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► Pesticide application practices in tea and vegetable farming in Suryodaya Municipality, Ilam District, Nepal



► **Pesticide application practices in tea and vegetable farming in Suryodaya Municipality, Ilam District, Nepal**

and recommendations
for safe practices



Group of women workers
collecting tea leaves,
Ilam district, Nepal @ ILO.

► About this brief

This brief summarizes a study conducted in 2024 part of the [ILO Safety + Health for All in South Asia project](#) funded by the Government of Japan. Field level work was conducted by the researchers of

the Occupational Safety and Health Professionals Nepal (OSHNP) and the Suryodaya Municipality of Ilam district in Nepal.

► Snapshot of the agricultural sector

Nepal is predominantly an agricultural country, with around 60% of its 30 million population depending on farming for their livelihoods.¹ Within the agricultural sector, plantations, particularly of tea and vegetables, play a pivotal role in driving socio-economic development.²

Pesticides are commonly used in agriculture, including in tea and vegetable farming. These substances, whether chemical or biological, are intended to repel, eliminate, or control pests, or to regulate plant growth. The term encompasses a wide range of products, including insecticides, herbicides, fungicides, rodenticides, molluscicides, wood preservatives, and other agents used to manage pest-related threats in agricultural production.³ Nepal imports about 211 metric tons of pesticides annually, with an average use of 142 g/ha.⁴ The history of pesticide use in Nepal dates back to the 1950s, initially introduced through malaria eradication programmes. Over time, misuse and overreliance on pesticides caused soil degradation, pest resistance, and adverse health effects.⁵ While awareness about the potential impact of pesticides on the health of workers and the surrounding communities has risen, challenges persist in promoting sustainable agricultural practices.

These challenges are compounded by other issues affecting the agricultural sector, which is marked by poor working conditions, limited

awareness of fundamental rights, including the right to a safe and healthy working environment, low productivity, inadequate skills development, restricted access to public services, and a weak presence of trade unions. These vulnerabilities disproportionately affect women, who make up the majority of the agricultural workforce and often face workplace discrimination, including sexual harassment. As men frequently migrate for employment, women are left to carry out most agricultural tasks, including the handling of pesticides. However, they are typically excluded from physically demanding activities such as ploughing with tractors or lifting heavy loads.⁶

Nepal is a party to key international environmental agreements, including the Basel, Rotterdam, and Stockholm Conventions, which aim to protect human health and the environment from hazardous chemicals and waste. In alignment with these commitments, Nepal has implemented Integrated Pest Management (IPM) programmes in 62 districts to reduce pesticide-related risks. However, the country has yet to ratify Fundamental International Labour Organization (ILO) Conventions on occupational safety and health, including the Fundamental Conventions No. 155, No. 187, Convention No. 154 focusing on agriculture and the Chemicals Convention No. 170, which are critical for strengthening OSH protections.

¹ Central Bureau of Statistics (CBS). (2023). Statistical Yearbook of Nepal.

² For more information on safety and health in tea plantations, please see – [Assessment of the fundamental right to a safe and healthy working environment in Nepal's tea sector | International Labour Organization](#).

³ See FAO definitions in the Pesticide Registration Toolkit – [Terms and definitions P | Pesticide Registration Toolkit | Food and Agriculture Organization of the United Nations](#).

⁴ Atreya, K., Kattel, K., Pandit, S., Chaudhary, P., & Sipkhan, P. (2022). Understanding farmers' knowledge, attitudes and practices of pesticide use in Nepal: synthesis of a systematic literature review. *Archives of Agriculture and Environmental Science*, 7(2), 278-287.

⁵ Gyawali, K. (2018). Pesticide Uses and its Effects on Public Health and Environment. *Journal of Health Promotion*. Vol. 6: 28-36.

⁶ [Assessment of the fundamental right to a safe and healthy working environment in Nepal's tea sector | International Labour Organization](#).

► The case of Suryodaya municipality

Suryodaya Municipality in Ilam District, Koshi Province, provides a local illustration of these broader dynamics. Known for its commercial production of tea and cardamom, Suryodaya covers an area of 252.52 sq km, with approximately 250 hectares dedicated to these plantations. Key tea-growing areas include Fikkal, Pachakanya, and Kanyam. The municipality is also renowned for a variety of vegetables such as potatoes, chayote, ginger, broom grass, Akabare chilli, and dairy products. Its strategic location as a gateway to Darjeeling, India, another major tea-producing region, adds to its economic and tourism potential.

With a population of 54,727 across 14,032 households, Suryodaya has been actively promoting small enterprises to improve local livelihoods, particularly for smallholder farmers. Tea plantations cover about 60% of the land, employing approximately 40% of the economically active

population in tea production or related work. The municipality exports around 5 million kilograms of tea annually. However, precise data on the number of households and workers involved in tea production remains unavailable, especially considering the large number of internal and cross-border migrant workers estimated at 15,000 regular and an additional 5,000 seasonal workers.

In response to growing concerns about pesticide residues, particularly among Indian buyers, the Suryodaya Tea Producers Association (STPA), with municipal backing, implemented a pesticide ban in tea plantations starting April 2024. Non-compliant farmers face penalties. This initiative highlights how local action can align with international market expectations and environmental standards. However, pesticide use continues in vegetable farming, reflecting the uneven adoption of sustainable practices across crop types.

► Objective

This study aims to assess pesticide use practices in vegetable and tea farming within Suryodaya Municipality. It seeks to evaluate farmers' knowledge, attitudes, and practices (KAP) related to safe

pesticide use, identify risks posed to worker and community health as well as the environment, and recommend key safety and health practices while promoting safer alternatives to pesticide use.

► Methodology

The study assessed pesticide use in Suryodaya Municipality, Ilam, through a combination of desk reviews, primary data collection, stakeholder consultations, and field observations. Research was conducted in four wards (administrative areas), 4, 8, 9, and 10, selected for their active tea and vegetable farming. Fieldwork, including focus group discussions (FGDs) and consultations, was completed in September 2024.

A desk review was conducted, examining 29 publications and national legislation, including the Pesticide Act (1991), Pesticide Rules (1994), Environment Protection Act (2019), Plant Protection Act (2007), Food Act (1967), Labour Act (2017), and Local Government Operation Act (2017), alongside international commitments such as the Rotterdam, Stockholm, and Basel Conventions.

Primary data collection involved several methods. Three FGDs were organized, two with tea farmers and one with vegetable farmers, engaging a total of 48 participants, with semi-structured questionnaires guiding the discussions.⁷ Participants were primarily smallholders and cooperative members, who are the main producers of tea and vegetables in the municipality. Consultations were also held with relevant government bodies such

as the Agriculture Knowledge Center, the Health Section of Suryodaya Municipality, local hospitals, and customs officials. Interactions with pesticide retailers and distributors from Suryodaya, Ilam Municipality, and Birtamod provided insights into pesticide types, storage practices, and sales information. Discussions were also conducted with farmers' and workers' associations, including the Central Tea Cooperative Federation (CTCF) and various tea and vegetable cooperatives. Field observations, involving site visits and informal discussions with farmers, helped to verify and supplement the data gathered through FGDs. Fifty percent of the participants who provided information regarding various aspects of pesticide usage during focus group discussions and field visits were women.

Collected data from both primary and secondary sources were compiled, analyzed, and presented in tabulated formats. Based on the findings, conclusions were drawn, and recommendations were formulated to improve pesticide management and enhance farmer safety practices. However, the study was limited to four wards within Suryodaya Municipality, and the purposive sampling approach means that the findings may not be fully representative of conditions in other areas beyond the study location.

⁷ Twelve farmers (eight tea and four vegetable) were purposively selected from each ward for FGDs, ensuring representation of farm sizes and gender balance (50% women), with additional random sampling for field verification.



Discussion with farmers' group
@ ILO/OSHNP.

► Results and discussion

The study identified **major pests affecting tea and vegetable cultivation**. In tea plantations, six significant insect pests, five major plant diseases, and five dominant weed species were reported. The main insect pests included thrips, tea mosquito bug, aphids, leaf rollers, red spider mites, and cockchafer grubs. The key diseases were

caused mainly by fungal pathogens like blister blight and twig dieback, with an algal disease (red rust) also noted. In vegetable farming, especially crops like Akabare chili, cucurbits, ginger, and potatoes, six insect pests and six major diseases were recorded, along with various annual weed species.



Acute and chronic health problems are widespread

Almost all pesticide users reported experiencing **acute health effects from pesticide exposure**. Headaches were among the most common symptoms, with 56% experiencing them for one day, 33% for two to four days, and 11% for up to a week. Dizziness was reported universally, with most farmers feeling it for one day. Skin irritation affected 88% of users for one day and 12% for a longer duration of two to four days. Nausea was another frequent symptom, affecting 91% of users for one day and 9% for longer periods. Fatigue was reported by all farmers after pesticide use. Specific incidents of severe suspected pesticide-related health issues were recorded by the survey team, including numerous cancer cases among tea workers near Kanyam Tea Estate, as well as widespread pelvic organ prolapse among women tea workers, and mass reports of headaches, vertigo, and eye issues in the GuptiTole area were also reported by interviewees. Data from the Regional Hospital at Fikkal also indicated an increase in chronic diseases among pesticide users, particularly cancer, cardiovascular disease, and kidney failure. In the case of cancer and kidney failure, the majority of patients were women.



The ban on pesticide use in tea farming is respected but with no spillover effect to other crops

Farmers interviewed in FGDs adopted multiple **pest management strategies** such as field sanitation, cultural practices such as tillage, mechanical removal, use of biopesticides, and chemical pesticides. However, chemical pesticide use was dominant. Until 2023, about 90% of tea farmers used pesticides, applying 20 different types, including insecticides, fungicides, and herbicides.

However, this practice was halted after the April 2024 ban enforced by the Suryodaya Tea Producers Association and supported by the municipality.

In vegetable farming, however, chemical pesticide use remains widespread. Farmers commonly apply 10 insecticides and 8 fungicides during each cropping season, typically about five times per four-month season. Most insecticides used are classified as moderately hazardous by WHO standards (class II), posing a moderate acute risk to human health, meaning they are harmful or potentially fatal if swallowed, absorbed through the skin, or inhaled. Fungicides used are generally less hazardous. Two herbicides, glyphosate and 2,4-D, were also used in tea farming but not in vegetables. Although none of the pesticides used are on Nepal's banned list, the health and environmental risks remain significant.



Health issues disappear following pesticide ban

According to tea farmers, after discontinuing pesticide spraying from 2024 onward, they experienced a disappearance of immediate health issues such as headaches, dizziness, skin irritation, nausea, and fatigue. This improvement made them realize that these symptoms were linked to acute pesticide poisoning. Although pesticide use in tea farming has been minimized since 2024, it remains widespread in vegetable cultivation.



Majority of farmers lack expert guidance on pesticide use

Awareness of health risks

However, despite this increased awareness, many vegetable farmers still do not adhere to proper pesticide handling practices, likely due to limited access to protective equipment and insufficient



Interview with local agrovet
@ ILO/OSH PN.

training on safe pesticide use. The study assessed **farmers' awareness regarding pesticide handling** and found that, while 94% were aware of the potential health risks, such as acute poisoning symptoms like headaches and nausea, as well as chronic conditions like cancer and cardiovascular diseases, proper handling practices were still lacking. Regarding **decision-making**, 53% of farmers chose to use pesticides on their own initiative, without seeking input from others. Around 22% sought advice from agro vets (retailer of pesticide who sells to farmers directly), while fewer consulted neighbours (9%), lead farmers (8%), government technicians (5%), or agricultural experts (3%). This shows that most farmers lack expert guidance, increasing the risk of improper use.

Preparing the pesticides

The study also found a serious **knowledge gap among farmers regarding pesticide formulation and safe use**. About 92% of farmers were unaware of the active ingredients or the systemic/

contact nature of the pesticides they used. Only 11% of farmers followed the recommended pesticide dosage when applying. Most farmers prepared pesticide solutions without measuring or following correct procedures and in open areas, including residential yards, crop fields, and nearby communal water sources. Additionally, 84% of farmers did not know about the role of stickers and spreaders, which are important adjuvants for improving pesticide efficacy. This lack of knowledge significantly heightens the risk of health hazards and environmental contamination.

Transportation and application

Indeed, the study found that only 16% of farmers knew **how to handle pesticides** correctly, including safe transportation, storage, and application. Knowledge about primary health care in the event of pesticide poisoning was also low, with just 16% aware of appropriate first-aid measures, resulting in farmers to stay at home and rely on self-recovery from acute poisoning symptoms.

Safe transportation and storage of pesticides were also neglected by most interviewed farmers who use public or their own vehicles and often keep pesticides in cattle sheds, beneath the roofs of verandas, or hanging from beams and pillars of their homes, leading to risks of accidental contamination, especially among children.

Very few farmers (5%) practiced correct pesticide application techniques to minimize drift and environmental contamination. Only 12% applied pesticides at appropriate times, avoiding adverse weather conditions, while the rest disregarded timing, further reducing pesticide efficacy and increasing risk.

Disposal

The study further found that only 31% of pesticide users practiced proper **post-application hygiene**, such as taking a shower, washing contaminated clothing, and cleaning utensils and sprayers. Regarding the **disposal of pesticide waste**, only 20% of farmers were aware of the need for proper disposal of leftover pesticides and containers, posing environmental and health hazards and only 20% of users safely disposed of leftover pesticides and empty containers, typically by burying them. The majority, about 80%, reported discarding them into streams, forests, open spaces, or even reuse containers for kitchen purposes, contributing to environmental and health hazards. Very few farmers properly managed leftover pesticides and containers. Adherence to the recommended safe period after pesticide application was also very poor, with only 16% of users following it, while 84% harvest crops, especially vegetables, immediately after spraying.

Use of PPE

Awareness of **necessary safety measures**, such as using personal protective equipment (PPE) and avoiding pesticide drift during application, was very low (16%), and most farmers continued

to neglect basic precautions during pesticide handling. During **pesticide formulation and application**, only 6% of interviewees indicated using separate utensils, while the majority use household items, heightening contamination risks. No farmers used full PPE, with only a small portion using inadequate protection like gloves or surgical masks. The lack of access to proper PPE in local markets may contribute to this issue

Checking labels

Farmers' readiness practices showed that only 16% sought technical advice before pesticide use, while the majority relied on neighbours or agro-vets without consulting labels or safety guidelines. This oversight may stem from the literacy levels of the farmers, as nearly all pesticide labels are in English, which many cannot understand. Additionally, the small font size on the labels often makes them difficult to read.

Waiting periods for food safety

Awareness of the preharvest interval (PHI) and restricted entry interval (REI) after pesticide application was similarly poor, with just 16% understanding the importance of waiting periods to ensure food safety.



Limited awareness of safer alternatives and practices

While a majority of farmers (79%) were aware of the **environmental impacts of pesticide misuse**, the low awareness (30%) of safer alternatives like bio-pesticides and ecological pest management highlighted a significant knowledge gap that may hinder the adoption of sustainable farming practices.



Field observations
@ ILO/OSHPN.

► Consultation with stakeholders and highlights from initiatives taken to address the issues raised

Consultations with stakeholders in Suryodaya Municipality revealed a growing commitment to improving OSH and promoting safer, more sustainable agricultural practices. In collaboration with the ILO, the municipality launched a pilot intervention to develop a municipal-level OSH management system. This included the establishment of a tripartite OSH committee at the municipal level and the development of a detailed operational procedure. To support this initiative at the community level, four wards within the municipality established OSH committees. These committees are tasked with raising awareness and monitoring working conditions. The committees meet regularly to discuss OSH concerns, recommend improvements, and report to the municipal OSH committee. A one-day orientation was conducted for committee members and supporting stakeholders to clarify their roles and responsibilities. Further capacity-building, particularly through

training in the ILO's participatory action-oriented methodology, was implemented to enhance their ability to effectively monitor and address OSH issues.

Another significant development was the creation of OSH technical guidelines specifically for the tea sector, which were validated by relevant stakeholders.

Consultation with Central Tea Cooperative Federation (CTCF) also highlighted their initiative in collaboration with the ILO. Among others, it supported 25 of its member cooperatives in Koshi Province to pilot OSH interventions, developed guidelines, and organized orientation sessions that were eventually extended to all 101 member cooperatives. Some cooperatives formally endorsed the guidelines and allocated budgets to support their implementation.

► We often overlook safety and health issues at work, but through the ILO Safety + Health for All Project and CTCF, we now understand that tea gardens can be unsafe (...). However, we've assessed these challenges and made improvements in our workplace and factory. These include creating shaded areas in the garden, toilets, drinking water facilities, modifying load-carrying systems, improving plucking practices with gloves and lowcost methods, providing first aid kits, keeping records of accidents and incidents, and promoting organic production to reduce pesticide exposure.

► **Devi Kumari Rai**, OSH Committee Member, Sundarpani Tea Cooperative

Meanwhile, the Agriculture Knowledge Center and the municipality have continued promoting the use of bio-pesticides and Integrated Pest Management (IPM), particularly in vegetable farming, where participation and awareness are

gradually increasing. The study though noted that traditional practices remain prevalent, but there is a noticeable shift in farmer attitudes toward safer and more sustainable approaches.

► Conclusion and recommendations

The study underscores both commendable progress and persistent challenges in promoting safe and sustainable pesticide use in Suryodaya Municipality. On a positive note, the municipality has demonstrated strong leadership through its collaboration with the ILO to establish a municipal-level occupational safety and health management system. In addition, the ban on pesticide use in tea farming since April 2024 represents a significant policy shift, already yielding health benefits for farmers and improving product safety. The Central Tea Cooperative Federation's (CTCF) rollout of OSH guidelines across its network and the growing promotion of Integrated Pest Management (IPM) and bio-pesticides in vegetable farming reflect encouraging steps toward long-term sustainability.

At the same time, the study reveals critical gaps that require urgent attention. Pesticide use in vegetable farming remains widespread and largely unsafe. The majority of farmers lack access to reliable technical advice and continue to rely on

informal sources, resulting in widespread misuse of hazardous chemicals. Awareness of safe pesticide handling, correct application, protective equipment, and disposal methods is low. Poor practices such as using household tools to mix pesticides, storing chemicals in living areas, and harvesting crops immediately after spraying continue to expose farmers and communities to acute and chronic health risks. Reported symptoms include headaches, dizziness, skin irritation, and fatigue, with documented cases of hospitalization and chronic illnesses such as cancer and kidney disease, especially among women, further underscoring the public health implications.

While local initiatives show promising direction, they remain in early stages and must be scaled and strengthened through continued investment in farmer training, access to safety resources, improved regulatory enforcement, and integration of safe agrochemical practices across both tea and vegetable sectors. Only through sustained, coordinated action can the municipality ensure lasting

improvements in farmers' health, environmental protection, and agricultural resilience. The below recommendations are made to reach this goal:

► **1. Local-level recommendations
(municipalities, farmers, employers,
and local stakeholders)**

- **1.1** Promote safer farming practices by training farmers in Integrated Pest Management techniques and expanding the use of bio-pesticides. Demonstration farms and Farmer Field Schools (FFS) could be established to provide practical examples of sustainable approaches.
- **1.2** Strengthen farmer capacity and awareness by offering hands-on training on pesticide formulation and handling. Increase awareness of the health risks associated with pesticide use and promote consistent use of Personal Protective Equipment (PPE). Educational efforts should also focus on the importance of respecting Pre-Harvest Intervals (PHI) and Restricted Entry Intervals (REI), with support from local authorities to ensure monitoring and compliance.
- **1.3** Improve technical support by enhancing agricultural extension services to ensure timely, accurate, and practical advice. Agro-vet operators should be trained and monitored to provide reliable guidance to farmers.
- **1.4** Enhance safe handling and disposal by educating farmers on proper pesticide storage and disposal methods. Local government should establish accessible disposal systems for pesticide containers and outdated chemicals.
- **1.5** Strengthen local health infrastructure by training farmers in first aid procedures for pesticide exposure and improving the capacity of local health centres to diagnose and manage pesticide-related illnesses.
- **1.6** Engage employers and workers in workplace safety and health. Employers in the tea sector should adopt OSH policies in line with the 2017 Labour Act, create safety and health committees with worker participation, and integrate health

promotion initiatives into their workplace programmes. They must ensure the safe use and storage of hazardous substances, maintain OSH records, and provide PPE free of charge. Workers should be active participants in OSH initiatives, comply with safety procedures, report hazards, participate in training programmes, and collaborate with trade unions to enhance workplace safety standards.

► **2. National-level recommendations
(Government of Nepal and social
partners)**

- **2.1** Strengthen policy and regulatory frameworks by enforcing tighter controls on pesticide sales and use, promoting organic certification, and offering subsidies or incentives to support the adoption of alternative practices. Clear guidelines should be established to define the responsibilities of federal, provincial, and local governments regarding pesticide and OSH management.
- **2.2** Develop institutional capacity and enforcement mechanisms by building the capacity of the labour inspectorate to monitor OSH conditions, especially in the tea sector. The National OSH Programme should be implemented across all production systems, including orthodox and smallholder farms, to ensure consistent standards. An improved system for reporting occupational injuries and illnesses is necessary for policy development and intervention planning.
- **2.3** Promote a culture of prevention by expanding awareness campaigns on OSH, especially regarding chemical risks. The government should support research on pesticide alternatives and foster innovation in safe agricultural technologies and practices.
- **2.4** Foster inter-agency coordination by ensuring collaboration among government entities responsible for labour, agriculture, health, education, and trade. These coordinated efforts should promote the safe use of pesticides and the implementation of OSH policies at all levels.

ILO Country Office for Nepal
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ilo.org

Tel: +977 1 5970 424
Email: kathmandu@ilo.org
Dhobighat, Nayabato
Lalitpur, Kathmandu
Nepal
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<https://doi.org/10.54394/BBFX7644>