



Impact of Agrochemical Awareness Campaigns on Farmers' Health and Sustainable Agriculture

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Agrochemicals, including pesticides and synthetic fertilizers, are important inputs in modern crop production, but inappropriate selection, dosage, handling, storage and disposal can expose farmers and farm workers to avoidable health risks and can contribute to soil, water and biodiversity impacts. This paper examines how NSS-led awareness campaigns can support safer agrochemical practices and sustainable agriculture in rural communities. The study is structured as an evidence-informed participatory intervention framework for villages in Rajnandgaon district, Chhattisgarh, using baseline awareness assessment, farmer meetings, door-to-door communication, label-reading demonstrations, personal protective equipment (PPE) demonstrations, safe-storage and disposal messages, and promotion of Integrated Pest Management (IPM). Evidence from WHO, FAO and recent ICAR initiatives indicates that direct training, farmer field learning and informed decision-making can reduce unnecessary pesticide exposure and encourage non-chemical and lower-risk pest management. The proposed evaluation focuses on changes in knowledge, safe handling behaviour, PPE use, pesticide record-keeping, IPM adoption and perceptions of farm and environmental health. Because no primary post-campaign dataset was supplied with the source document, this paper does not fabricate numerical impact results; instead, it presents an evidence-based research framework, expected outcome indicators and a practical NSS action plan suitable for field implementation and later statistical evaluation.

Keywords: Agrochemicals, Pesticide Safety, Farmer Health, NSS, Integrated Pest Management, Sustainable Agriculture, Awareness Campaigns

Introduction and Background

Agrochemicals have an important role in protecting crops from insects, weeds and diseases and in supplying nutrients required for crop production. However, the health and environmental risks associated with pesticides increase when products are selected without adequate diagnosis, applied at incorrect doses, mixed or loaded without appropriate precautions, stored insecurely, or disposed of improperly. WHO identifies agricultural workers and people who are directly involved in pesticide handling or are present during application as groups with comparatively higher exposure risk. Safe work practices therefore

require attention to product labels, application procedures, personal protection and exposure prevention. (WHO, 2001; WHO, 2020). Sustainable agriculture requires a shift from input intensity toward informed, need-based and integrated crop management. FAO describes Integrated Pest Management (IPM) as an ecosystem-based decision process that combines biological, cultural, physical and chemical measures and uses pesticides only when justified. IPM can reduce pesticide risks while protecting natural pest-control mechanisms, soil, water, and biodiversity and food safety. (FAO, 2022)

In India, farmer awareness is increasingly being connected with scientific extension, balanced input use and sustainable farming. Recent ICAR activities have emphasized integrated pest management, soil health, balanced fertilizer application and field-level farmer training. In September 2026, ICAR specifically described IPM as a sustainable approach that prioritizes prevention, monitoring, non-chemical methods and judicious pesticide use when required. (ICAR, 2026). Role of NSS in farmer awareness: The National Service Scheme provides a practical institutional platform through which student volunteers can connect educational institutions with rural communities. Its participatory approach can translate technical recommendations into farmer-friendly demonstrations, local-language messages, household visits, village meetings and community campaigns. For agrochemical safety, NSS volunteers can complement—not replace—qualified agricultural and plant-protection experts by reinforcing scientifically approved messages and directing farmers to Krishi Vigyan Kendras (KVKs), agriculture departments and other technical services.

Objectives of the Study

1. To assess the role of NSS awareness campaigns in improving farmers' knowledge of safe agrochemical handling and exposure prevention.
2. To promote need-based pesticide use, correct label interpretation, recommended dose and safe application practices.
3. To encourage personal protective equipment (PPE), safe storage, transport and disposal of agrochemical containers.
4. To strengthen adoption of Integrated Pest Management and other lower-risk crop protection practices.
5. To develop measurable indicators for evaluating changes in farmer health-safety behaviour and sustainable agricultural practices.

Study Area, Research Methodology and Intervention Strategy

Study Location Profile: The proposed NSS intervention is situated in Rajnandgaon district, Chhattisgarh, using the same rural extension setting described in the source document: Kopedihi, Barga and Torankatta. Kopedihi is located about 07 km from the college of horticulture, has a reported population of 1,321, 357 farmers, a geographical area of 257.47 ha and a cropped area of 162 ha. Its cropping pattern includes vegetables such as tomato, brinjal, chilli, cauliflower, cabbage and pointed gourd, fruit crops such as muskmelon, marigold and field crops including rice, wheat and chickpea. These crops provide a relevant setting for discussing pesticide safety, pest monitoring and integrated crop protection.

Parameter	Profile
Village	Kopedihi
Tehsil	Dongargaon
District	Rajnandgaon
Location	07 km from college of horticulture
Total population	1321 (Male-684, Female-637)
Total no. of farmers	357
Total geographical area	257.47 ha
Total cropped area	162 ha
Cropping pattern	Vegetables – tomato, brinjal, chilli, cauliflower, cabbage, knol khol, pointed gourd; fruit – muskmelon; ornamental – marigold; field crops – rice, wheat/chickpea

Sampling and research design: The original source document used a sample of 120 adult respondents across Kopedih, Barga and Torankatta and applied participatory rural appraisal with structured pre- and post-intervention surveys. The same research architecture can be retained for an agrochemical-awareness study. Respondents should be selected from farming households and pesticide-handling workers, with informed participation and confidentiality. A baseline questionnaire should record knowledge, exposure-prevention practices, PPE use, label-reading ability, storage and disposal behaviour, pesticide mixing practices, pest diagnosis, IPM adoption and access to technical advice. Follow-up assessment should be conducted after the awareness cycle. The original source confirms the use of N=120 respondents and participatory tools such as resource mapping, social mapping and problem identification.

Important research note: No agrochemical-specific survey dataset was supplied with the source document. Therefore, the present paper does not present invented pre- or post-campaign percentages. The numerical profile above is retained only where it is directly supported by the source document; outcome indicators below are proposed for actual field measurement.

NSS Agrochemical Awareness Intervention Framework

The awareness campaign should use multiple communication channels so that technical safety messages are repeated in simple, locally understandable forms. FAO's Farmer Field School experience supports field-based learning, observation and farmer decision-making rather than one-way distribution of technical information. (FAO, n.d.)

Intervention Component	Major Activities	Expected Behavioural Focus
Baseline assessment	Household survey; exposure-risk mapping; identify commonly used products; identify existing PPE and storage practices	Establish measurable starting point
Door-to-door awareness	Short local-language messages on label reading, dose, re-entry, PPE, storage and emergency response	Reduce unsafe routine handling
Demonstration sessions	PPE demonstration; safe mixing/loading principles; calibrated sprayer demonstration; label and hazard-symbol interpretation	Improve practical safety skills
IPM field learning	Pest scouting; economic-threshold concepts; biological and cultural methods; need-based chemical intervention	Reduce unnecessary pesticide use
Safe storage & disposal	Separate locked storage; keep away from food/feed; prevent container reuse; promote approved disposal practices	Reduce household and environmental exposure
School/youth engagement	Posters, slogan and quiz activities; youth-led awareness messages for farming households	Extend campaign reach
Follow-up evaluation	Repeat KAP survey; observation checklist; farmer feedback and referral to KVK/agriculture experts	Measure knowledge-to-practice change

Results and Discussion: Evidence-Based Impact Pathways

Farmer health and occupational safety: WHO guidance emphasizes that improper or careless pesticide handling can create health risks and recommends attention to mixing, loading, application, transport, storage and disposal. An effective awareness campaign should therefore be judged not only by attendance but by whether farmers can demonstrate safer practices. Key outcomes include improved understanding of exposure routes, increased use of suitable PPE, avoidance of eating or smoking during handling, safer storage and improved knowledge of what to do after suspected exposure. (WHO, 2001; WHO, 2020)

Reduction of unnecessary pesticide exposure: Awareness should move farmers from routine or calendar-based spraying toward pest observation and need-based decisions. FAO notes that pesticide risk reduction includes rational use, lower-risk product selection, lifecycle management and appropriate waste management. Thus, a campaign can contribute to health protection even without eliminating pesticide use, provided it improves decision quality and reduces avoidable exposure.

Sustainable agriculture and IPM adoption: IPM integrates biological, cultural, physical and chemical measures and aims to minimize disruption of agro-ecosystems. Awareness campaigns that teach pest identification, beneficial insects, field scouting and non-chemical options can therefore link farmer health with environmental sustainability. FAO reports that Farmer Field School approaches have been used to strengthen farmer knowledge and decision-making around IPM in many countries.

Soil, water and biodiversity protection: Inappropriate pesticide use can contaminate agricultural soils and water and harm non-target organisms and beneficial insects. Awareness of drift, runoff, disposal and protection of water bodies should therefore be included in NSS activities. The environmental objective is not simply 'zero pesticide use' but scientifically justified, safer and integrated crop protection that maintains ecosystem services.

Impact Dimension	Indicator for Field Measurement	Evidence of Positive Change
Knowledge	Score on label, dose, hazard and exposure questions	Higher post-campaign knowledge score
PPE & exposure prevention	Observed/self-reported use of appropriate PPE and hygiene practices	More consistent protective behaviour
Safe storage	Separate, secure storage away from food/feed and children	Fewer unsafe storage practices
Application decisions	Pest scouting and need-based spray decisions	Lower routine/unnecessary spraying
IPM adoption	Use of cultural, mechanical, biological and monitoring-based practices	Greater integration of non-chemical methods
Waste management	No reuse of containers for domestic purposes; safer disposal practices	Reduced unsafe container handling
Environmental stewardship	Avoidance of spraying near water bodies and protection of beneficial organisms	Greater awareness of ecosystem risks
Technical linkage	Contact with KVK/agriculture/plant-protection experts when uncertain	More evidence-based decisions

Challenges in Agrochemical Awareness Campaigns

1. **Traditional practice and habit:** Farmers may rely on familiar pesticide brands, tank mixtures or calendar-based spraying even when pest pressure is low.
2. **Commercial and information pressures:** Product choice can be influenced by local availability and informal advice, making independent technical guidance important.
3. **Literacy and label complexity:** Technical labels may be difficult for some farmers; visual demonstrations and local-language communication are therefore valuable.
4. **Cost of safety equipment:** Smallholders may perceive PPE and safer equipment as additional expenses unless the health and exposure-prevention benefits are clearly demonstrated.
5. **Limited access to technical diagnosis:** Farmers need timely access to KVKs, extension personnel and plant-protection specialists for pest identification and IPM decisions.
6. **Disposal and storage constraints:** Empty containers and leftover products can create risks when secure storage or appropriate disposal systems are unavailable.

Strategic Recommendations and Policy Action Plan

1. Formalize collaboration among NSS units, KVKs, State Agriculture Department, plant-protection specialists and Gram Panchayats for recurring agrochemical-safety campaigns.
2. Use demonstration-led learning rather than only lectures: show label interpretation, calibrated spraying, PPE use, safe storage and IPM field scouting.
3. Develop simple visual materials in the local language covering hazard symbols, recommended dose, pre-harvest interval, re-entry precautions and emergency actions.
4. Promote IPM as the first decision framework: prevention and monitoring first, non-chemical options where effective, and pesticides only when justified and correctly used.
5. Establish village-level referral channels so farmers can obtain expert advice on pest diagnosis, pesticide choice and safer alternatives.

6. Include women, farm workers and youth in awareness activities because pesticide exposure is not limited to the person who purchases or applies the product.
7. Repeat follow-up surveys and field observations after 3–6 months to determine whether awareness has translated into sustained behaviour change.

Conclusion

Agrochemical awareness campaigns can serve as an important bridge between scientific crop-protection recommendations and everyday farm practice. The strongest pathway is not simply to tell farmers to stop using pesticides, but to improve the quality of decisions: identify the pest correctly, assess whether intervention is necessary, prioritize IPM and lower-risk methods, follow the product label and recommended dose, use appropriate protective measures, and manage storage and waste safely. WHO and FAO guidance supports this health-protective and sustainability-oriented approach, while recent ICAR initiatives demonstrate the continued importance of farmer training and integrated pest management in India. (WHO, 2020; FAO, ICAR, 2026). For NSS, the value of the campaign lies in sustained community engagement. Volunteers can organize awareness rallies, household visits, demonstrations, school activities and follow-up contacts, while technical decisions remain linked to qualified agricultural experts. The source document's participatory NSS model—baseline assessment, multi-channel communication, physical community action and follow-up evaluation—provides a useful structure for this agrochemical-health theme. The present paper intentionally avoids fabricated numerical claims about health or pesticide-use reduction because no agrochemical-specific primary dataset was provided. Once field data are collected using the indicators proposed in this paper, the same structure can be used to calculate pre–post changes, participation rates, adoption percentages and statistical associations between awareness and safe-practice adoption.

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