~80% of rural women (often farm laborers) face worsening drought and heat impacts, which reduce productivity and demand longer work hours in harsh conditions [8][8]. Droughts in 2023 impacted over 30% of India's land area, including UP, compounding water scarcity for farms [8]. Climate-driven pest cycles also burden farmers; warmer nights and changing rainfall have accelerated pest reproduction, prompting repeated pesticide applications [2]. Climate-linked crop failures increase farmer indebtedness and mental stress. Some studies report higher suicide rates during droughts in UP, indicating deep livelihood insecurity (despite primary focus being organic, these broader findings apply) [8]. Sustainable practices like crop diversification and organic soil management can enhance resilience, but adoption is limited. Organic methods (e.g. mulching, crop rotation) sequester carbon and improve water retention, yet research shows Indian awareness of agro-climate strategies is low [8][5]. In summary, climate variability amplifies existing farm risks, especially for resource-poor organic farmers who may lack irrigation or crop insurance safety nets [2][8].

Health Vulnerabilities and PPE: Occupational health among farmers is under-researched in India, but available data indicate significant vulnerabilities. A comparison of agrichemical-exposed vs. unexposed farmers found far higher symptom rates in the exposed group [1]. Fatigue was reported by 35% of exposed farmers (vs 20% controls); notable complaints included backache (32%) and neck pain (36%), as well as dermatitis (burns/blisters) and eye irritation [1]. These suggest chronic strain and chemical injury due to long hours and toxic contact. Lack of PPE exacerbates these outcomes. Even among literate and educated farmers, practice lags behind awareness: one study noted 74% knew PPE was needed but only about 59% actually wore a mask [1]. Common reasons for non-use include discomfort, cost, and lack of availability. Surveys in UP and elsewhere consistently find <30% of farmers use masks or gloves during spraying [1][1]. Low PPE use means acute poisonings go unprevented. The PPE deficit, combined with heat stress from climate, creates a perfect storm of vulnerability.

Organic manure production (vermicompost) provides a chemical-free soil amendment that many UP organic farmers make locally. Recycling cow dung and plant waste into vermicompost helps reduce fertilizer purchases and can improve soil health [9][5]. Organic manure exemplifies one protective strategy: by enhancing soil fertility naturally, farmers maintain yields without synthetic chemicals. Many NGOs train farmers in composting and biopesticide preparation to cut chemical use. For instance, local groups promote neem- or chili-based organic sprays to manage pests. Even so, knowledge gaps remain: studies show over half of rural farmers had never heard of organic alternatives to pesticides [1]. Government extension and NGOs conduct workshops, but their reach is limited. Nonetheless, research indicates that organic farming confers health benefits: a 2021 review found organic farmers have better overall health (both physical and psychological) than conventional farmers globally [10]. The lower chemical exposure and healthier practices likely underlie this advantage.

Findings

Chemical Exposure Prevalence: Literature and reports consistently show heavy chemical use and frequent poisonings in Indian farming. *ThinkGlobalHealth* reports a BMC review estimating 385 million annual cases of pesticide poisoning worldwide (11,000 fatalities), with South Asia having the highest incidence – roughly 44% of farmers poisoned yearly [2]. **[Table 1]** summarizes PPE usage deficits: only about a quarter of exposed farmers use basic protection [1]. Many engage in mixing or spraying without any gear [1]. This unsafe practice translates into common health problems (see **[Table 2]**), such as skin rashes, respiratory symptoms, and neurological issues (tremors, headaches) among rural pesticide handlers [1][3]. In organic areas, farmers avoid synthetic pesticides, but residual risk remains if neighbors use chemicals. Climate change worsens exposure: hotter temperatures not only boost pest pressures but can make chemicals more volatile. Thus, pesticide poisoning risk is likely higher now than a decade ago [2].

Health Vulnerabilities: Farm work entails chronic strain and exposure to zoonotic or toxic hazards. Manual labor leads to musculoskeletal injuries (back/neck pain) reported in more than 30% of exposed farmers [1]. Heat stress from long sun exposure is rarely reported but is likely significant. Malnutrition and lack of healthcare in rural areas further undermine farmer health. Organic farmers may have slightly better nutrition (due to on-farm food diversity) and mental wellbeing, but they share the burdens of heat and heavy labor with other farmers. Ultimately, the literature suggests that farm communities in Uttar Pradesh have elevated rates of chronic illnesses, cancer, and psychological distress compared to the general population [2][10], partly due to occupational hazards.

Protective Mechanisms – Government: In response to these risks, the Indian government has launched agricultural insurance and support schemes. PMFBY (crop insurance) is a flagship program: since 2016, 568 million farmer policies have been issued, with 232.2 million claims paid [4]. However, about 70% of cropped area remains uninsured [4]. Delays and claim rejections by insurers are chronic complaints [4]. **[Table 3]** below outlines coverage: only ~30% of land is insured, and weather advisories reach under 20% of farmers [4]. Organic farmers are eligible but often find little tailored support – for example, many rely on rainfed crops and may not qualify for indemnities tied to yield. The government also supports organic clusters through PKVY: by end-2024, ~15 lakh hectares and 2.53 million farmers were enrolled nationwide [9]. In Uttar Pradesh, these cluster programs and subsidies for bio-inputs aim to strengthen organic farming. Still, farmers report that policy details are hard to access, and training funds (₹9,000/ha for capacity building) are underutilized [9].

【Table 1】 PPE Usage Among Pesticide-Exposed Farmers in India

Source: [1]

PPE Type	% Farmers Using PPE during Spraying
Mask	27%
Goggles	20%
Gloves	15%

【Table 2】 Global Annual Pesticide Poisoning and Farmer Impact

Source: [2]

Metric	Value
Unintentional pesticide poisonings	~385 million/yr
Fatalities from poisonings	~11,000/yr
% of farmers poisoned (South Asia)	~44% annually

【Table 3】 Crop Insurance & Advisory Coverage in India

Source: [4]

Program/Metric	Coverage/Value
Farmers enrolled under PMFBY	568 million (2016–2024)
Farmers received insurance claims	232.2 million (claims paid)
Insured cropped area	~30% of total (70% uninsured)
Farmers reached by agro-advisories	27 million (~18% of farmers)

Protective Mechanisms – Training & NGOs: In addition to insurance, extension services and NGOs provide training on safe practices. Krishi Vigyan Kendras and agriculture departments conduct periodic workshops, but many farmers rely on pesticide dealers for advice (32.6%) or fellow farmers [3]. NGOs have stepped in to fill gaps: for example, Pesticide Action Network India works to reduce reliance on toxic agrochemicals [6]. The Organic India Foundation runs health clinics and workshops in UP, offering group health insurance (~₹50,000/family) and training on organic methods [7]. Such programs have reached thousands of farmers with sanitation, hygiene, and health support [7]. Nevertheless, awareness remains incomplete: a Lucknow study found 61% of farmers had never heard of alternatives to synthetic pesticides [3]. The available evidence suggests that while these measures exist, their penetration is uneven – many farmers in remote areas receive little official training or support beyond sporadic NGO camps [3][3].

Discussion

Our review underscores that organic farmers in Uttar Pradesh face many of the same risks as other cultivators, with unique nuances. Chemical exposure is lower by choice, but windborne drift, contaminated irrigation, or interactions in mixed landscapes mean organic farmers are not entirely shielded [2][5]. Climate risks (droughts, heat) do not spare organic plots; indeed, without access to water-intensive cash crops, they may stick to drought-resistant legumes or millets. However, organic soil management (compost, mulching) can improve moisture retention. As [Figure 2] illustrates, organic manure is a valuable resource produced on-farm. Yet adoption of these practices remains spotty and often unsupported.

Government schemes provide a safety net in theory, but in practice protective coverage is partial. Our findings show that only a fraction of farmers benefit from crop insurance or advisories [4]. These gaps are partly due to logistical issues (e.g., insurers shifting liability) and partly due to farmer awareness. Many smallholders in UP do not purchase insurance or understand it fully, even when eligible [4]. Moreover, organic farmers are often excluded from input subsidy programs that favor conventional cash crops. Our [Table 3] highlights that despite hundreds of millions of policies, large areas and many farmers remain unprotected [4]. Improved outreach and scheme design (e.g. parametric weather insurance) could help.

[Figure 3] Despite awareness, PPE remains underused on Indian farms. This image shows a farmer spraying without any mask or gloves. Safety training has not translated into practice for many; as a result, acute poisoning and chronic illness continue unchecked [1][3]. Educational drives by industry bodies (e.g. CropLife India's PPE campaigns) and regulators emphasize safety, but enforcement is lax and gear is often unaffordable. Healthcare infrastructure

in rural UP is inadequate to handle pesticide injuries, meaning prevention is crucial. In sum, farmers see the value in PPE (74% knew they should use it [3]) but rarely comply [1]. This suggests behavioral, cultural, and economic barriers that training alone cannot fully overcome.

Overall, the literature indicates increased need for support. Organic farmers especially could benefit from more targeted interventions: extension programs on organic pest management, market support for organic produce (to improve farm incomes), and fair insurance mechanisms recognizing their lower-input systems. NGOs have shown positive results through community-based health and training programs [7][6], but they lack scale. Strengthening institutions (farmer producer organizations, cooperatives) could help organic farmers negotiate for better prices and services. Lastly, monitoring and evaluation of existing schemes is essential. Many reports call for simplifying claim processes and involving local authorities to ensure farmers actually receive promised relief [4].

Conclusion

The risks to farmers' health in Uttar Pradesh are serious and multifaceted, spanning chemical exposures, climate change, and occupational strain. Organic farmers mitigate some chemical risks by eschewing synthetic inputs, but they still confront environmental hazards and systemic challenges. Our review highlights that current protective measures – while well-intentioned – fall short in reach and implementation. Crop insurance (PMFBY) and organic farming schemes (PKVY) exist, yet coverage gaps leave many unprotected [4][9]. Training and NGO efforts help but need scaling up. We conclude that strengthening the farmer safety net requires (1) broader insurance coverage with efficient claim settlement, (2) more widespread agroecological training and extension, (3) subsidized access to PPE and organic inputs, and (4) stronger healthcare support for rural communities. Greater investment and coordination among government bodies, NGOs, and farmer organizations are urgently needed to safeguard these essential workers..

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