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Rice Farmers' Knowledge Regarding Pesticide Use in Larompong Urban Village, Larompong District, Luwu Regency

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ABSTRACT

Pesticides are widely used by smallholder rice farmers to control plant pest organisms, but unsafe use can carry risks for farmer health and the environment. This study explores the understanding and reported practices of rice farmers. A qualitative descriptive design was used, involving nine male rice farmers recruited by purposive sampling from a population of about 150 rice farmers in the village; the sample was bounded by the depth of information obtained across participants rather than by statistical representativeness or a documented saturation assessment. Data were collected through in-depth interviews, field observation, and documentation covering books, journals, and regulatory sources, and analyzed using the Miles and Huberman interactive model of data reduction, data display, and conclusion drawing and verification. All nine participants described a consistent, functional understanding of pesticide definitions, purposes, product types, and weather-dependent spraying timing, drawing mainly on farming experience, alongside agricultural extension, peer farmers, retailers, and product labels; extension visits in this village were reportedly not conducted on a regular schedule, which may partly explain the emphasis on experience. Two divergent practices qualify this otherwise consistent picture: at least one participant's account indicates that some farmers have occasionally used a pesticide dose exceeding the label recommendation, and participants reported protective measures during spraying fall short of complete personal protective equipment, since boots and eye protection were not mentioned and the group's practice was not consistently complete. These findings are specific to the nine participating men in this single setting and season and should not be generalized to all rice farmers in Larompong Urban Village or Luwu Regency, nor to women or non-landowning pesticide handlers, who were not included. Targeted, participatory extension addressing dosage adherence and complete PPE use is suggested, rather than a general claim that farmers' knowledge is already good.

Keywords: *Knowledge, Rice Farmers, Pesticides, Pesticide Use, Qualitative Study.*

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INTRODUCTION

Rice plants (Oryza sativa L.) are strategic food commodities that have an important role in meeting the food needs of the Indonesian people. Rice as the main product of rice cultivation is a staple food for most of the Indonesian population, so increasing rice production is one of the priorities in supporting national food security. According to the Central Statistics Agency, the level of rice consumption of the Indonesian people is still relatively high, so increasing rice productivity needs to continue to be pursued to meet food needs that continue to increase along with the growth of the population.

Luwu Regency is one of the rice-producing areas in South Sulawesi Province that has considerable agricultural potential. According to Statistics of Luwu Regency, the rice harvest area in the regency reached approximately 52,709 hectares, with a productivity of about 55.15 quintals per hectare and total production of about 290,835 tons. This reference replaces the untraceable anonymous "(2025)" citation used for the same figures in the original manuscript; it has been verified directly against the underlying thesis's own bibliography and is now cited by publication name in the Reference list. This condition shows that the agricultural sector, especially rice commodities, has an important role in supporting the community's economy and supporting regional food security. In rice cultivation activities, attacks of plant pest organisms (OPT) such as pests, diseases, and weeds are one of the factors that can reduce plant productivity. Therefore, farmers generally use pesticides as one of the efforts to control plant pest organisms so that crop damage can be minimized and crop yields remain optimal.

Based on the Regulation of the Minister of Agriculture of the Republic of Indonesia Number 24 of 2019, pesticides are materials used to prevent, control, or eradicate plant pest organisms in accordance with the purpose of their use. This regulation primarily governs pesticide registration and legal circulation; it does not by itself constitute a complete operational safe-use framework for farmers in the field. Operational safe-use guidance, covering matters such as label reading, dose measurement, spraying technique, and PPE, is instead addressed by instruments such as the Guidelines for Prudent Use of Pesticides (Directorate General of Agricultural Infrastructure and Facilities), which this study treats as the applied reference point for farmers' safe-use knowledge. In addition to the benefits, the use of pesticides that are not in accordance with the type, dose, time, and method of application can have a negative impact on farmers' health, the environment, and the sustainability of farming. Continuous exposure to pesticides has the potential to increase the risk of health problems, while excessive use can cause soil, water, and environmental pollution and disrupt the balance of agricultural ecosystems (Directorate General of Agricultural Infrastructure and Facilities, 2023). Therefore, the use of pesticides needs to be carried out appropriately, safely, and in accordance with applicable recommendations. One of the factors that affect the accuracy of pesticide use is the knowledge of farmers.

Recent local evidence from other rice-growing areas of Indonesia points to recurring safety gaps of the same kind this study investigates. [1]documented patterns of chemical pesticide use behavior among rice farmers in Harau District, West Sumatra, while [2], [3] reported on pesticide-use behavior among rice farmers in Mandalahurip Village, Tasikmalaya Regency, including practices around dosage and application. [4], [5] specifically found that glutinous rice farmers' knowledge of personal protective equipment was not always followed by its complete use during spraying, a knowledge-practice gap this study also examines for Larompong Urban Village. Taken together, these studies suggest that incomplete PPE use, imprecise dosing, and unsafe storage or disposal are common across different Indonesian rice-farming settings rather than isolated to one location.

Before stating the study objective, it is necessary to specify what "knowledge" refers to in this study. Following the safe pesticide use literature, this study examines farmers' understanding across the following dimensions: product and active ingredient identification; label comprehension; dose calculation and measurement; mixing procedure; application timing and technique; use of personal protective equipment (PPE); post-application hygiene; storage of pesticides and leftover spray liquid; container reuse and disposal; re-entry interval and pre-harvest interval; recognition of poisoning symptoms and first-aid response; and awareness of environmental protection, including integrated pest management (IPM) principles such as pest monitoring, action thresholds, non-chemical control options, resistance management, and reduction of unnecessary spraying. These dimensions guided the interview and observation focus described in the Methodology section.

A qualitative approach was chosen because the study is concerned with how farmers understand and describe pesticide use in their own terms, and with the meaning they attach to specific practices, rather than with measuring the prevalence of a predefined set of correct answers. This depth of understanding, including farmers' own reasoning about when and why they deviate from recommended practice, is not readily captured by a conventional knowledge-attitude-practice (KAP) survey with closed-ended items, which was therefore judged less suitable for the exploratory aim of this study.

Pesticide retailers are frequently the most accessible source of product information for smallholder farmers, but retailers also have a commercial interest in pesticide sales, which can create an incentive to encourage more frequent or higher-volume use than is agronomically necessary. This potential commercial bias is a reason why independent sources of advice, particularly government agricultural extension officers, remain important alongside retailer information, and it is examined in this study as a contextual factor shaping farmers' knowledge rather than treated as a neutral information channel equivalent to extension advice.

Good knowledge of the definition, function, type, dosage, time of application, how to use, and the impact of pesticides will help farmers use pesticides effectively, efficiently, and safely. This knowledge can be obtained through farming experience, agricultural extension, information from fellow farmers, pesticide sellers, and instructions for use listed on pesticide packaging. On the other hand, limited knowledge can lead to the use of pesticides that are not in accordance with the recommendations, increasing the risk to the health of farmers and the environment.

Larompong Urban Village is one of the areas where most of the people make a living as rice farmers. The absence of a prior study specifically located in this urban village is a geographical gap rather than a demonstrated scientific one on its own; the intended contribution of this study is instead to provide an in-depth, triangulated account that distinguishes what farmers report knowing from what is directly observed, in a smallholder rice-farming context where this distinction has rarely been made explicit. Two research questions guide the study: first, what do participate farmers report knowing and understanding about pesticide use, across the dimensions listed above; second, how does directly observed practice, particularly PPE use, correspond with or diverge from what farmers report. Information about farmers' knowledge is needed as a basis for the preparation of counseling and mentoring programs so that the use of pesticides can be carried out in a safer, more effective, and environmentally friendly manner. Based on this description, this study aims to explore rice farmers' understanding and reported practices regarding pesticide use in Larompong Urban Village, Larompong District, Luwu Regency, and to compare these accounts with observed practice.

MATERIAL AND METHOD

This study uses a qualitative descriptive approach to describe the knowledge of rice farmers on the use of pesticides in Larompong Urban Village, Larompong District, Luwu Regency. The approach follows a naturalistic, interpretive orientation: it treats farmers' own accounts of their practice as meaningful data in their own right, rather than testing them against a fixed external scale, while still comparing those accounts against direct observation where possible. The research was carried out in April to May 2026 by involving nine rice farmers as informants who were selected using purposive sampling techniques. Informants are determined based on criteria, namely cultivating their own rice fields, using pesticides directly in rice cultivation activities, and being willing to provide information in accordance with the focus of the research.

This inclusion criterion restricts the sample to landowning farmers who personally apply pesticides. It excludes tenant farmers, hired laborers, and family members who may also mix or apply pesticides and be exposed to them, even though they are not the landowner. This is an important limitation on the scope of the findings and is revisited in the Limitations section; future work should consider a maximum-variation sampling strategy that deliberately includes these groups.

Study Setting

Larompong Urban Village (Kelurahan Larompong) lies in the southern part of Luwu Regency, South Sulawesi Province, within Larompong District. The village covers approximately 14.26 km2 and is bordered by Suli District to the north, Bone Bay to the east, South Larompong District to the south, and Enrekang Regency to the west. It comprises six neighborhood units (lingkungan) and 12 RT/RW. According to Larompong District in Figures 2025 (Statistics of Luwu Regency), the village had a population of 3,777 in 2025 (1,839 men and 1,938 women), a population density of about 264.87 people per km2, roughly 16.2% of the district's total population. Topography is relatively flat and low-lying, supported by river-fed irrigation and rain-fed systems that allow two rice-planting seasons per year; part of the low-lying area bordering the river is prone to flooding in the rainy season. Rice is the dominant food crop; cloves, cacao, durian, and avocado are also cultivated as plantation crops. Local health facilities include an integrated health post (posyandu) and a private physician's clinic; agricultural extension staff are present in the district, but interview data (Section 5.7) indicate that extension activities in this specific village have not been conducted on a regular schedule, so farmers rely more on farming experience and peer networks than on routine extension contact. Fieldwork was conducted from April to May 2026.

Population, Sample Size, and Recruitment

The population for this study was all rice farmers in Larompong Urban Village, reported as 150 farmers. Nine were recruited by purposive sampling based on the three criteria above (cultivating one's own rice land, applying pesticides directly, willingness to participate) [6], [7]. The source materials do not report how many farmers were approached or declined, or whether data collection continued until no substantially new themes emerged (formal data saturation or information-power assessment); this remains a limitation to be clarified by the author, since nine appears to have been fixed in advance as a workable number for in-depth interviewing rather than justified by a documented saturation check.

Participant characteristics below are drawn from the original field records (thesis Table 5.1 and Appendix 2). Full names recorded in the source document are withheld here and replaced with the anonymized codes used throughout the interview data, consistent with the confidentiality assurance given to participants during data collection. All nine participants were men; no women were included, which is noted in the Limitations section, since land tenure may exclude women's participation in pesticide decisions.

Table 1. Participant Characteristics

Code	Age (yr)	Gender	Education	Farming Experience (yr)	Land Area	Dependents
A-1	55	Male	Senior high school	10	1 ha	2
A-2	70	Male	Junior high school	15	0.5 ha (50 are)	5
A-3	58	Male	Senior high school	10	0.4 ha (40 are)	4
A-4	60	Male	Senior high school	25	0.4 ha (40 are)	4
A-5	56	Male	Bachelor's degree	3	0.5 ha (50 are)	4

Code	Age (yr)	Gender	Education	Farming Experience (yr)	Land Area	Dependents
A-6	45	Male	Junior high school	10	0.6 ha (60 are)	5
A-7	31	Male	Senior high school	7	1 ha	4
A-8	45	Male	Senior high school	25	0.85 ha (85 are)	4
A-9	40	Male	Senior high school	7	1 ha	5

Ages ranged from 31 to 70 years; education ranged from junior high school to a bachelor's degree, with senior high school most common; farming experience ranged from 3 to 25 years; land area ranged from 0.4 to 1 hectare; and household dependents ranged from 2 to 5. This range supports a degree of maximum variation in age, education, and farming experience, although not in gender, tenant status, or hired-labor status, which the inclusion criteria excluded (see Limitations).

Data Collection Procedure

Data collection was carried out through observation, in-depth interviews, and documentation. The data used consisted of primary data obtained from interviews and observations of informants, as well as secondary data derived from books, scientific journals, documents, and regulations related to pesticide use [8], [9], [10]. The reviewed manuscript does not report who conducted the interviews, the interviewer's relationship (if any) with participants, interview location, language used, typical duration, whether interviews were audio-recorded, and how recordings were transcribed and, if needed, translated; nor does it report whether field notes were kept or whether the interview guide was piloted before use. These procedural details should be added by the author, since they materially affect how the findings should be read.

Interview Guide

The actual interview guide used in the field, reproduced below from the original research instrument, covered 19 open-ended questions in five areas: participant identity; knowledge of pesticide definition, function, and need; knowledge of pesticide type and selection; knowledge of dosage, label use, and mixing; knowledge of spraying time and weather; knowledge of health and environmental impact and risk-reduction practices; and sources of knowledge and extension participation. The closing script assured participants that their information would be kept confidential and used only for the stated research purpose, which functioned as a verbal confidentiality assurance, though it was not accompanied by a documented formal consent form or a recorded ethics-committee approval.

Compared with the knowledge dimensions set out in the Introduction, this actual guide does not include explicit questions on sprayer equipment calibration, spray drift as distinct from general weather effects, personal protective equipment as a dedicated topic (PPE is only reachable indirectly through question 14 on risk reduction), storage of pesticides or leftover spray liquid, container reuse or disposal, re-entry interval or pre-harvest interval, or recognition of poisoning symptoms and first aid, or integrated pest management action thresholds and non-chemical control as a dedicated topic. These are genuine gaps in the instrument as used, not merely a reporting omission, and are carried into the Limitations section; a revised guide for future rounds of data collection should add explicit questions on each of these topics.

PPE and Risk-Reduction Practices Reported

In response to the risk-reduction question (question 14), participants described using a mask, long-sleeved clothing, and gloves during spraying, together with post-application hygiene practices such as bathing and washing clothes after spraying. Boots and eye protection were not mentioned by any participant in the interview material available. Using the operational definition below, this pattern indicates partial rather than complete PPE use [11], [12], [13]. The number of participants using each specific component, and the reasons for omitting boots or eye protection, are not broken down per participant in the source material; the aggregate finding in the source is that some farmers had not used PPE "completely and consistently" during spraying, without a reported per-participant count. This more precise, but still incomplete, picture replaces the fully unknown placeholder used in an earlier draft of this revision.

Defining Complete PPE

For the purposes of this study, complete PPE for pesticide spraying is defined as the concurrent use of, at minimum, a mask or respirator, gloves, boots, a long-sleeved shirt or coverall, and eye protection, with a hat recommended in addition. Judged against this definition, the mask, long sleeves, and gloves reported by participants represent partial coverage; boots and eye protection appear to be absent from common practice in this group, based on the interview material available, though this was not the subject of a dedicated observation checklist item and so cannot be confirmed by direct observation records.

Key Informants and Documentary Evidence

The manuscript describes triangulation through comparison of information from various informants and data sources, and lists observation, interviews, and documentation as data-collection methods. To avoid overstating triangulation, it should be clarified that observation and documentation are methods of data collection, while the informants triangulated in this study were the nine participating farmers themselves [14], [15]; extension officers, agricultural or health service staff, and pesticide retailers were not separately interviewed as primary key informants, and no village- or farm-level documentary evidence (such as extension visit records or retailer sales records) is reported as having been reviewed. If such key-informant interviews or documentary evidence were in fact collected, they should be added here with the number of sessions or documents reviewed and how they influenced the analysis; if not, this is noted as a limitation.

Analytical Process

Data analysis uses the Miles and Huberman model which includes data reduction, data presentation, and conclusion drawn. The validity of the data was tested through the source triangulation technique by comparing information obtained from various informants and data sources.

In reproducible terms, this process is understood to involve: familiarization with the interview and observation records; initial (open) coding of the raw data; development of a codebook grouping codes into candidate themes; a combination of inductive coding, driven by what participants said, and deductive coding, guided by the knowledge dimensions set out in the Introduction; iterative review and naming of themes; and final conclusion drawing, cross-checked against the original data [16], [17], [18]. The reviewed manuscript does not report whether coding was done by a single analyst or more than one, how disagreements were resolved, whether qualitative analysis software was used, how negative or divergent cases were handled, or whether an audit trail of coding decisions was kept. These reproducibility details should be added by the author. The workflow is illustrated in Figure 1.

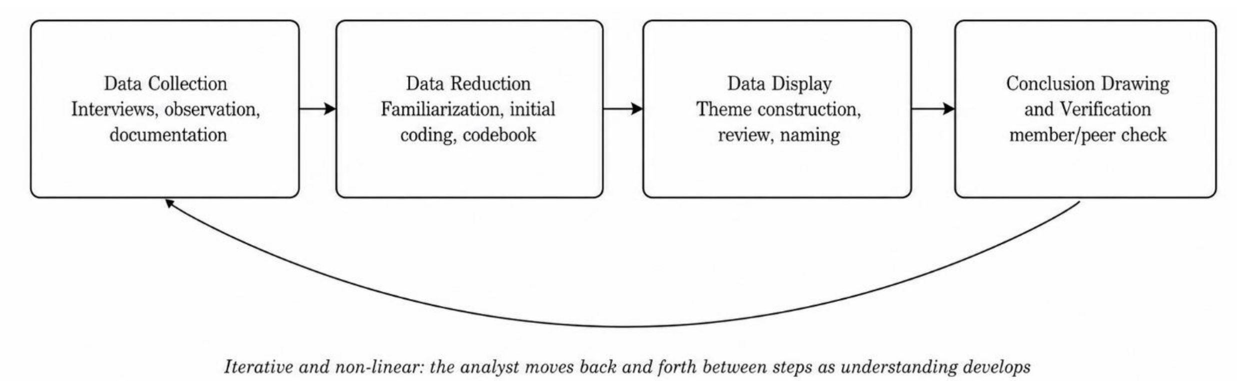

Figure 1. Data Analysis Workflow

Conceptual Framework

This study separates five related constructs: pesticide knowledge, risk perception, reported practice, observed practice, and contextual barriers. Interviews were used to explore knowledge, risk perception, and reported practice; field observation was used to record observed practice, particularly PPE use; and documentation provided secondary background rather than farm-level primary evidence. Contextual barriers, such as heat, discomfort, cost, PPE availability, literacy, time pressure, retailer influence, and social norms, are treated as factors that can explain divergence between what farmers know or say and what they are observed to do, rather than as a simple knowledge deficit. This framework, shown in Figure 2, structures the Results and Discussion sections below.

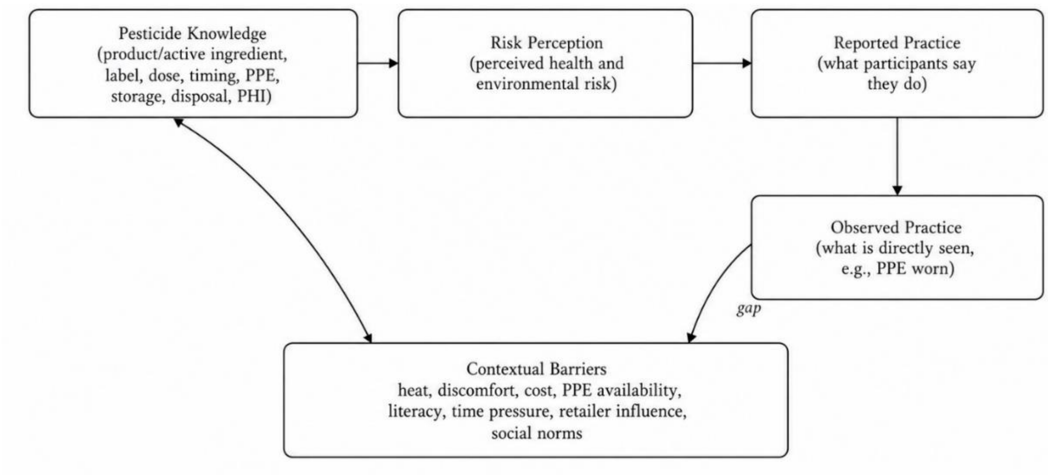

Figure 2. Conceptual framework used in this study

Trustworthiness Procedures

To support credibility, dependability, confirmability, and transferability, qualitative studies of this kind typically use procedures such as member reflection or member checking of preliminary themes with participants, peer debriefing with colleagues not involved in data collection, thick description of the setting and participants, deliberate search for negative or disconfirming cases, and a documented audit trail of analytic decisions. The reviewed manuscript does not report whether any of these procedures were used [19], [20]. The author should specify which were applied, and should consider following a qualitative reporting checklist such as COREQ (Consolidated Criteria for Reporting Qualitative Research) when preparing the resubmission.

Ethics and Data Availability

The interview guide's closing script informed participants that their information would be kept confidential and used only for the stated research purpose, which served as a verbal confidentiality assurance read out before or after each interview. No documented written consent form, no recorded consent to audio recording, no formal ethics-committee approval or exemption letter, no stated withdrawal procedure, no description of data storage arrangements, and no statement on compensation are reported in the source material [21], [22]. These remain gaps that should be filled by the author: at minimum, a statement of which institutional or departmental review (if any) covered this student research, and confirmation of whether verbal consent was deemed sufficient under that review, consistent with standard practice for low-risk social-science interviews with adult farmers. A data-availability statement should also be added indicating whether de-identified interview notes can be made available on request, subject to participant confidentiality.

RESULTS

This section reports findings separately from their interpretation, following the theme structure introduced in the Methodology. Participant characteristics are presented first (Table 1, Methodology), followed by interview findings, observation and risk-reduction findings, and documentation findings. Verbatim quotations below are reproduced from the original Indonesian-language interview records and translated into English for this manuscript, with anonymized participant codes (A-1 to A-9) consistent with Methodology; the original Indonesian wording remains the primary record, and the author should have the translation checked (for example by back-translation) before final submission. Where the source material reports a count (for example "all nine informants"), that count is given; where the source material uses a general quantifier such as "most" or "some" without a reported number, that wording is retained rather than converted into an invented number.

Interview Findings

Theme 1: Definition, Function, and Purpose of Pesticides

All nine informants understood pesticides as a substance or agent used to control plant pest organisms, pests, diseases, and weeds, on rice plants. As Informant A-1 put it: *"A pesticide destroys the pests and diseases that attack rice plants so that yields increase."* Informant A-4 stated: *"A pesticide is a substance used to destroy pests and diseases so the rice plant is not damaged."* Informant A-8 added: *"Pesticides are used to control pests so the plant stays healthy and the harvest increases."* Several informants described pesticides in simple everyday terms, most commonly as medicine or pest-killing poison, reflecting a practical rather than technical framing of the concept.

All nine informants also understood the function and purpose of pesticide use: protecting the rice crop from pest organisms so that growth and yield are maintained. Informant A-1: *"Pesticides are used to eliminate the pests and diseases that attack rice plants so that yields increase."* Informant A-3: *"Pesticides are used to control pests so the plant is not damaged and the harvest stays good."* Informant A-7: *"I only use pesticide when there is a pest or disease, so the plant stays healthy and the harvest does not decrease."* Most informants also described need-based rather than continuous use, applying pesticide only when an actual pest or disease attack was present.

Theme 2: Product Type, Label Use, and Dosage

All nine informants recognized herbicides, insecticides, and fungicides as pesticide categories matched to weeds, insect pests, and fungal disease respectively, and several also named specific trade products in local use (for example Antigi, Macang, Posting, Bentan, and TMA). Informant A-3: *"I usually use herbicide to kill grass, insecticide for planthoppers and caterpillars, and fungicide when the plant starts showing disease."* Informant A-6: *"The type of pesticide I use depends on the need. If there is a lot of grass I use herbicide, if there are pests I use insecticide, and if there is disease, I use fungicide."* Informant A-7: *"I usually use Antigi, Macang, and Posting. The choice depends on the pest or disease attacking the rice."*

Most informants determined dose according to the packaging instructions, sometimes supplemented by farming experience or advice from a pesticide seller or a more experienced peer. Informant A-2: *"I set the dose according to the instructions on the package. If I don't understand it well, I usually ask the pesticide seller or a more experienced friend."* Informant A-6 described the mixing procedure: *"Before spraying, I measure the pesticide according to the dose, then mix it into the tank that already has some water, stir until even, then add water until full."* Informant A-9: *"I usually follow the recommended dose because too much can damage the plant. Although some farmers add more dose so the pest dies faster, I prefer to follow the instructions."*

Informant A-9's account points to a genuine divergent practice within this group: the source material explicitly notes that some farmers had, on occasion, used a dose exceeding the recommendation, in the belief that a higher dose kills pests faster. This is reported here as a disconfirming case rather than smoothed into a uniform account of correct dosing, since it directly qualifies the more general finding that dosage knowledge in this group was adequate: stated understanding of the correct dosing principle did not fully prevent occasional over-dosing in practice for at least part of the group.

Theme 3: Spraying Time and Weather

All nine informants stated that weather conditions strongly influence spraying effectiveness, and most reported spraying in the morning or evening. Informant A-3: *"I usually spray in the morning or evening because the weather is not too hot and the wind is not too strong, so the pesticide can stick well to the plant."* Informant A-4: *"If it's raining or very windy, I don't spray, because the pesticide can wash off or blow away, so the result is not optimal."* Informant A-7: *"I prefer to spray in the evening because the sun is not too strong. If it's cloudy or raining I usually wait until the weather improves."*

Theme 4: Perceived Health and Environmental Impact

Most informants (exact count not reported in the source) described both health and environmental risks of inappropriate pesticide use. Informant A-1: *"Yes, I usually feel dizzy and nauseous if I use too much pesticide. Pesticide can also pollute the water and plants around the rice field."* Informant A-6: *"If pesticide is used too much it can endanger the farmer's health. The water in the field can also become polluted and fish or other animals can die."* Informant A-9: *"In my view, pesticide use that doesn't follow the rules can damage the plant, pollute the environment, and be dangerous for the person spraying if they don't wear protection."*

Theme 5: Sources of Knowledge and Extension Access

Farming experience was the source most frequently emphasized by participants, alongside agricultural extension, peer farmers, pesticide retailers, and product labels. Informant A-2: *"In my view what matters most is farming experience. The longer you farm, the more you know about the type of pesticide, the dose, and how to use it."* Informant A-5: *"Much of my knowledge comes from the agricultural extension officer and fellow farmers. If there's a new pest, we usually ask each other which pesticide is suitable."* Informant A-8: *"In my view farming experience and information from the extension officer really help farmers understand how to use pesticide correctly. The pesticide seller also often explains how to use the product."*

The source material also reports, in the discussion of this theme, that extension counseling in this village has not been carried out on a regular schedule. This qualifies the finding that experience was the source most often mentioned: with routine extension visits reportedly infrequent, farmers may be relying on experience and peer networks partly by default rather than because those sources are inherently more informative than extension would be. A ranked count of how many of the nine participants named each specific source (experience, extension, peers, retailers, label) is not given in the source material, so no numeric ranking is reported here.

Observation and Risk-Reduction Findings

In response to the interview question on reducing risk, participants described using a mask, long-sleeved clothing, and gloves during spraying, together with post-application hygiene measures such as bathing and washing clothes afterward. Neither boots nor eye protection were mentioned by any participant in the material available. Against the complete-PPE definition in the Methodology, this represents partial rather than complete protective equipment use. The source material's own conclusion states that some farmers had not used PPE completely and consistently during spraying, without breaking this down to a specific count or by participant code; a structured, per-participant observation checklist recording which components were worn, their condition, and the reasons for any non-use (heat, discomfort, cost, availability, habit, or perceived risk) was not part of the actual data collection instrument used (see Methodology, Interview Guide) and is recommended for future rounds of data collection on this topic. No data on storage of pesticides or leftover spray liquid, container reuse or disposal, re-entry interval, or pre-harvest interval were collected, since the interview guide did not include dedicated questions on these topics.

Documentation Findings

The secondary documentation reviewed for this study consists of books, scientific journal articles, and regulatory or guideline documents (for example Ministry of Agriculture Regulation No. 24 of 2019 and the Guidelines for Prudent Use of Pesticides), together with regional statistical publications used for the setting description (Statistics of Luwu Regency's harvest-area and production data, and Larompong District in Figures 2025). These sources were used to contextualize and benchmark participants' reported understanding rather than to independently verify individual practice; no farm-level or village-level document (such as an extension attendance log or a retailer sales record) was reviewed.

Consistency Across Sources

Reported knowledge and observed or self-described practice converged for the general definition and purpose of pesticide use, where all nine participants gave essentially consistent accounts, and for weather-dependent spraying timing, also endorsed by all participants. They diverged in two respects that qualify the overall positive framing found in the source material: first, on dosage, where Informant A-9's account and the source's own summary both acknowledge that some farmers have, at least occasionally, exceeded the recommended dose despite stating the correct principle; second, on protective equipment, where reported risk-reduction practice (mask, long sleeves, gloves, post-spray hygiene) falls short of the study's complete-PPE definition (missing boots and eye protection), and the source itself states that PPE use was not complete or consistent across the group. These two points are treated here as the principal divergent findings, rather than compressed into a single uniform “good knowledge” narrative.

Table 2. Theme Matrix

Theme	Subtheme(s)	Coverage	Illustrative Quotation	Observation/Doc. Evidence	Divergence Noted
Definition and function	Pest/disease/weed control; needs-based use	9/9	A-1, A-4, A-8 (definition); A-1, A-3, A-7 (function)	Not directly observed	None
Product type and dosage	Herbicide/insecticide/fungicide; label reliance	9/9 (type); most (dosage, n not given)	A-3, A-6, A-7 (type); A-2, A-6, A-9 (dosage)	Not independently checked	Yes: occasional over-dosing (A-9's account)
Spraying time and weather	Morning/evening timing; wind and rain avoidance	9/9	A-3, A-4, A-7	Not directly observed	None
Health/environment impact	Symptoms; water/soil contamination	Most (n not given)	A-1, A-6, A-9	Not directly observed	None
Sources of knowledge	Experience, extension, peers, retailers, label	9/9 mention experience; ranking not quantified	A-2, A-5, A-8	Extension reported irregular	Context qualifies “most dominant” framing
PPE and risk reduction	Mask, long sleeves, gloves; post-spray hygiene	Aggregate only, n not given per component	(Aggregate description, no individual quotation attributed in source)	No structured observation checklist used	Yes: boots and eye protection absent; not complete/consistent

Theme	Subtheme(s)	Coverage	Illustrative Quotation	Observation/Doc. Evidence	Divergence Noted
Storage, disposal, re-entry/PHI, IPM	Not asked in the interview guide used	-	Not collected	Not collected	Instrument gap, not a reporting omission

DISCUSSION

Experiential Versus Scientifically Validated Knowledge

Participants' understanding of pesticide use appears to draw heavily on repeated farming experience. Long farming experience can reinforce effective, safe routines through trial and observation, but it can equally normalize unsafe routines if they have not produced an immediately visible harm, since chronic health effects of pesticide exposure are not always apparent in the short term [23], [24]. The interview data in this study cannot distinguish which of these two patterns is occurring for a given practice without corroborating observation or documentation, which is one reason the PPE finding (reported awareness of risk alongside incomplete observed PPE use) is analytically important rather than a minor inconsistency to be smoothed over.

The Knowledge-Practice Gap and Its Barriers

These findings are in line with [25], who show that farmers' knowledge about the use of PPE has not always been followed by the complete application of PPE when applying pesticides. Rather than assuming that this gap can be closed by providing more information, it is more consistent with the framework used in this study (Figure 2) to treat incomplete PPE use as shaped by contextual barriers such as heat and physical discomfort in tropical field conditions, the cost of acquiring and replacing PPE, local availability of appropriate PPE, established habits, and a participant's own perceived level of risk. Addressing the knowledge-practice gap accordingly requires attention to these structural and behavioral barriers alongside, rather than instead of, information provision.

The Retailer's Dual Role

Pesticide retailers were described by participants as one of several sources of information, alongside farming experience, extension, and peers. Retailers occupy a dual position: they are often the most physically accessible and immediately responsive source of practical advice, but they also have a commercial interest in pesticide sales volume, which can create pressure toward more frequent or higher-dose recommendations than is agronomically necessary. This dual role is a reason to treat retailer-sourced knowledge with some caution and to support independent, repeated, field-based extension visits as a counterbalance, rather than treating retailer advice as equivalent in reliability to extension guidance.

Connection to Integrated Pest Management

The findings reported above, particularly the description of needs-based rather than continuous pesticide use by some participants, touch on integrated pest management (IPM) principles without the study having directly measured IPM adoption. Stronger integration of IPM principles, including regular pest monitoring, use of action thresholds before spraying, non-chemical control options, resistance-management practices such as rotating active ingredients, and deliberate reduction of unnecessary spraying, would be expected to reduce both pesticide resistance risk and unnecessary exposure of farmers, water, soil, and non-target organisms. This connection is an interpretation drawn from the wider IPM literature and was not itself tested in this study.

Recall, Social-Desirability, and Interviewer-Influence Bias

Because most of the evidence on knowledge and reported practice in this study comes from farmers' own accounts in interviews, the findings are subject to recall bias, in which participants may not precisely remember past dosing or timing decisions, and social-desirability bias, in which participants may describe their practice as more compliant with recommendations than it actually is, particularly on a topic, like PPE use, where participants may be aware their practice falls short of official guidance. The relationship (if any) and rapport between interviewer and participants, which is not reported in the reviewed manuscript, can also shape how candidly participants speak about non-compliant practices. Where self-reported and observed data are available for the same behavior, as with PPE, the observed data are treated in this study as the more reliable indicator of actual practice.

Factors Shaping Both Knowledge and Practice

Education, literacy, farming experience, access to extension services, product availability, cost of inputs including PPE, local climate conditions, and community norms around pesticide use are all plausible influences on both what farmers know and what they do, consistent with the contextual-barriers component of the conceptual framework in Figure 2. This study's interview data provide illustrative examples of some of these influences but do not allow their relative importance to be compared or ranked, since the sample is small, purposive, and drawn from a single village and season.

Comparison with Related Studies

The findings of this study show a broadly similar pattern to other Indonesian rice-farming settings, with some informative differences in emphasis [7], studying rice farmers in Harau District, West Sumatra, found that farmers were willing to pay a premium for pesticides proven effective against rice pests, weighing the risk of crop failure more heavily than the potential environmental harm of chemical pesticides; this helps explain, alongside the present study's finding on occasional over-dosing, why farmers in both settings sometimes depart from label-based recommendations even while stating the correct principle in interview. [8], studying rice farmers in Mandalahurip Village, Tasikmalaya Regency, reported statistical relationships between knowledge, attitude, and length of work experience and pesticide-use behavior, but no relationship between age or education level and that behavior; this is broadly consistent with the present study's qualitative impression that farming experience, rather than age or formal education level, was the source participants themselves emphasized most. [13], studying glutinous rice farmers in Penanggungan Village, similarly found that a good level of stated PPE knowledge was not always followed by complete PPE practice, which matches the central knowledge-practice gap identified in this study. Beyond confirming a familiar pesticide-safety problem in a new location, this study's contribution is the explicit identification of two divergent cases (occasional over-dosing and incomplete PPE) within a small, named sample, together with the observation that irregular extension access in this specific village may itself help explain the heavy reliance on farming experience, a contextual link the cited comparison studies do not examine in the same way.

Recommended Targeted Interventions

1. Participatory farmer-field-school sessions on pesticide safety, led jointly by agricultural extension and, where possible, primary health center staff.
2. Label-literacy training focused on reading active-ingredient names, dose instructions, and hazard symbols.
3. Practical dosage-measurement demonstrations using farmers' own sprayers and water sources.
4. PPE trials or subsidized distribution addressing the specific barriers (heat, cost, availability) identified for this group.
5. Sprayer equipment calibration sessions to align actual output with intended dose.
6. Organized, safe collection points for empty pesticide containers and leftover spray liquid.

Limitations

1. The sample is small (nine farmers), purposive, entirely male, and confined to landowning farmers in a single urban village during a single cropping season, which restricts transferability to other farmers, seasons, or locations. The all-male composition in particular means the study says nothing about women's knowledge or exposure, even though women in farming households may also handle pesticides.
2. The inclusion criterion excluded tenant farmers, hired laborers, and other family members who may also handle pesticides, so the study does not capture their knowledge or exposure.
3. Most findings rely on self-report, which is subject to recall and social-desirability bias; PPE-related practice is only available as an aggregate, unattributed description rather than a per-participant, directly observed record, since the interview guide used did not include a structured PPE observation checklist.
4. The source material does not report whether data saturation or information power was formally assessed, nor procedural details such as who conducted the interviews, interview duration, whether interviews were audio-recorded, or coder involvement and an audit trail for the analysis; nine participants and the specific themes reported appear consistent with the interview guide used, but reproducibility of the coding step itself cannot be fully verified from the material available.
5. Extension officers, health service staff, and pesticide retailers were not interviewed as independent key informants, and no farm-level documentary evidence was reviewed, so triangulation in this study is better described as multi-method (interview, observation, documentation) than multi-source.
6. The interview guide used did not include dedicated questions on sprayer calibration, spray drift, pesticide and leftover-liquid storage, container disposal, re-entry interval, pre-harvest interval, or poisoning first aid, so this study cannot report findings on those topics; this is a gap in the original instrument rather than in reporting.
7. Two divergent practices are reported (occasional over-dosing; incomplete PPE relative to the study's own definition), but variation was not systematically probed for every theme, so the true extent of divergence among participants may be understated.
8. The study does not include exposure or health indicators, so no claim about actual health protection or environmental outcomes can be supported by the data collected.
9. Because of these limitations, the findings describe variation and illustrative patterns among nine purposively selected farmers in one urban village and season; they are not a measured population knowledge level and should not be presented or read as one.

CONCLUSION

This study describes, rather than measures at population level, the pesticide-related knowledge and practice of nine purposively selected rice farmers in Larompong Urban Village, Larompong District, Luwu Regency. The conclusions below are limited strictly to these nine participants and should not be generalized to all rice farmers in Larompong Urban Village, Larompong District, or Luwu Regency.

On knowledge, all nine participants demonstrated a consistent understanding of the general definition, function, and purpose of pesticides, and of the principle of needs-based rather than continuous application. Understanding of product type and dosage relied heavily on product labels and farming experience; despite this stated understanding, at least one participant's account, corroborated by the source's own summary, indicates that some farmers have occasionally exceeded the recommended dose in the belief that this kills pests faster. On reported practice, participants described spraying timed around morning or evening weather conditions and described awareness of potential health and environmental harm. On protective practice, participants reported using a mask, long-sleeved clothing, and gloves, together with post-spray bathing and clothes-washing, but neither boots nor eye protection were mentioned, and the source material states that PPE use was not complete or consistent across the group; a per-participant, directly observed PPE record was not part of the data collected. These levels (knowledge, reported practice, protective practice) are kept separate here because they were not fully consistent with one another, particularly for dosage and PPE.

Knowledge in this group of participants is described by several sources, most frequently farming experience, alongside agricultural extension, peer farmers, pesticide retailers, and product labels; because agricultural extension in this village has reportedly not been conducted on a regular schedule, farmers' emphasis on experience should be read partly against this backdrop of limited routine extension contact, rather than as evidence that experience is inherently the most informative source. The data do not support ranking farming experience as the single most dominant source without a reported source-frequency count, and no causal claim is made here about the relative influence of experience, extension, peers, or retailers on practice. The clearest unresolved safety gaps identified in this study are the occasional use of doses exceeding the recommendation and incomplete, inconsistent PPE use during spraying; a related gap is the absence of any collected data on storage, container disposal, re-entry interval, or pre-harvest interval, since the interview guide used did not ask about these topics.

Rather than recommending generic continuous counseling, this study recommends targeted, participatory intervention for this specific group of farmers, prioritizing practical PPE trials or subsidized access addressing the barriers identified (heat, cost, availability), dosage-measurement demonstrations using farmers' own equipment, label-literacy training, sprayer calibration, and organized safe disposal of containers and leftover spray liquid. Suitable responsible actors include the district agricultural extension service (in coordination with the Department of Agriculture), the local primary health center for poisoning-symptom and first-aid training, and village government or farmer groups for organizing PPE access and container collection points.

Future Research

Future research would benefit from a larger and more diverse sample that includes tenant farmers, laborers, and other family members who handle pesticides; structured, repeated observation rather than single-visit observation; validated knowledge measures used alongside qualitative interviews in a mixed-method design; exposure or health indicators; and comparison across cropping seasons or multiple villages to assess transferability of the patterns described here.

Ethics, Funding, Conflict of Interest, Author Contributions, and Data Availability

Ethics: participants were given a verbal confidentiality assurance as part of the interview guide's closing script (their information would be kept confidential and used only for the stated research purpose); no documented written consent form, recording consent, formal ethics-committee approval or exemption, withdrawal procedure, or data-storage description is reported in the source material, and these should be completed by the author, including the approving body or the basis for exemption. Funding: this research received funding support from the BULOG Research Fund Assistance Program in 2026; the authors should state whether the funder had any role in study design, data collection, analysis, or the decision to publish. Conflict of interest: to be stated by the author; if none, this should say so explicitly. Author contributions: to be stated by the author using a standard taxonomy (for example conceptualization, data collection, analysis, writing). Data availability: de-identified interview notes may be made available on reasonable request, subject to participant confidentiality; the author should confirm this or state the applicable restriction.

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