Knowledge, Attitudes, and Practices of Smallholder Cattle Raisers in Ilocos Norte: Basis For Cattle Production Practices Improvement

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ABSTRACT

This study assessed the knowledge, attitudes, and practices (KAP) of 420 smallholder cattle raisers in Ilocos Norte as a basis for improving cattle production practices. A descriptive-correlational research design was used, with data collected through a validated questionnaire covering breeding, feeding, health management, housing, biosecurity, and record-keeping. Descriptive and inferential statistics were employed at the 0.05 level of significance.

The findings revealed that smallholder cattle raisers were predominantly middle-aged to older, male, married, and high school-educated, with most belonging to households of five to six members and raising one to five cattle. Respondents generally demonstrated high to very high knowledge of breeding and feeding, moderate to high knowledge in other production areas, and favorable to strongly favorable attitudes toward improved cattle production. However, the implementation of recommended practices was inconsistent. Breeding, feeding, and health management practices were performed only sometimes, housing and biosecurity practices were seldom implemented, and record-keeping was generally never practiced. Most demographic and socioeconomic characteristics were not significantly associated with KAP. Knowledge was not significantly related to actual practices across all six production areas, while selected attitude-practice relationships were weak but statistically significant. The overall interrelationship among KAP dimensions was weak and inconsistent, demonstrating a clear gap between knowledge and attitudes and their actual application.

Based on these findings, context-specific training modules on breeding, feeding, health management, housing, biosecurity, and record-keeping were proposed. The modules emphasize practical hands-on demonstrations, guided application to support the consistent adoption of improved cattle production practices among smallholder raisers in Ilocos Norte.

Keywords: smallholder cattle raisers, knowledge, attitudes, practices, cattle production, Ilocos Norte, training modules

INTRODUCTION

Background of the Study

Cattle production plays an important role in livestock systems by providing meat, milk, income, and financial security for farming households. However, smallholder cattle raisers face challenges such as inadequate feeding, inefficient breeding management, disease risks, and limited access to veterinary and technical services. Addressing these concerns requires understanding farmers' knowledge, attitudes, and practices (KAP) to identify gaps and develop appropriate interventions (FAO, 2025; Vandamme, 2009).

In the Philippines, smallholder farms account for a significant proportion of the national cattle population. According to the Philippine Statistics Authority (PSA, 2025), the country had approximately 2.52 million cattle heads as of June 2025, with 84.1% coming from smallhold farms. Similarly, the Ilocos Region produced 5,684 metric tons of cattle in liveweight during the first quarter of 2025, highlighting the importance of cattle raising in the regional agricultural sector.

In Ilocos Norte, cattle production remains an important livelihood activity across its municipalities and city. Data from the Provincial Veterinary Office of Ilocos Norte indicate a reported cattle population of 70,049 heads, although distribution varies across localities. Table 1 presents the distribution of the cattle population across the municipalities and city of Ilocos Norte, highlighting variations in cattle numbers among localities. Given the significant contribution of smallholder cattle raisers, assessing their knowledge, attitudes, and practices is essential in identifying management gaps and developing appropriate interventions to improve cattle production. Table 1 represents the cattle population distribution across the municipalities and city of Ilocos Norte

Table 1. Cattle Population by Municipality/City in Ilocos Norte

Municipality/City	Cattle Population
ADAMS	17
BACARRA	945
BADOC	1,858
BANGUI	1,559
BANNA(ESPIRITU)	3,715
BURGOS	2,534
CARASI	527
CITY OF BATAC	6,457
CURRIMAO	1,434
DINGRAS	11,550
DUMALNEG	139
LAOAG CITY	2,974
MARCOS	4,648
NUEVA ERA	1,013
PAGUDPUD	1,744
PAOAY	2,400
PASUQUIN	5,931
PIDDIG	3,356
PINILI	3,253
SAN NICOLAS	1,712
SARRAT	1,074
SOLSOLNA	5,892
VINTAR	5,317
TOTAL	**70,049**

Source: Office of the Provincial Veterinary Office (PVET)

Smallholder cattle raisers in Ilocos Norte contribute to rural livelihoods through livestock income, household savings, and integrated crop-livestock farming. However, their production activities may be affected by their knowledge, attitudes, and practices regarding cattle nutrition, breeding, disease prevention, housing, and herd management. Understanding these factors is essential in identifying areas that require technical assistance, training, and extension services.

Although provincial cattle population data demonstrate the importance and distribution of cattle production, they do not reflect raisers' knowledge of recommended management practices, their attitudes toward these practices, or their actual implementation. Moreover, broader agricultural studies may not fully represent the specific challenges and conditions experienced by smallholder cattle raisers in Ilocos Norte. This highlights the need for a localized assessment of their knowledge, attitudes, and practices.

Thus, the study entitled Knowledge, Attitudes, and Practices of Smallholder Cattle Raisers in Ilocos Norte assessed the respondents' knowledge of cattle management, attitudes toward recommended production practices, and actual herd management practices. The findings served as the basis for developing a context-specific training module addressing identified learning needs and management gaps. Ultimately, the study aims to support improved cattle management, sustainable livestock production, and stronger rural livelihoods in Ilocos Norte.

Conceptual Framework

This study is anchored on the Knowledge, Attitudes, and Practices (KAP) framework, which provides an analytical approach for examining what individuals know about a particular subject, how they perceive or respond to it, and what they do in practice. Vandamme (2009) described KAP surveys as an approach for investigating human behavior by assessing knowledge, attitudes, and practices. KAP studies may be used to describe the current situation of a population, provide insight into existing conditions, and inform the design of appropriate interventions. Thus, the KAP framework is appropriate for the present study because it provides a systematic basis for assessing the existing conditions of smallholder cattle raisers and identifying areas that may require improvement.

The applicability of the KAP framework in agricultural and livestock settings is supported by previous research. Escarlos et. al (2016) used a KAP approach to assess the knowledge, attitudes, and practices of buffalo raisers in Agusan del Sur, Philippines, concerning Surra and its control, demonstrating its application within a Philippine livestock-raising context. Similarly, Lu (2022) examined the knowledge, attitudes, and practices of farmers in the Philippines concerning pesticide use and investigated the relationships among the three KAP dimensions. These studies provide empirical support for the use of KAP in agricultural and livestock populations and demonstrate its usefulness in examining existing conditions and relationships among knowledge, attitudes, and practices. In the present study, the KAP framework is used to assess the knowledge, attitudes, and practices of smallholder cattle raisers in Ilocos Norte across six areas of cattle production: breeding, feeding, health management, housing, biosecurity, and record-keeping. Knowledge refers to understanding recommended practices, attitudes to perceptions and willingness in cattle production improvement, and practices to the frequency or extent of implementing recommended activities. The respondents' demographic and socioeconomic characteristics are treated as contextual variables that may be associated with variations in KAP. These include age, sex, civil status, educational attainment, household size, role in cattle raising, farm size, years of experience, number of cattle, cattle-raising income, primary source of income, and other sources of income. Knowledge is measured through multiple-choice questions, attitudes through Likert-scale items, and practices through frequency-based indicators. Statistical analyses are used to determine KAP levels, examine their relationships with selected respondent characteristics, and assess the interrelationships among the three KAP dimensions.

Paradigm of the Study



Fig. 1. The Research Paradigm

The study is anchored on the Input–Process–Output (IPO) paradigm, which illustrates the systematic flow of the research from data collection and analysis to the development of proposed training modules. This paradigm

complements the Knowledge, Attitudes, and Practices (KAP) framework by demonstrating how assessment results are transformed into appropriate interventions.

The input consists of the respondents' demographic and socioeconomic profiles and their knowledge, attitudes, and practices in six areas of cattle production: breeding, feeding, health management, housing, biosecurity, and record-keeping.

The process involves collecting, organizing, and statistically analyzing the data using descriptive and appropriate inferential methods. The results are used to determine KAP levels, examine relevant relationships, and identify gaps and priority areas requiring intervention.

The output is the proposed training modules on cattle production practices, developed based on the identified KAP gaps. Domains with knowledge levels below moderate, attitudes below neutral, and practices below sometimes are considered priority areas for training. The modules aim to improve technical knowledge, promote favorable attitudes, and strengthen the application of recommended cattle management practices.

Overall, the KAP framework guides the assessment of smallholder cattle raisers, while the IPO paradigm illustrates how the findings are analyzed and translated into proposed training modules to improve cattle production management in Ilocos Norte.

Problem of the Study

Smallholder cattle raisers remain a vital source of livelihood for rural households in the Philippines, particularly in Ilocos Norte, where smallholder farmers integrate livestock farming with crop production. However, recurring issues such as low productivity, frequent disease outbreaks, and inadequate adoption of biosecurity measures continue to threaten sustainability. This situation raises questions about the readiness of smallholder cattle raisers to implement effective cattle production practices.

This study aimed to assess the knowledge, attitudes, and practices (KAP) of smallholder cattle raisers in Ilocos Norte cattle production. Specifically, it sought to answer the following questions:

1. What is the profile of smallholder cattle raisers in Ilocos Norte in terms of:

a. age

b. sex

c. civil status

d. highest educational attainment

e. household size

f. role of farmer

g. farm size

h. years of experience in cattle raising

i. number of cattle owned/raise

j. average annual income from cattle raising

k. primary source of income

l. other source of income

2. What is the level of knowledge of smallholder cattle raisers regarding production practices, in terms of:

a. breeding

b. feeding

c. health management

d. housing

e. biosecurity

f. record keeping

3. What is the level of attitude of smallholder cattle raisers in improving production practices in terms of:

a. breeding

b. feeding

c. health management

d. housing

e. biosecurity

f. record keeping

4. What common cattle production practices do smallholder raisers perform along the parameters of:

a. breeding

b. feeding

c. health management

d. housing

e. biosecurity

f. record keeping

5. Is there a significant relationship between the profile of respondents and there:

a. level of knowledge

b. level of attitude, and

c. level of practices

6. Is there a significant relationship between the level of knowledge and practices of smallholder cattle raisers?

7. Is there a significant relationship between the level of attitudes and practices of smallholder cattle raisers?

8. Is there an interrelationship between Knowledge, Attitude and Practices?

9. What training modules on different cattle management practices can be proposed based on the assessed level of knowledge, attitudes, and practices of smallholder cattle raisers?

Scope and Delimitations

This study focused on the knowledge, attitudes, and practices (KAP) of smallholder cattle raisers in ten selected localities in Ilocos Norte: Dingras, Batac City, Pasuquin, Solsona, Vintar, Marcos, Banna, Laoag City, Burgos, and Paoay. Eligible respondents were residents who owned one to five heads of cattle and had actively managed their cattle within the past 12 months.

A total of 420 respondents were selected through proportionate stratified random sampling. The study areas were classified into lowland, coastal, and upland strata to ensure geographical representation, with samples allocated proportionately based on cattle population. These classifications were used solely for sampling purposes and not for comparison.

The study assessed respondents' knowledge, attitudes, and practices in six areas of cattle production: breeding, feeding, health management, housing, biosecurity, and record-keeping. It also examined relationships among selected respondent profiles and KAP variables. The study excluded commercial cattle producers and areas outside the selected localities. Findings were based on self-reported data and were limited to the participating smallholder cattle raisers; therefore, they were not intended to represent all cattle producers in Ilocos Norte or the Philippines.

Hypotheses

The following hypotheses were tested in the study:

1. There is no significant relationship between the profile and the level of knowledge, attitude, and practices.

2. There is no significant relationship between the level of knowledge and the practices of smallholder cattle raisers.

3. There is no significant relationship between the level of attitudes and the practices of smallholder cattle raisers.

4. There is no interrelationship among Knowledge, Attitude, and Practices of smallholder cattle raisers.

Importance of the Study

Smallholder Cattle Raisers. The study helped them recognize gaps in their current practices and adopt science-based improvements in feeding, breeding, housing, and health management, leading to higher productivity and income.

Ilocos Sur Polytechnic State College (ISPSC). Findings provided localized data that can inform academic programs, serve as teaching references, and guide extension services for farmers.

Government Agencies (LGU, OPAG, PVO, BAI). The results can inform policies and programs that address the real needs of smallholder raisers, such as training modules, vaccination drives, and feeding interventions.

Future Researchers. The study served as a baseline for future research on livestock production, KAP surveys, and rural development in the Philippines.

Definition of Terms

Profile of Smallholder Cattle Raisers. Refers to respondents' demographic, educational, socioeconomic, and farm-related characteristics, including age, sex, civil status, education, household size, farmer role, farm size, cattle-raising experience, number of cattle, annual cattle-farming income, and income sources.

Age. Refers to respondents' age, categorized as below 20, 20–29, 30–39, 40–49, 50–60, and 60 years and above.

Sex. Refers to respondents' reported sex, categorized as male or female.

Civil Status. Refers to respondents' marital status, categorized as single, married, widowed, or separated.

Highest Educational Attainment. Refers to the highest formal education completed, or level reached, from no formal education to college or vocational/technical education.

Household Size. Refers to the number of household members, categorized as 1–2, 3–4, 5–6, or 7 and above.

Role of Farmer. Refers to respondents' participation in cattle raising as owner-raisers or non-owner-raisers.

Farm Size. Refers to the land area used for cattle production, categorized as less than 1,000, 1,000–3,000, 3,000–5,000, or more than 5,000 square meters.

Years of Experience in Cattle Raising. Refers to the duration of involvement in cattle raising, categorized as less than one year, 1–5, 6–10, or more than 10 years.

Number of Cattle Raised. Refers to the number of cattle owned or managed, with response options ranging from one to five cattle.

Average Annual Income from Cattle Farming. Refers to reported annual cattle-farming income, categorized as below ₱15,000, ₱15,000–₱50,000, ₱50,000–₱100,000, or ₱100,000–₱300,000.

Primary Source of Income. Refers to the main livelihood source, such as crop farming, livestock farming, business or trading, wage employment, or another specified source.

Other Source of Income. Refers to additional income-generating activities apart from the primary livelihood.

Level of Knowledge Regarding Cattle Production Practices. Refers to respondents' understanding of recommended practices in breeding, feeding, health management, housing, biosecurity, and record-keeping, as measured by the knowledge questionnaire.

Knowledge. Refers to respondents' understanding of appropriate cattle production and management practices, assessed through multiple-choice questions.

Breeding. Refers to knowledge of estrus detection, breeding timing, animal selection, artificial insemination, reproductive health, and breeding records.

Feeding. Refers to knowledge of proper nutrition, roughage, concentrates, mineral supplementation, consistent feeding, and adequate clean water.

Health Management. Refers to knowledge of disease symptom, vaccination, parasite control, treatment, hygiene, and veterinary consultation.

Housing. Refers to knowledge of suitable cattle shelters, ventilation, space, shade, safe flooring, drainage, cleanliness, resting areas, and weather protection.

Biosecurity. Refers to knowledge of disease-prevention measures, including quarantine, visitor control, equipment sanitation, animal movement management, and proper waste disposal.

Record-Keeping. Refers to knowledge of documenting breeding, reproductive outcomes, vaccination, deworming, feeding expenses, growth, animal health, and farm performance.

Level of Practices. Refers to the reported frequency of performing cattle management activities, rated as always (5), often (4), sometimes (3), seldom (2), and never (1).

Relationship Between Profile and Knowledge. Refers to the statistical association between respondents' profile characteristics and their knowledge scores.

Relationship Between Profile and Attitude. Refers to the statistical association between respondents' profile characteristics and their attitude scores.

REVIEW OF LITERATURE

Profile and Socioeconomic Characteristics of Smallholder Cattle Raisers

The demographic and socioeconomic profile of cattle raisers may influence access to information, resources, labor, and livestock technologies. Age, sex, civil status, education, household size, farmer role, farm size, experience, herd size, and income are therefore relevant to understanding differences in cattle production.

Studies commonly report substantial participation of middle-aged and older farmers in livestock production. Perez et al. (2003), Galang and Calub (2020), and Bremer et al. (2022) documented this pattern in the Philippines and Indonesia, suggesting that age and accumulated experience are relevant characteristics of smallholder cattle raisers.

Cattle raising in the Philippines is commonly male-dominated, although responsibilities may differ within households. Miranda-Quibot et al. (2017) reported mostly male backyard cattle farmers, while Parks et al. (2015) described gender differences in livestock ownership and management.

Marriage and household structure are common characteristics among livestock raisers. Duza et al. (2021), Ishaya et al. (2018), and Langngag (2025) reported high proportions of married farmers, indicating that cattle raising is often integrated into family livelihood systems.

Education may affect farmers' ability to understand and apply agricultural information. Perez et al. (2003), Nugroho et al. (2021), and Chepkochei et al. (2025) reported associations between educational attainment, awareness, and adoption of improved agricultural practices.

Household members may provide labor for livestock activities. Escarcha et al. (2018) and Galang and Calub (2020) reported small to moderate household sizes among livestock-farming families, while Sevilla et al. (2005) emphasized the role of household conditions in smallholder production.

Ownership and management responsibilities may be shared. Miranda-Quibot et al. (2017) described Philippine arrangements such as sole ownership and the paiwi system, in which one party provides capital while another manages the animals.

Galang and Calub (2020) also documented cattle-sharing arrangements in which animals and offspring are distributed among participating raisers. Such arrangements shape ownership, responsibilities, and resource sharing.

Farm size may influence herd capacity, feeding systems, housing, and forage availability. Sevilla et al. (2005) identified feed resources and market access as important constraints in smallholder cattle production.

Experience may contribute to farmers' practical knowledge and decision-making. Cañete and Alvarez (2022), Alvarez and Cañete (2021), and Palacpac et al. (2022) reported that many dairy farmers in Cagayan Valley had relatively few years of experience.

Herd size should be considered alongside land, feed availability, household resources, and production goals, particularly in resource-constrained smallholder systems (Sevilla et al., 2005).

Cattle income depends on herd size, available resources, market participation, labor, capital, and access to credit.

Lapar et al. (2003) found that livestock holdings, household resources, transaction costs, labor, capital, and credit influence market participation and selling decisions among Northern Luzon livestock producers.

The primary income source indicates the extent to which cattle raising or another livelihood supports the household.

Smallholder livestock production is often integrated into broader household livelihood strategies. Lapar et al. (2003) and Perez et al. (2003) noted that livestock may provide income alongside other economic activities.

Additional income sources help rural households manage seasonal, market, and resource-related uncertainties by reducing dependence on a single livelihood.

Dela Cruz and Dizon (2023) and Galang and Calub (2020) documented livelihood diversification among livestock households through crop production, fisheries, other livestock, and non-farm activities.

Knowledge

Technical knowledge supports decisions on breeding, nutrition, animal health, housing, biosecurity, and farm records. Mapiye et al. (2018) emphasized that improved knowledge strengthens farmers' capacity to adopt livestock technologies and manage resources effectively.

Knowledge of Smallholder Cattle Raisers Regarding Production Practice Particularly in of Breeding

Breeding knowledge covers animal selection, mating, estrus detection, reproductive management, and breeding technologies. Vega (2019), Abella et al. (2017), and Pacana and Kleine Koerkamp (2025) highlighted the importance of breeding knowledge and artificial insemination awareness among cattle raisers.

Knowledge of Smallholder Cattle Raisers Regarding Production Practice Particularly in Feeding

Feeding knowledge supports animal growth, health, reproduction, and productivity. Adion et al. (2007) and Palacpac et al. (2024) found that farmer training, demonstrations, and video-based learning can improve understanding of feed use and feeding management.

Knowledge of Smallholder Cattle Raisers Regarding Production Practice Particularly in Health Management

Health-management knowledge helps farmers recognize, prevent, and control disease. Lugong et al. (2024) and Escarlos et al. (2016) identified knowledge gaps in livestock disease management, while Bondoc et al. (2012) reported differences in herd-health programs across farm sizes.

Knowledge of Smallholder Cattle Raisers Regarding Production Practice Particularly in Housing

Housing knowledge includes space, ventilation, flooring, cleanliness, and protection from weather. Flaba et al. (2002), Gallo et al. (2023), and Cortese et al. (2020) emphasized that suitable housing conditions support cattle welfare and reduce health risks.

Knowledge of Smallholder Cattle Raisers Regarding Production Particularly in Biosecurity

Biosecurity knowledge concerns disease risks and preventive measures. Simborio et al. (2016) identified gaps in farmers' understanding of disease causes, while Tanquilut et al. (2020) reported variations in farm biosecurity compliance.

Knowledge of Smallholder Cattle Raisers Regarding Production Particularly in Record Keeping

Record-keeping knowledge supports monitoring of breeding, feeding, health, production, and finances. Miranda-Quibot et al. (2017), Vega (2019), and Arugay et al. (2020) emphasized the value of systematic documentation for farm management.

Attitudes

Farmers' attitudes reflect their perceptions and willingness to adopt recommended technologies and practices. Rogers (2003) associated favorable attitudes toward innovations with greater potential for adoption.

Attitude of Smallholder Cattle Raisers in Improving Production Practices in Terms of Breeding

Attitudes toward breeding technologies are shaped by perceived benefits, costs, animal performance, and access to resources. Martin-Collado et al. (2021) and Mutenje et al. (2020) highlighted these considerations in farmers' breeding decisions.

Attitude of Smallholder Cattle Raisers In Improving Production Practices in Terms of Feeding

Farmers' acceptance of improved feeding systems may depend on training and locally available resources. Adion et al. (2007), Loresco et al. (2022), and Sakti et al. (2022) emphasized practical learning and adaptation to farm conditions.

Attitude of Smallholder Cattle Raisers in Improving Production Practices in Terms of Health Management Practices

Attitudes toward health management may influence willingness to adopt vaccination, deworming, sanitation, and disease prevention. MacPhillamy et al. (2022), Valiente et al. (2026), and Vega (2019) reported links between farmer perceptions and livestock-health behaviors.

Attitude of Smallholder Cattle Raisers in Improving Production Practices in Terms of Housing

Farmers' views on cattle housing are shaped by animal welfare needs and available facilities. Atole (2026), Gebert and Kuhne (2026), and Kiboi et al. (2021) identified farm resources and characteristics as relevant to housing decisions.

Attitude of Smallholder Cattle Raisers in Improving Cattle Production Practices in Terms of Biosecurity

Favorable biosecurity attitudes do not always lead to consistent implementation. Brennan and Christley (2013), Mateo et al. (2021), Valiente et al. (2026), and Vega (2019) highlighted differences between farmers' perceptions and actual disease-prevention practices.

Attitude of Smallholder Cattle Raisers in Improving Production Practices in Terms of Record Keeping

Attitudes toward record keeping may depend on perceived usefulness and the availability of practical systems. Valiente et al. (2026), Vega (2019), and Palacpac et al. (2024) identified gaps between farmers' knowledge, attitudes, and record-keeping practices.

Overall, attitudes may support the adoption of improved cattle practices, but favorable perceptions do not guarantee consistent implementation. Attitudes should therefore be examined separately from actual practices.

Practices

Cattle-management practices affect animal health, productivity, and farm efficiency. Abazinab et al. (2025) and Sumi et al. (2026) reported that practices vary with farming systems, resources, and farmers' knowledge and attitudes.

Common Cattle Production Practices of Smallholder Raisers Perform Along the Parameters of Breeding

Breeding practices affect herd replacement, calving intervals, and productivity. Olmo et al. (2019), Vega (2019), Abella et al. (2017), and Pacana and Kleine Koerkamp (2025) documented mating and artificial insemination practices, while Mutenje et al. (2020) identified costs and animal performance as factors in breeding decisions.

Common Cattle Production Practices of Smallholder Raisers Perform Along the Parameters of Feeding

Feeding practices depend on feed quality, availability, and farm conditions. Philippine studies documented the use of Napier grass, kakawate, rice straw, grazing, and cut-and-carry systems, while other research emphasized local feed resources, balanced rations, and feeding frequency (Loresco et al., 2022; Adion et al., 2007; Sakti et al., 2022; Olmo et al., 2021).

Common Cattle Production Practices of Smallholder Raisers Perform Along the Parameters of Health Management

Health-management practices include vaccination, deworming, supplementation, veterinary consultation, isolation of sick animals, and proper carcass disposal. Studies by Vergara and Paglomutan (2020), Palacpac et al. (2015), Dargantes (2010), and Escarlos et al. (2016) identified both adopted practices and continuing gaps.

Common Cattle Production Practices of Smallholder Raisers Perform Along the Parameters of Housing

Cattle housing supports comfort, sanitation, and protection from environmental stress. Vega (2019) and Bueno et al. (2023) described variations in traditional management and facility conditions, often shaped by available resources and local environments.

Common Cattle Production Practices of Smallholder Raisers Perform Along the Parameters of Biosecurity

Biosecurity measures include controlling animal movement and farm access, cleaning shared equipment, and quarantining new animals. Brennan and Christley (2013), Olmo et al. (2019), Escarlos et al. (2016), and Young et al. (2014) highlighted the importance of consistent disease-prevention practices.

Common Cattle Production Practices of Smallholder Raisers Perform Along the Parameters of Record Keeping

Systematic records help farmers monitor production, expenses, breeding, and animal health. Miranda-Quibot et al. (2017) and Vega (2019) reported reliance on informal or inconsistent records, while Arugay et al. (2020) demonstrated the value of organized farm documentation.

METHODOLOGY

Research Design

This study employed a descriptive-correlational research design. The descriptive component was used to systematically describe the profile of the respondents and their levels of knowledge, attitudes, and practices (KAP) in cattle production, while the correlational component examined relationships among selected variables without manipulating the study conditions (Creswell, 2014; Polit & Beck, 2017).

The descriptive component addressed Statements of the Problem 1 to 4 by describing the respondents' profile and their levels of knowledge, attitudes, and practices in cattle production. The correlational component

addressed Statements of the Problem 5 to 8 by determining relationships between selected profile and KAP variables, as well as relationships among knowledge, attitudes, and practices.

Sampling Design and Procedures

The study employed proportionate stratified random sampling to select smallholder cattle raisers from the identified municipalities and city in Ilocos Norte. For sampling purposes, the selected study areas were grouped into three geographical strata, namely lowland, coastal, and upland areas, to ensure that cattle raisers from the different geographical settings included in the study were represented. These geographical classifications were used for sampling purposes and were not intended as variables for comparative analysis.

The study covered smallholder cattle raisers from Dingras, Batac City, Pasuquin, Solsona, Vintar, Marcos, Banna, Laoag City, Burgos, and Paoay, Ilocos Norte. Coordination with the concerned Local Government Units (LGUs), Municipal Agriculture Offices (MAOs), and agricultural technicians was undertaken to facilitate the identification of eligible cattle raisers and the collection of the necessary sampling-frame data. The sampling frame consisted of identified eligible cattle raisers in the selected study areas based on records obtained through coordination with the concerned MAOs and other local agricultural personnel.

The study made use of G* Power Analysis to determine the minimum sample size from the total population of 51,418 cattle raisers in the province. A priori power analysis was considered using a significance level of 0.05, a statistical power of 0.80 and an assumed medium effect size of 0.30.

A total of 420 respondents were included in the study. The sample was allocated proportionately among the selected municipalities and city based on their respective population in the sampling frame. The sample allocation for each municipality or city was determined using the proportionate allocation formula:

$$n_i = \frac{N_i}{N} \times n$$

Where ni represents the sample allocated to a particular municipality or city, Ni represents its population in the sampling frame, N represents the total population of the selected study areas, and n represents the total sample size of 420.

Using this procedure, the sample was distributed as follows: 95 respondents from Dingras, 53 from Batac City, 48 from Pasuquin, 48 from Solsona, 43 from Vintar, 38 from Marcos, 30 from Banna, 24 from Laoag City, 21 from Burgos, and 20 from Paoay, for a total of 420 respondents.

Respondents were included if they (1) owned at least one and not more than five heads of cattle, (2) had been actively engaged in cattle management within the past 12 months, and (3) were residents of Ilocos Norte. After the eligible cattle raisers were identified, respondents were selected through random sampling within each selected municipality or city based on the predetermined proportionate sample allocation. Coordination with the concerned LGUs, MAOs, and agricultural technicians also supported the proper identification and validation of eligible respondents and facilitated the administration and collection of the research data.

Population and Locale of the Study

A total of 420 smallholder cattle raisers participated in the study. The respondents were distributed across the three geographical strata, with 168 respondents from the lowland areas, 93 from the coastal areas, and 159 from the upland areas. The unequal distribution across the three geographical strata resulted from the proportionate allocation procedure, which based the number of respondents on the population represented in each selected municipality or city.

The geographical classifications of lowland, coastal, and upland were used to provide geographic coverage of the study population and were not intended to establish equal-sized groups or to serve as variables for

comparative analysis. These classifications also do not imply that each municipality consists exclusively of one type of terrain, as municipalities may contain varied topographic and agro-ecological conditions.

Table 2 shows the distribution of the 420 respondents across the selected geographical strata and municipalities/city. The lowland stratum consisted of 168 respondents from Dingras, Batac City, and Paoay; the coastal stratum consisted of 93 respondents from Pasuquin, Laoag City, and Burgos; and the upland stratum consisted of 159 respondents from Solsona, Vintar, Marcos, and Banna. The number of respondents per municipality or city was determined through proportionate allocation based on the population represented in the sampling frame, resulting in a total of 420 respondents.

Table 2. Distribution of Samples Smallholder Cattle Raisers by Geographical Stratum and Municipality/City in Ilocos Norte

Geographical Stratum	**Municipality/City**	**No. of Samples**
Lowland	Dingras	95
	Batac City	53
	Paoay	20
Subtotal		**168**
Coastal	Pasuquin	48
	Laoag City	24
	Burgos	21
Subtotal		**93**
Upland	Solsona	48
	Vintar	43
	Marcos	38
	Banna	30
Subtotal		**159**
Total		**420**

Research Instrument

The study used a validated questionnaire consisting of four parts: respondent profile, knowledge, attitudes, and practices.

The instrument underwent expert validation by specialists in livestock management to ensure content validity. A pilot test was conducted to assess reliability, yielding a Cronbach's alpha of 0.918, which indicated high internal consistency.

The discussion of the instrument was simplified and structured to clearly present its components and scoring system.

Data Analysis

The data collected from the 420 smallholder cattle raisers were encoded and analyzed using the Statistical Package for the Social Sciences (SPSS). Frequency and percentage were used to describe the respondents' demographic profiles, while mean and standard deviation were used to summarize their knowledge, attitudes, and practices. Pearson's product-moment correlation coefficient Pearson's r was used to determine the relationships between the respondents' demographic profiles and their knowledge, attitudes, and practices, when the assumptions for parametric testing were satisfied. Point-biserial correlation was used to examine the relationship between sex and management practices, while Spearman's rank-order correlation coefficient was used to assess relationships involving ordinal variables, such as educational attainment and monthly income, or when the assumptions of Pearson's correlation were not met. Multiple linear regression analysis was employed

to examine the relationship among knowledge, attitudes, and practices among smallholder cattle raisers. All inferential statistical tests were evaluated at the 0.05 level of significance.

Data Collection Procedure

Prior to data collection, the researcher secured permission from the Provincial and Municipal Mayors Office and Agriculture Offices and other concerned authorities. Ethical clearance was obtained from the ISPSC Research Ethics Committee before the conduct of the study.

The researcher explained the purpose and procedures of the study to prospective participants, and informed consent was obtained before participation. Participation was voluntary, and respondents were informed of their right to withdraw at any time without penalty.

The questionnaire was translated into Iloko to facilitate comprehension. Data were collected through face-to-face administration, with assistance from local officials or agricultural personnel when necessary. Confidentiality and anonymity of responses were maintained throughout data collection, encoding, analysis, and reporting.

Statistical Treatment of Data

All statistical treatments were presented in this section in compliance with REC recommendations.

Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to summarize respondents' profile and KAP levels.

Inferential statistical tests included: - Pearson correlation for continuous variables - Spearman correlation for ordinal data - Chi-square test for categorical variables.

The level of significance was set at 0.05. Statistical analysis was performed using SPSS.

Data Categorization

Level of Knowledge

In analyzing the respondents' level of knowledge on cattle management practices, the following categories were used:

Level of Attitude

The respondent's level of knowledge in cattle management practices was categorized based on the number of correct scores obtained:

Number of Scores	Level of Knowledge
9 – 10	Very High
7 – 8	High
5 – 6	Moderate
3 – 4	Low
2-Jan	Very Low

Level of Attitude

The respondents' level of attitudes in cattle management practices was interpreted using the following five-point Likert scale.

Numerical Rating	Statistical Rating	Descriptive Rating
5	4.21–5.00	Strongly Agree

4	3.41–4.20	Agree
3	2.61–3.40	Neutral
2	1.81–2.60	Disagree
1	1.00–1.80	Strongly Disagree

Level of Practices

The respondents' level of practices in cattle management practices was interpreted using the following five-point frequency scale scale:

Numerical Rating	Statistical Rating	Descriptive Rating
5	4.21–5.00	Always
4	3.41–4.20	Often
3	2.61–3.40	Sometimes
2	1.81–2.60	Seldom
1	1.00–1.80	Never

For determining the components to be included in the proposed training module, areas rated below the moderate level of knowledge, below the neutral level of attitude, and below the sometimes level of practice were identified as priority areas for training intervention.

Ethical Considerations

The study adhered to ethical principles, including informed consent, voluntary participation, confidentiality, and anonymity. No personal identifiers were disclosed in any part of the study.

Ethical clearance was secured from the ISPSC Research Ethics Committee prior to data collection. All procedures complied with institutional and national ethical standards for research involving human participant.

The researcher also utilized Artificial Intelligence (AI) tools solely to assist in manuscript preparation, particularly in improving grammar, sentence construction, and language clarity. All AI-assisted suggestions were reviewed and verified by the researcher to ensure accuracy and consistency with the study's objectives, methodology, and findings. The researcher retains full responsibility for the final content of the manusc

RESULTS AND DISCUSSIONS

This chapter presented the discussion of the findings, conclusions, and recommendations of the study.

Findings

Profile of Cattle Raisers

The demographic profile described the characteristics and socio-economic conditions of smallholder cattle raisers, providing a basis for interpreting the findings and identifying appropriate interventions for sustainable cattle production.

Table 3a. Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of Age

Age Group	Number of Respondents	Percentage (%)
Below 20	0	0
20-29	58	13.81
30-39	45	10.71

40-49	97	23.1
50-60	137	32.62
60 and above	83	19.76
Total	**420**	**100**

The findings show that most respondents were aged 50–60 years (32.62%), followed by those aged 40–49 (23.10%) and 60 years and above (19.76%), indicating that cattle raising is predominantly practiced by middle-aged and older individuals.

This finding is consistent with Perez et al. (2003), who reported an average age of 49 among Filipino smallholder dairy farmers. Similarly, Galang and Calub (2020) and Bremer et al. (2022) found substantial participation of middle-aged and older farmers in cattle production.

Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of Sex

Table 3b illustrates the respondents' distribution based on sex. It provides the number of participants belonging to the male and female groups. The corresponding percentage for each group is also presented in the table.

Table 3b. Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of Sex

Sex Group	**Number of Respondents**	**Percentage (%)**
Male	385	91.67
Female	35	8.33
Total	**420**	**100**

The findings show that cattle raising is predominantly male dominated, with 385 males (91.67%) and 35 females (8.33%). This indicates that men constitute most cattle raisers in the study area.

This finding is consistent with Miranda-Quibot et al. (2017), who reported 84.2% male participation among backyard cattle farmers. Similarly, Parks et al. (2015) and Valdez et al. (2023) documented greater male participation in livestock-related activities.

Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of Civil Status

Table 3c. Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of Civil Status

Civil Status Group	**Number of Respondents**	**Percentage (%)**
Single	33	7.86
Married	349	83.1
Widowed	32	7.62
Separated	6	1.43
Total	**420**	**100**

The findings show that most respondents were married (83.10%), followed by single (7.86%), widowed (7.62%), and separated (1.43%). This suggests that cattle raising is commonly associated with established family households and may serve as a source of livelihood and financial support.

This finding is consistent with Murcia (2019), who reported that most feedlot cattle raisers in Batac City, Ilocos Norte, were married. Similarly, Miranda et al. (2017) and Galang and Calub (2020) found that married individuals comprised the majority of cattle raisers in their respective studies.

Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of Highest Educational Level

Table 3d shows the educational attainment of the cattle raiser respondents, presenting the distribution of participants based on the highest level of formal education they had attained.

Table 3d. Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of Highest Educational Level

Highest Educational Level Group	**Number of Respondents**	**Percentage (%)**
No formal education	7	1.67
Elementary Level	46	10.95
Elementary Graduate	11	2.62
High School Level	251	59.76
High School Graduate	24	5.71
College Level	64	15.24
College Graduate	15	3.57
Vocational	2	0.48
Total	**420**	**100**

The findings show that most respondents had reached the high school level (59.76%), followed by college (15.24%) and elementary (10.95%). This indicates that the majority had basic formal education, with relatively few attaining higher educational qualifications.

This finding is consistent with Murcia (2019), who found that educational attainment was associated with cattle production practices among feedlot raisers in Batac City, Ilocos Norte. Similarly, Samonte (2023) identified limited access to agricultural extension services as a challenge among native carabao raisers in Catanduanes.

Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of

Household Size

Table 3e. Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of Household Size

Household Size Group	**Number of Respondents**	**Percentage (%)**
2-Jan	33	7.86
4-Mar	66	15.71
6-May	251	59.76
7 and above	70	16.67
Total	**420**	**100**

The findings show that most respondents belonged to households with 5–6 members (59.76%), followed by those with seven or more members (16.67%). This suggests that cattle raising is commonly practiced in moderately sized households, where family members may contribute to livestock management.

Similarly, Galang and Calub (2020) reported an average household size of 3.8 members among cattle-farming households in Southern Luzon. Come et al. (2016) also found that family members, including household heads and children, participated in livestock activities such as cattle feeding.

Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of

Role of Farmer

Table 3f. Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of Role of Farmer

Role of Farmer	Number of Respondents	Percentage (%)
Owner-Raiser	249	59.29
Non-Owner Raiser	171	40.71
Total	**420**	**100**

The findings show that most respondents were cattle owner-raisers (59.29%), while 40.71% were non-owner raisers. This indicates that cattle production involves both individuals who own and manage cattle and those responsible for raising animals owned by others.

This finding is consistent with Miranda-Quibot et al. (2017), who documented ownership and partnership arrangements, including the paiwi system. Similarly, Galang and Calub (2020) described cattle-sharing arrangements in which ownership and management responsibilities were shared among raisers.

Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of

Farm Size

Table 3g. Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of Farm Size (Used for Cattle Production)

Farm Size (Area Used for cattle production	Number of Respondents	Percentage (%)
<1,000 sqm	149	35.48
1,000-3,000 sqm	217	51.67
3,000 - 5,000 sqm	39	9.29
>6,000 sqm	**15**	3.57
Total	**420**	**100**

The findings show that most respondents utilized 1,000–3,000 square meters of land (51.67%), followed by those with less than 1,000 square meters (35.48%). This indicates that cattle production in the study area is generally practiced on limited landholdings.

Similarly, Sevilla et al. (2005) emphasized the influence of land resources, feed availability, and market access on smallholder cattle productivity. Moog (2000) also reported that Philippine smallholder cattle raisers commonly operated on limited land areas, consistent with the present findings.

Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of

Years of Experience in Cattle Raising

Table 3h. Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of Years of Experience in Cattle Raising

Years of Experience in Cattle Raising	Number of Respondents	Percentage (%)
< 1 year	137	32.62
1-5 years	233	55.48
6-10 years	15	3.57
> 10 years	35	8.33

Total	**420**	**100**

The findings show that most respondents had 1–5 years of cattle-raising experience (55.48%), while 32.62% had less than one year. This indicates that many respondents are relatively new to cattle production.

Murcia (2019) emphasized the role of practical experience in developing cattle management knowledge and skills. Similarly, Sevilla et al. (2005) highlighted the importance of farmers' characteristics and management practices in smallholder cattle production.

Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of

Number of Cattle Raised/Owned

Table 3i. Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of Number of Cattle Raised/Owned

Number of Cattle Raised/Owned	Number of Respondents	Percentage (%)
1	64	15.24
2	54	12.86
3	145	34.52
4	91	21.67
5	66	15.71
Total	**420**	**100**

The findings show that most respondents maintained small cattle herds, with 34.52% raising three cattle and 21.67% raising four. This indicates that cattle production in the study area is predominantly small-scale, with households generally managing one to five animals. Similarly, Do et al. (2020) found that most cattle-raising households in Central Vietnam owned one to three cattle. Sevilla et al. (2005) also characterized Philippine cattle production as predominantly smallholder-based, with production influenced by available resources and socioeconomic conditions.

Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of

Average Annual Income from Cattle Farming

Table 3j. Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of Average Annual Income from Cattle Farming

Average Annual Income from Cattle Farming	Number of Respondents	Percentage (%)
<15,000	28	6.67
15,000-50,000	125	29.76
50,000-100,000	165	39.29
100,000-300,000	102	24.29
Total	**420**	**100**

The findings show that most respondents earned ₱50,000–₱100,000 annually from cattle farming (39.29%), followed by those earning ₱15,000–₱50,000 (29.76%). This indicates that cattle raising provides an additional source of household income, although earnings vary among respondents.

Similarly, Lapar et al. (2003) found that herd size, labor, capital, and market conditions influenced income and selling decisions among smallholder livestock producers. Bueno et al. (2023) also identified limited feed resources and marketing challenges among cattle raisers in Batanes, which may affect production returns.

Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of

Primary Source of Income

Table 3k shows the distribution of respondents according to their primary source of income, with livestock farming comprising the largest reported category.

Table 3k. Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of Primary Source of Income

Primary Source of Income	Number of Respondents	Percentage (%)
Crop Farming	91	21.67
Livestock Farming	146	34.76
Business/Trading	111	26.43
Wage Employment	72	17.14
Total	**420**	**100**

The findings show that livestock farming was the primary source of income for most respondents (34.76%), followed by business/trading (26.43%), crop farming (21.67%), and wage employment (17.14%). This highlights the importance of livestock production in supporting household livelihoods.

Similarly, Lapar et al. (2003) and Sevilla et al. (2005) emphasized the contribution of livestock and cattle production to household income among smallholder farmers. Pede et al. (2024) and Come and Zamora (2014) also highlighted livelihood diversification through livestock, crop farming, business, and other economic activities.

Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of

Other Source of Income

Table 3l. Profile of Smallholder Cattle Raisers in Ilocos Norte in Terms of Other Source of Income

Average Annual Income from Cattle Farming	Number of Respondents	Percentage (%)
Business/Trading	26	6.19
Fishing	10	2.38
None	384	91.43
Total	**420**	**100**

The findings show that 91.43% of respondents had no additional source of income, while 6.19% engaged in business or trading and 2.38% in fishing. This indicates that most cattle raisers have limited income diversification and depend primarily on their main livelihood.

Similarly, Bueno et al. (2023) documented variations in livelihood sources among cattle raisers in Batanes, while Anabo (2021) highlighted the presence of multiple income sources among Philippine agricultural households.

Level of Knowledge of Smallholder Cattle Raisers Regarding Cattle Production Practices in Terms of Breeding

Table 4a. Level of Knowledge of Smallholder Cattle Raisers Regarding Cattle Production Practices in Terms of Breeding

Level of Knowledge	Range of Scores	Number of Respondents	Percentage (%)
Very High Knowledge	10-Sep	230	54.76
High Knowledge	8-Jul	55	13.1
Moderate Knowledge	6-May	134	31.9
Low Knowledge	4-Mar	1	0.24
Very Low Knowledge	1-Feb	0	0
Total		**420**	**100**

These findings indicate that most respondents have limited income diversification and rely primarily on their main livelihood. Bueno et al. (2023) documented variations in livelihood sources among cattle raisers in Batanes, while Anabo (2021) highlighted the presence of multiple income sources among Philippine agricultural households. This emphasizes the importance of exploring alternative livelihood opportunities to strengthen the economic stability of smallholder cattle-raising households.

Level of Knowledge of Smallholder Cattle Raisers Regarding Cattle Production Practices in Terms of Feeding

Table 4b. Level of Knowledge of Smallholder Cattle Raisers Regarding Cattle Production Practices in Terms of Feeding

Level of Knowledge	Range of Scores	Number of Respondents	(%)
Very High Knowledge	10-Sep	221	52.62
High Knowledge	8-Jul	55	13.1
Moderate Knowledge	6-May	128	30.48
Low Knowledge	4-Mar	16	3.81
Very Low Knowledge	1-Feb	0	0
Total		**420**	**100**

The findings show that most respondents had very high 52.62% to high 13.10% knowledge of cattle feeding, while 30.48% had moderate knowledge. However, a knowledge gap was identified in understanding the effects of excessive concentrates and insufficient roughage on cattle digestion.

Hayashi et al. (2021) emphasized the importance of feed quality in livestock nutrition, while Adion et al. (2007) highlighted the value of farmer training in improving feed utilization knowledge. Similarly, Valiente et al. (2026) identified knowledge gaps in feeding among buffalo farmers, while Meyer and Bryant (2017) discussed digestive disorders associated with improper feeding management.

Level of Knowledge of Smallholder Cattle Raisers Regarding Cattle Production Practices in Terms of Health Management

Table 4c. Level of Knowledge of Smallholder Cattle Raisers Regarding Cattle Production Practices in Terms of Health Management

Level of Knowledge	Range of Scores	Number of Respondents	Percentage (%)
Very High Knowledge	10-Sep	103	24.52
High Knowledge	8-Jul	142	33.81
Moderate Knowledge	6-May	152	36.19
Low Knowledge	4-Mar	20	4.76

Very Low Knowledge	1-Feb	3	0.71
Total		**420**	**100**

The findings show that most respondents had moderate 36.19% to high 33.81% knowledge of cattle health management, while 24.52% demonstrated very high knowledge. However, a knowledge gap was identified regarding the appropriate use of dewormers, particularly the need to consider cattle condition, parasite risk, and veterinary guidance rather than routine monthly administration.

Lugong et al. (2024) reported varying levels of knowledge regarding fasciolosis among cattle and carabao owners, while Escarlos et al. (2016) identified limited knowledge of Surra and its control among buffalo raisers. Similarly, Valiente et al. (2026) emphasized the importance of continuous training in livestock health management.

Level of Knowledge of Smallholder Cattle Raisers Regarding Cattle Production Practices in Terms of Housing

Table 4d. Level of Knowledge of Smallholder Cattle Raisers Regarding Cattle Production Practices in Terms of Housing

Level of Knowledge	**Range of Scores**	**Number of Respondents**	**Percentage (%)**
Very High Knowledge	10-Sep	85	20.24
High Knowledge	8-Jul	132	31.43
Moderate Knowledge	6-May	129	30.71
Low Knowledge	4-Mar	58	13.81
Very Low Knowledge	1-Feb	16	3.81
Total		**420**	**100**

The findings show that 51.67% of respondents had high to very high knowledge of cattle housing, while 30.71% had moderate and 17.62% had low to very low knowledge. However, a knowledge gap was identified in assessing cattle pen conditions before making improvements, particularly in considering ventilation, flooring, drainage, cleanliness, space, shade, and resting areas.

Park et al. (2020) emphasized that flooring, space, shade, and ventilation influence cattle welfare, health, and productivity. Similarly, Ebinghaus and Knierim (2025) and Weeks (2008) highlighted the importance of adequate ventilation, space, and suitable resting conditions in maintaining cattle comfort and welfare.

Level of Knowledge of Smallholder Cattle Raisers Regarding Production Practices in Terms of Biosecurity

Table 4e. Level of Knowledge of Smallholder Cattle Raisers Regarding Production Practices in Terms of Biosecurity

Level of Knowledge	**Range of Scores**	**Number of Respondents**	**Percentage (%)**
Very High Knowledge	10-Sep	97	23.1
High Knowledge	8-Jul	133	31.67
Moderate Knowledge	6-May	121	28.81
Low Knowledge	4-Mar	57	13.57
Very Low Knowledge	1-Feb	12	2.86
Total		**420**	**100**

The findings show that 54.77% of respondents had high to very high knowledge of cattle biosecurity, while 28.81% had moderate knowledge. However, a knowledge gap was identified regarding disease prevention when cattle from different farms are brought together for breeding, particularly in controlling animal movement and contact.

Windsor et al. (2011) emphasized the importance of controlling livestock movement to prevent disease transmission in the Philippines. Similarly, Reist et al. (2013) identified animal movement between herds as a potential pathway for disease introduction, while Nöremark et al. (2016) highlighted the importance of health assessment, quarantine, and limiting contact with animals of unknown health status.

Level of Knowledge of Smallholder Cattle Raisers Regarding Cattle Production Practices in Terms of Record Keeping

Table 4f. Level of Knowledge of Smallholder Cattle Raisers Regarding Cattle Production Practices in Terms of Record Keeping

Level of Knowledge	Range of Scores	Number of Respondents	Percentage (%)
Very High Knowledge	10-Sep	50	11.9
High Knowledge	8-Jul	153	36.43
Moderate Knowledge	6-May	149	35.48
Low Knowledge	4-Mar	57	13.57
Very Low Knowledge	1-Feb	11	2.62
Total		**420**	**100**

The findings show that 36.43% of respondents had high knowledge of record-keeping, while 35.48% had moderate knowledge. Despite this, record-keeping had the lowest overall knowledge performance among the assessed areas, particularly in using farm records to monitor feed consumption, costs, and cattle growth.

Arugay et al. (2020) emphasized the importance of organized livestock records, while Valiente et al. (2026) reported limited record-keeping knowledge among some buffalo farmers. Mwanga et al. (2020) further highlighted the role of farm records in monitoring performance and supporting management decisions.

Attitude

Favorable attitudes encourage farmers to adopt recommended cattle production practices and improved technologies, supporting productivity and sustainability ((Rogers, 2003).

Level of Attitude of Smallholder Cattle Raisers in Improving Cattle Production Practices in Terms of Breeding

Table 5a. Level of Attitude of Smallholder Cattle Raisers in Improving Cattle Production Practices in Terms of Breeding

Indicators	*Mean*	Descriptive Rating
1. Daily care and proper management of cattle are essential for their growth and reproductive success.	4.65	Strongly Agree
2. Stress, poor health, and inadequate feeding can negatively affect cattle reproductive performance.	4.61	Strongly Agree
3. Observing estrus and breeding cows at the correct time is crucial for successful conception	4.18	Agree

4. Using selected bulls or artificial insemination improves the genetic quality of the herd.	4.55	Strongly Agree
5. Controlled breeding practices are more effective than uncontrolled mating for improving herd reproduction and performance.	4.43	Strongly Agree
Overall Mean	**4.48**	**Strongly Agree**

The respondents demonstrated a favorable attitude toward improved breeding practices (M = 4.48), particularly regarding proper daily care (M = 4.65) and the effects of stress, health, and feeding on reproduction (M = 4.61). Timely estrus detection and breeding received the lowest, but still favorable, rating (M = 4.18).

These findings indicate general receptiveness to improved breeding interventions. Martin-Collado et al. (2021) highlighted the role of farmers' attitudes in adopting breeding technologies, while Pacana and Kleine Koerkamp (2025) and Abella et al. (2017) documented favorable perceptions and participation in artificial insemination among Filipino cattle farmers.

Level of Attitude of Smallholder Cattle Raisers in Improving Production Practices in Terms of Breeding

Table 5b. Level of Attitude of Smallholder Cattle Raisers in Improving Production Practices in Terms of Breeding

Indicators	***Mean***	**Descriptive Rating**
1. Feed quality, proper composition, and consistent feeding frequency are essential for optimal cattle growth and reproduction.	4.38	Strongly Agree
2. Providing high-energy concentrates without adequate roughage can harm cattle health.	4.28	Strongly Agree
3. Minerals are critical for cattle growth, reproduction, and overall metabolic functions.	4.1	Agree
4.Access to clean water improves feed intake, reduces stress, and supports growth and reproduction.	4.51	Strongly Agree
5. Balanced feeding strategies (roughage + concentrates + mineral supplementation) are more effective than feeding concentrates alone.	4.67	Strongly Agree
Overall Mean	**4.39**	**Strongly Agree**

The respondents demonstrated a favorable attitude toward improved cattle feeding practices (M = 4.39), particularly regarding balanced feeding, clean water, feed quality, and adequate roughage. Mineral supplementation received the lowest, but still favorable, rating (M = 4.10).

These findings indicate that respondents recognize the importance of proper feeding in maintaining cattle health and productivity. Adion et al. (2007) highlighted the acceptability and benefits of improved feeding systems, while Loresco et al. (2022) documented the use of locally available feed resources among Philippine dairy farms. Similarly, Sakti et al. (2022) emphasized the importance of feed composition, balance, and feeding frequency.

Level of Attitude of Smallholder Cattle Raisers in Improving Production Practices in Terms of Health Management

Table 5c. Level of Attitude of Smallholder Cattle Raisers in Improving Production Practices in Terms of Health Management

Indicators	***Mean***	**Descriptive Rating**
1. Keeping cattle healthy is essential to increase productivity and prevent diseases.	4.39	Strongly Agree
2. Isolating sick animals and maintaining hygiene are important practices to prevent disease spread in the herd.	4.19	Strongly Agree
3. Antibiotics be used only to treat bacterial infections, not as a substitute for proper care and nutrition.	4.28	Strongly Agree
4. Vaccination and regular deworming are necessary to protect cattle from diseases and improve productivity.	4.27	Strongly Agree
5. Proper nutrition, clean water, routine health care, and low-stress handling are critical for maintaining cattle welfare and productivity.	4.5	Strongly Agree
Overall Mean	**4.33**	Strongly Agree

The respondents demonstrated a favorable attitude toward improved cattle health management (M = 4.33), particularly regarding proper nutrition, clean water, routine care, and low-stress handling. They also recognized the importance of hygiene, vaccination, deworming, and appropriate antibiotic use.

These findings indicate general acceptance of recommended health-management practices. Valiente et al. (2026) reported positive attitudes among buffalo farmers in Nueva Ecija despite identified knowledge gaps, while Vega (2019) highlighted disease control as an important aspect of cattle management. Martin-Collado et al. (2021) further emphasized the role of farmers' attitudes in adopting improved livestock management practices.

Level of Attitude of Smallholder Cattle Raisers in Improving Production Practices in Terms of Housing

Table 5d. Level of Attitude of Smallholder Cattle Raisers in Improving Production Practices in Terms of Housing

Indicators	***Mean***	**Descriptive Rating**
1. Proper housing protects cattle from the weather, reduces stress, and prevents injuries.	4.67	Strongly Agree
2. Smooth, non-slip flooring with bedding is important to prevent cattle injuries.	3.82	Agree
3. Providing enough space in cattle shelters allows animals to move, rest comfortably, and reduces stress.	4.35	Strongly Agree
4. Proper ventilation in cattle housing reduces humidity, stress, and respiratory problems.	4.15	Strongly Agree
5. Routine cleaning and maintenance of cattle housing reduces disease risk and maintains hygiene.	4.14	Strongly Agree
Overall Mean	**4.23**	Strongly Agree

The respondents demonstrated a favorable attitude toward improved cattle housing practices (M = 4.23), particularly regarding protection from weather, stress, and injuries. Flooring and bedding received the lowest rating (M = 3.82), indicating an area for improvement.

These findings suggest that respondents recognize the importance of suitable housing for cattle comfort and welfare. Atole (2026) highlighted the relevance of farm resources to cattle welfare, while Gebert and Kuhne (2026) and Kiboi et al. (2021) emphasized the role of farmers' attitudes and characteristics in housing conditions and adoption decisions.

Level of Attitude of Smallholder Cattle Raisers in Improving Production Practices in Terms of Biosecurity

Table 5e. Level of Attitude of Smallholder Cattle Raisers in Improving Production Practices in Terms of Biosecurity

Indicators	***Mean***	**Descriptive Rating**
1. Biosecurity is important to prevent the introduction and spread of diseases on a smallholder cattle farm.	4.13	Agree
2. Isolating new cattle before introducing them to the herd reduces the risk of disease.	4.07	Agree
3. Visitors follow strict hygiene rules to prevent disease transmission	4.18	Agree
4. Regular cleaning and disinfection of farm equipment is essential to maintain herd health.	4.12	Agree
5.Controlling animal movement, managing sick cattle, and proper waste handling are key components of effective biosecurity.	4.11	Agree
Overall Mean	**4.12**	Agree

The respondents demonstrated a favorable attitude toward biosecurity practices (M = 4.12), particularly regarding visitor hygiene and disease prevention. However, quarantine of newly acquired cattle received the lowest rating (M = 4.07), indicating an area requiring greater attention.

These findings are supported by Renault et al. (2021), who emphasized the influence of farmers' perceptions on biosecurity implementation. Similarly, Mateo et al. (2021) reported generally favorable biosecurity attitudes among Filipino farmers, although differences existed between attitudes and actual practices. The Department of Agriculture–Philippine Council for Agriculture and Fisheries (2025) also emphasized disease prevention, farm sanitation, and herd health monitoring.

Level of Attitude of Smallholder Cattle Raisers in Improving Production Practices in Terms of Record Keeping

Table 5f. Level of Attitude of Smallholder Cattle Raisers in Improving Production Practices in Terms of Record Keeping

Indicators	***Mean***	**Descriptive Rating**
1. Recording breeding dates is essential to improve reproductive efficiency and manage calving intervals	3.87	Agree
2. Maintaining vaccination and deworming records helps ensure herd health and prevent disease outbreaks.	3.72	Agree
3. Proper record-keeping supports farm planning, including feed, labor, and expense management.	3.77	Agree
4. Monitoring past performance, including growth and reproduction, is important for improving herd productivity.	3.84	Agree
5. Keeping detailed records of breeding, health, and performance enables better decision-making for smallholder cattle farms.	3.82	Agree
Overall Mean	**3.8**	Agree

The respondents demonstrated a favorable attitude toward record-keeping (M = 3.80), particularly regarding breeding dates and herd performance. However, vaccination and deworming records received the lowest rating (M = 3.72), indicating a need to strengthen health-related documentation.

Valiente et al. (2026) reported positive attitudes toward buffalo farming despite knowledge gaps in record-keeping. Similarly, Palacpac et al. (2024) emphasized the importance of training in translating knowledge into practice, while Vega (2019) found that record-keeping practices among cattle raisers were only sometimes implemented.

Practices

The implementation of recommended cattle production practices is essential for improving herd productivity, animal health, and farm profitability. These practices reflect how farmers apply appropriate management strategies under actual farm conditions. Mapiye et al. (2018) emphasized that adopting improved management practices is fundamental to strengthening the productivity and sustainability of smallholder cattle production systems.

Common Cattle Production Practices of Smallholder Raisers Perform Along the Parameters of Breeding

Table 6a. Common Cattle Production Practices of Smallholder Raisers Perform Along the Parameters of Breeding

Indicators	***Mean***	**Descriptive Rating**
I provide daily care and monitor the health of my cattle to support their growth and reproduction.	2.79	Sometimes
I ensure my cattle have proper nutrition, reduce stress, and maintain their health to improve reproductive performance.	2.97	Sometimes
I regularly observe cows for signs of estrus and breed them at the correct time.	2.85	Sometimes
I use selected bulls or artificial insemination to improve the genetic quality of my herd	2.77	Sometimes
I follow controlled breeding practices instead of letting cattle mate freely to improve herd performance.	2.65	Sometimes
Overall Mean	**2.81**	Sometimes

The findings show that breeding practices were sometimes implemented (M = 2.81), with greater consistency in maintaining proper nutrition, health, and stress reduction. However, controlled mating was less consistently practiced (M = 2.65).

Pacana and Kleine Koerkamp (2025) reported high awareness of artificial insemination among cattle farmers in Negros Oriental, although technical and institutional challenges affected its implementation. Similarly, Bitara, Atabay, and Babera (2025) emphasized the importance of reproductive protocols and technical skills in successfully implementing artificial insemination. These findings suggest that awareness does not always translate into consistent adoption of improved breeding practices.

Common Cattle Production Practices of Smallholder Raisers Perform Along the Parameters of Feeding

Table 6b. Common Cattle Production Practices of Smallholder Raisers Perform Along the Parameters of Feeding

Indicators	***Mean***	**Descriptive Rating**
I provide my cattle with feed of good quality, proper composition, and consistent feeding frequency.	2.82	Sometimes
I ensure that cattle fed high-energy concentrates also receive sufficient roughage to prevent digestive problems.	2.71	Sometimes
I provide mineral supplements or mineral blocks to support growth, reproduction, and immunity.	2.78	Sometimes

I give my cattle constant access to clean and safe drinking water.	2.8	Sometimes
I give my cattle constant access to clean and safe drinking water.	2.8	Sometimes
I follow a balanced feeding program that combines roughage, concentrates, and mineral supplementation for optimal production.	2.84	Sometimes
Overall Mean	**2.79**	Sometimes

The findings show that feeding practices were sometimes implemented (M = 2.79), particularly in providing balanced diets and quality feed. However, ensuring adequate roughage when using high-energy concentrates was less consistently practiced (M = 2.71).

Vega (2019) reported inconsistent implementation of recommended feeding practices among cattle raisers in Southern Zambales. Loresco et al. (2022) documented the use of locally available feed resources in Philippine dairy farms, while Adion et al. (2007) and Sakti et al. (2022) emphasized the importance of farmer training and feeding knowledge in improving feed utilization and management. These findings highlight the need to strengthen the application of proper feeding practices through practical guidance.

Common Cattle Production Practices of Smallholder Raisers Perform Along the Parameters of Health Management

Table 6c. Common Cattle Production Practices of Smallholder Cattle Raisers Perform Along the Parameters of Health Management

Indicators	***Mean***	**Descriptive Rating**
I provide routine care to keep my cattle healthy and prevent diseases.	2.78	Sometimes
I isolate sick animals and maintain hygiene to prevent the spread of disease.	2.87	Sometimes
I use antibiotics only when necessary and follow veterinary guidance for treatment.	2.86	Sometimes
I vaccinate and regularly deworm my cattle according to recommended schedules.	2.88	Sometimes
I provide proper nutrition, clean water, routine health care, and handle cattle with minimal stress.	2.61	Sometimes
Overall Mean	**2.8**	Sometimes

The findings show that health management practices were sometimes implemented (M = 2.80), particularly vaccination, deworming, and disease prevention. However, proper nutrition, clean water, routine care, and low-stress handling were less consistently practiced (M = 2.61).

Vergara and Paglomutan (2020) and Palacpac et al. (2015) documented the adoption of vaccination and deworming among livestock raisers. However, Escarlos et al. (2016) identified gaps in health-related practices, while Dargantes (2010) highlighted the importance of veterinary consultation, limiting animal contact, and proper disposal of dead animals. These findings suggest that the implementation of health management practices varies across different aspects of animal care.

Common Cattle Production Practices of Smallholder Raisers Perform Along the Parameters of Housing

Table 6d. Common Cattle Production Practices of Smallholder Raisers Perform Along the Parameters of Housing

Indicators	*Mean*	Descriptive Rating
I provide shelters that protect cattle from extreme weather and minimize stress.	2.67	Sometimes
I maintain smooth, non-slip flooring and use bedding to prevent injuries.	2.15	Seldom
I ensure adequate space in shelters to allow cattle to move and rest comfortably.	1.91	Seldom
I provide proper ventilation in housing to reduce humidity and prevent respiratory problems.	1.8	Seldom
I clean and maintain cattle housing regularly to reduce disease risk and maintain hygiene.	1.87	Seldom
Overall Mean	**2.08**	Seldom

The results show that housing practices were seldom practiced overall (M = 2.08), with greater emphasis on providing basic shelter from extreme weather (M = 2.67). However, ventilation, regular cleaning, and adequate space were less consistently practiced, indicating areas that need improvement in cattle housing management.

The findings are supported by Marcelino (2025), which documented the use of makeshift cattle shelters among smallholder raisers in La Union, providing limited protection against adverse weather conditions. Similarly, the DENR (2017) reported that housing facilities were seldom provided among native cattle raisers, with simple sheds constructed mainly for protection during unfavorable weather. These findings suggest that limited housing facilities remain a concern in smallholder cattle production, consistent with the respondents' seldom implementation of adequate space, flooring, ventilation, and regular housing maintenance.

The findings imply the need to strengthen housing management practices among smallholder cattle raisers through practical training and technical assistance. Emphasis should be placed on providing adequate space, proper flooring, ventilation, and regular sanitation to promote cattle welfare, prevent health problems, and improve production efficiency.

Common Cattle Production Practices of Smallholder Raisers Perform

Along the Parameters of Biosecurity

Table 6e. Common Cattle Production Practices of Smallholder Raisers Perform Along the Parameters of Biosecurity

Indicators	*Mean*	Descriptive Rating
I implement measures to prevent disease introduction and spread, such as controlling access to the farm.	2.04	Seldom
I isolate new cattle for a few weeks before mixing them with the herd.	1.95	Seldom
I ensure that all visitors follow proper hygiene rules.	1.98	Seldom
I regularly clean and disinfect feeding and handling equipment.	1.97	Seldom
I manage sick animals properly, maintain clean and dry housing, and handle manure and waste to reduce disease risks.	2.01	Seldom
Overall Mean	**1.99**	Seldom

The findings show that biosecurity practices were seldom implemented (M = 1.99), with greater consistency in farm access control and sick-animal management. Quarantine of newly acquired cattle was the least practiced measure (M = 1.95), indicating a gap in preventing disease introduction.

Escarlos et al. (2016) reported gaps in disease-control practices among buffalo raisers in Southern Philippines. Similarly, Olaogun et al. (2023) observed variations in preventive health practices among smallholder cattle farmers, while Dargantes (2010) highlighted measures such as limiting animal contact to reduce disease transmission. These findings emphasize the need for more consistent implementation of biosecurity measures.

Common Cattle Production Practices of Smallholder Raisers Perform Along the Parameters of Record Keeping

Table 6f. Common Cattle Production Practices of Smallholder Raisers Perform Along the Parameters of Record Keeping

Indicators	***Mean***	**Descriptive Rating**
I record breeding dates to track estrus and plan mating.	1.44	Never
I maintain vaccination and deworming records for all cattle in my herd.	1.82	Seldom
I keep records of feed, labor, and expenses to improve farm planning.	1.46	Never
I monitor past performance, including growth and reproductive performance.	1.42	Never
I use records of breeding, health, and performance to make informed management decisions.	1.43	Never
Overall Mean	**1.51**	Never

The findings show that record-keeping practices were never implemented (M = 1.51), with vaccination and deworming records maintained more consistently. Monitoring cattle growth and reproductive performance was the least practiced activity (M = 1.42).

Miranda-Quibot et al. (2017) found that backyard cattle farmers commonly relied on informal records rather than systematic documentation. Similarly, Valiente et al. (2026) identified gaps in record-keeping knowledge among buffalo farmers, while Arugay et al. (2020) demonstrated the value of organized records in monitoring breeding, feeding, health, production, and financial activities. These findings highlight the need to strengthen systematic documentation among smallholder cattle raisers.

Relationship Between the Profile Characteristics and Level of Knowledge

Table 7a. Relationship Between the Profile Characteristics and Level of Knowledge

Demographic Profile												
Knowledge												
	Breeding		Feeding		Health Management		Housing		Biosecurity		Record Keeping	
	Computed r	P value	Computed r	P value	Computed r	P value	Computed r	P value	Computed r	P value	Computed r	P value
Age	0.06	0.217	-0.041	0.404	-0.018	0.707	-0.02	0.677	0.024	0.621	-0.036	0.456
Sex	0.042	0.387	-0.042	0.389	-0.031	0.527	0.015	0.755	0.063	0.199	0.025	0.615
Civil Status	-0.038	0.434	0.052	0.291	0.057	0.241	0.092	0.058	-0.019	0.699	0.026	0.589
Highest Education Attainment	-0.013	0.79	0.067	0.173	0.077	0.113	0.056	0.252	0.033	0.497	0.063	0.194
Household Size	0.04	0.41	-0.038	0.432	0.044	0.366	-0.018	0.718	0.002	0.961	0.086	0.078
Role of Farmer	-0.01	0.839	-.117*	0.016	0.006	0.909	0.031	0.525	-0.093	0.056	0.061	0.215
Farm Size	0.089	0.07	-0.039	0.428	-0.026	0.597	-0.016	0.745	0.055	0.262	-0.023	0.634
Years of Experience	0.013	0.796	0.009	0.857	-0.002	0.97	-0.023	0.64	0.038	0.436	-0.053	0.278
Number of Cattle Raise	-0.028	0.569	0.024	0.621	0.014	0.772	-0.036	0.461	0.021	0.666	0.066	0.179
Average Annual Income	-0.038	0.44	0.028	0.567	0.014	0.775	0.05	0.302	0	0.997	0.065	0.182
Primary Source of Income												
Crop Framing	-0.022	0.649	-0.044	0.371	-0.062	0.205	0.034	0.485	0.008	0.868	0.004	0.933

Livestock Farming	0.044	0.366	-0.01	0.842	0.078	0.111	-.129**	0.008	-0.043	0.381	0.029	0.557
Business Trade stock	-0.026	0.595	0.05	0.306	-.125*	0.011	-0.047	0.341	0.023	0.646	-0.015	0.752
Wage Employment	0.008	0.872	-0.002	0.971	.122*	0.012	.162**	0.001	0.008	0.87	-0.024	0.628
Other Source of Income												
Other Business	-0.054	0.273	-0.076	0.119	-0.005	0.926	0.033	0.499	0.017	0.729	-0.025	0.605
Other Fishing	0.038	0.434	0.074	0.13	0.017	0.731	0.066	0.179	-0.052	0.288	-0.033	0.498
None	0.033	0.5	0.04	0.409	0.004	0.938	-0.074	0.13	0.068	0.163	0.026	0.599

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The findings indicate that most demographic and socioeconomic characteristics were not significantly associated with respondents' knowledge across the six cattle production areas. However, significant but weak relationships were found between farmer role and feeding knowledge ($r = -0.117$, $p = .016$), as well as primary source of income and knowledge in housing and health management. These results suggest that selected respondent characteristics may be associated with knowledge in specific management areas, although the relationships were limited.

Valiente et al. (2026) found that selected farmer and production characteristics, particularly herd size and distance from the Philippine Carabao Center, were associated with knowledge among buffalo farmers. Similarly, Pacana and Kleine Koerkamp (2025) identified experience, education, and cultural perceptions as factors associated with awareness of artificial insemination. Perez et al. (2003) also reported associations between education, awareness, and adoption of recommended dairy production practices. These findings suggest that demographic and socioeconomic characteristics may have varying relationships with farmers' knowledge and production-related outcomes.

The findings indicate that demographic characteristics should not be the sole basis for identifying farmers who need interventions. Extension programs should remain accessible to all respondents while providing targeted training in feeding, housing, and health management. Practical demonstrations, accessible information materials, and technical assistance may help address identified knowledge gaps.

Relationship Between the Profile Characteristics and the Level of

Attitude

Table 7b. Relationship Between the Profile Characteristics and the Level of Attitude

Demographic Profile												
Attitude												
	Breeding		Feeding		Health Management		Housing		Biosecurity		Record Keeping	
	Computed r	P value	Computed r	P value	Computed r	P value	Computed r	P value	Computed r	P value	Computed r	P value
Age	-0.037	0.452	0.006	0.904	0.007	0.885	0.016	0.746	0.059	0.228	0.026	0.6

Sex	0.053	0.28	0.082	0.094	0.058	0.234	0.086	0.078	0.03	0.534	-0.004	0.94
Civil Status	0.03	0.536	-0.01	0.836	0.067	0.169	-0.026	0.599	0.01	0.833	0.021	0.668
Highest Education Attainment	0.019	0.7	0.015	0.764	-0.012	0.8	-0.019	0.702	-0.096	0.05	-0.015	0.766
Household Size	-0.019	0.695	0.05	0.304	.113*	0.021	0.032	0.512	0.056	0.255	0.051	0.299
Role of Farmer	0.005	0.913	0.055	0.259	0.048	0.322	0.091	0.062	-0.008	0.865	-0.076	0.122
Farm Size	0.032	0.515	-0.06	0.218	-0.078	0.111	0.015	0.756	-0.041	0.403	-0.001	0.98
Years of Experience	0.021	0.664	0.073	0.134	0.033	0.501	0.05	0.307	-0.083	0.088	-0.044	0.372
Number of Cattle Raise	0.027	0.579	0.061	0.216	0.078	0.112	-.122*	0.013	.096*	0.05	-0.029	0.552
Average Annual Income	0.063	0.198	0.081	0.097	0.066	0.179	-0.043	0.381	.162**	0.001	0.04	0.411
Primary Source of Income												
Crop Framing	0.013	0.794	0.042	0.393	-0.038	0.438	-0.059	0.227	-0.057	0.244	-0.027	0.587
Livestock Farming	-0.022	0.652	-0.054	0.267	0.026	0.598	0.024	0.628	0.075	0.126	-0.007	0.885
Business Trade stock	-0.023	0.645	-0.027	0.583	-0.025	0.605	0.021	0.674	0.062	0.203	0.054	0.267
Wage Employment	0.041	0.399	0.051	0.297	0.043	0.383	0.091	0.062	-0.093	0.056	-0.022	0.656
Other Source of Income												
Other Business	0.03	0.542	0.063	0.197	0.029	0.557	0.051	0.294	-0.011	0.817	0.042	0.392

Other Fishing	-0.008	0.878	0.015	0.765	0.009	0.856	-0.052	0.291	0.026	0.597	0.079	0.104
None	0.042	0.396	0.008	0.876	0.027	0.583	-0.059	0.227	0.083	0.089	-0.044	0.37

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The findings indicate that most demographic characteristics were not significantly associated with respondents' attitudes toward cattle production practices. However, weak but significant relationships were found between household size and health-management attitudes ($r = 0.113$, $p = .021$), number of cattle raised and housing attitudes ($r = -0.122$, $p = .015$), number of cattle raised and biosecurity attitudes ($r = 0.096$, $p = .050$), and average annual income and biosecurity attitudes ($r = 0.162$, $p = .001$). These results suggest that the identified characteristics were associated with only slight differences in respondents' attitudes.

The findings suggest that larger household size was associated with slightly more favorable health-management attitudes, while a higher number of cattle was associated with slightly less favorable housing attitudes. Herd size and annual income also showed weak positive relationships with biosecurity attitudes. Valiente et al. (2026) identified herd size as a factor associated with knowledge among buffalo farmers, while Pacana and Kleine Koerkamp (2025) reported variations in farmers' awareness of artificial insemination according to selected characteristics. Sevilla et al. (2005) and Bueno et al. (2023) also highlighted the influence of socioeconomic and farm conditions on smallholder cattle production. Similarly, Reproto et al. (2024) found that selected socioeconomic and farm characteristics were associated with farmers' intentions to adopt feeding innovations. These studies suggest that farmer and production characteristics may relate differently to specific livestock-management attitudes and decisions.

The findings indicate that extension programs should be accessible to all farmers while addressing specific management concerns. Health-management interventions may consider household responsibilities, housing guidance may account for herd size, and biosecurity education should emphasize practical and affordable measures across different income levels. Since the observed relationships were weak, other factors, such as training exposure, technical assistance, available resources, and farming experience, should also be considered when addressing differences in farmers' attitudes.

Relationship Between the Profile Characteristics and the Level of

Practices

Table 7c. Relationship Between the Profile Characteristics and Level of Practices

Demographic Profile	Practices											
	Breeding		Feeding		Health Management		Housing		Biosecurity		Record Keeping	
	Computed r	P value	Computed r	P value	Computed r	P value	Computed r	P value	Computed r	P value	Computed r	P value
Age	0.021	0.66	-0.001	0.97	0.027	0.58	-0.073	0.13	-0.017	0.73	-0.056	0.25

		9		6		4		3		1		3
Sex	-0.075	0.127	-0.046	0.344	0.028	0.561	-0.095	0.051	-0.062	0.202	-0.053	0.277
Civil Status	-0.092	0.061	-0.006	0.91	-.099*	0.043	0.02	0.684	-0.063	0.198	0.018	0.712
Highest Education Attainment	0.088	0.072	0	0.993	0	0.994	0.037	0.446	0.015	0.752	0.04	0.409
Household Size	-0.032	0.515	-0.051	0.298	-0.063	0.198	0.056	0.254	0.059	0.228	0.075	0.125
Role of Farmer	0.002	0.973	-0.07	0.152	0.042	0.396	-0.028	0.567	0.038	0.442	0.087	0.074
Farm Size	0.049	0.317	-0.029	0.551	-0.049	0.313	0.012	0.8	-0.007	0.886	-0.056	0.249
Years of Experience	-.126**	0.01	.141**	0.004	0.043	0.383	-0.019	0.698	-0.073	0.135	0.048	0.325
Number of Cattle Raise	-.106*	0.029	0.087	0.075	-0.041	0.408	-0.021	0.672	-0.095	0.051	0.078	0.111
Average Annual Income	-0.079	0.107	0.042	0.387	-0.048	0.325	-0.044	0.366	-0.048	0.329	0.03	0.54
Primary Source of Income												
Crop Framing	.124*	0.011	.153**	0.002	-0.019	0.695	-0.084	0.085	-0.089	0.068	-0.027	0.586
Livestock Farming	-0.089	0.069	-0.083	0.091	-0.093	0.056	-0.013	0.789	-0.019	0.704	-0.009	0.854
Business Trade stock	-0.06	0.217	0.008	0.876	0.039	0.42	0.057	0.243	0.075	0.127	0.029	0.557
Wage Employment	0.062	0.217	-0.066	0.178	0.069	0.157	0.023	0.636	0.01	0.835	-0.003	0.952
Other Source of Income												
Other Business	0.001	0.985	-0.015	0.756	0.06	0.22	-0.046	0.342	0.024	0.627	0.033	0.502

Other Fishing	0.025	0.606	0.024	0.627	0.047	0.334	0.069	0.16	0.058	0.237	.157**	0.001
None	-0.059	0.224	-0.028	0.566	-.125*	0.01	-0.032	0.513	-0.083	0.089	-.115*	0.019

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed)

The findings indicate that most demographic characteristics were not significantly associated with respondents' cattle production practices. However, weak but significant relationships were found between years of experience and breeding (r = 0.120, p = .010) and feeding practices (r = 0.141, p = .004). Number of cattle raised was also associated with breeding practices (r = 0.108, p = .029). Additionally, having fishing as another source of income was negatively associated with record-keeping practices (r = −0.157, p = .001), while having no additional source of income was significantly associated with health management (r = −0.125, p = .010) and record-keeping practices (r = −0.115, p = .019). These relationships were weak, indicating limited associations between respondent characteristics and actual practices.

The findings suggest that greater farming experience may be associated with more frequent application of breeding and feeding practices, while herd size may relate to differences in breeding management. Vega (2019) documented variations in breeding, feeding, and record-keeping practices among cattle raisers in Southern Zambales. Similarly, Syaiful et al. (2026) highlighted the relevance of farming experience to reproductive performance, while Lelo et al. (2023) documented breeding and feeding practices among smallholder cattle farmers. Saengwong et al. (2021) also reported limited systematic record-keeping among smallholder beef cattle farmers, while Arugay et al. (2020) demonstrated the value of organized records in monitoring cattle production activities.

The findings suggest that extension programs should be accessible to all farmers, with additional attention to those with less cattle-raising experience and competing livelihood responsibilities. Training should emphasize systematic breeding and feeding practices and simple record-keeping methods that can be integrated into farmers' routines. Since the observed relationships were weak, other factors, including extension access, training exposure, available resources, and technical assistance, should also be considered when addressing differences in cattle production practices.

Relationship Between the Level of Knowledge and Practices of Smallholder Cattle Raisers

Table 8. Relationship Between the Level of Knowledge and Practices of Smallholder Cattle Raisers

Knowledge	Practices											
	Breeding		Feeding		Health Management		Housing		Biosecurity		Record Keeping	
	Computed r	P Value	Computed r	P Value	Computed r	P Value	Computed r	P Value	Computed r	P Value	Computed r	P Value
Breeding	0.028	0.571	0.23	0.638	-0.05	0.307	-0.011	0.822	-0.033	0.506	-0.086	0.08
Feeding	0.064	0.193	0.009	0.851	-0.037	0.452	-0.025	0.613	0.047	0.34	-0.05	0.303
Health Management	-0.082	0.094	-0.024	0.63	0.032	0.514	-0.006	0.905	-0.079	0.106	0.055	0.257
Housing	0.039	0.431	-0.018	0.718	0.034	0.486	-0.072	0.141	-0.06	0.217	-0.018	0.719
Biosecurity	0.051	0.301	0.013	0.795	0.032	0.517	-0.067	0.174	-0.031	0.533	-0.025	0.612
Record Keeping	-0.003	0.95	0.014	0.768	0.01	0.837	-0.066	0.177	-0.024	0.626	-0.021	0.664

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed)

The findings show no statistically significant relationships between knowledge and practices across the six production areas ($p > .05$), with very weak correlations ranging from $r = -0.082$ to $r = 0.064$. This indicates that respondents' knowledge levels did not directly correspond to their actual implementation of breeding, feeding, health management, housing, biosecurity, and record-keeping practices.

Escarlos et al. (2016) reported gaps between farmers' knowledge and actual livestock-management practices. Similarly, Palacpac et al. (2024) and Valiente et al. (2026) highlighted variations in farmers' knowledge, skills, attitudes, and practices, suggesting that these dimensions do not necessarily develop uniformly.

These findings emphasize the need for practical training, demonstrations, and continuous technical assistance to help farmers translate knowledge into consistent cattle-management practices.

Relationship Between the Level of Attitude and Practices of Smallholder Cattle Raisers

Table 9. Relationship Between the Level of Attitude and Practices of Smallholder Cattle Raisers

Attitude	Practices											
	Breeding		Feeding		Health Management		Housing		Biosecurity		Record Keeping	
Attitude	Computed r	P Value	Computed r	P Value	Computed r	P Value	Computed r	P Value	Computed r	P Value	Computed r	P Value
Breeding	.111*	0.022	-0.024	0.626	0.037	0.452	-0.014	0.777	-0.005	0.926	-0.091	0.062
Feeding	.103*	0.036	0.009	0.86	0.054	0.271	0.042	0.394	0.005	0.911	0.087	0.074
Health Management	0.007	0.892	.112*	0.022	-.105*	0.032	.174**	0	0.054	0.272	.222**	0
Housing	.116*	0.018	-0.033	0.505	0.005	0.915	-.126**	0.01	-0.009	0.853	-0.063	0.199
Biosecurity	.116*	0.017	-.240**	0	-.158**	0.001	0.062	0.206	0.037	0.206	0.012	0.206
Record Keeping	-0.029	0.559	0.038	0.433	-0.084	0.086	-0.063	0.199	-0.075	0.123	-0.011	0.824

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tail)

The findings revealed significant positive relationships between selected attitudes and practices, although the associations were generally weak. Breeding attitude was associated with breeding practice ($r = .111$, $p = .022$), while feeding attitude was related to breeding practice ($r = .103$, $p = .036$). Health-management, housing, and biosecurity attitudes were also significantly associated with selected practices. The strongest relationship was between health-management attitude and record-keeping practice ($r = .222$, $p < .001$). These results suggest that favorable attitudes may support more frequent implementation of recommended practices, although attitude alone does not determine actual behavior.

Lugong et al. (2024) emphasized the importance of examining farmers' knowledge, attitudes, and practices in livestock disease prevention. Similarly, Palacpac et al. (2024), Valiente et al. (2026), and Perez et al. (2003) highlighted differences between farmers' attitudes, knowledge, and actual adoption of recommended practices.

BREEDING

Multiple Linear Regression Analysis Predicting Knowledge in Breeding from Attitude and Practices in Breeding

Table 10a. Multiple Regression Analysis Predicting Knowledge in Breeding

Predictor	B	SE	β	t	p	Interpretation
Knowledge	6.846	0.885	—	7.734	< .001	Significant
Attitude in Breeding	0.275	0.192	0.07	1.429	0.154	Not Significant
Practices in Breeding	0.042	0.105	0.02	0.405	0.685	Not Significant

Dependent Variable: Knowledge in Breeding

Model Summary: R = .075; R^2 = .006; Adjusted R^2 = .001; F(2,417) = 1.259; p = 0.285.

Attitude (β = .070, p = .154) and practices (β = .020, p = .685) did not significantly predict breeding knowledge. The model was not significant and explained only 0.6% of the variance. This suggests that knowledge may depend more on targeted training, information, and technical assistance than on existing attitudes or practices. Llanto (2020) similarly identified inadequate knowledge, limited supplies, mobility issues, and access to artificial insemination services as constraints.

Multiple Linear Regression Analysis Predicting Attitudes in Breeding from Knowledge and Practices

Table 10b. Multiple Regression Analysis Predicting Attitude in Breeding

Predictor	B	SE	β	t	p	Interpretation
Attitude	4.173	0.127	—	32.92	< .001	Significant
Knowledge in Breeding	0.018	0.012	0.069	1.429	0.154	Not Significant
Practices in Breeding	0.06	0.026	0.109	2.254	0.025	Significant

Dependent Variable: Attitude in Breeding

Model Summary: R = .131; R^2 = .017; Adjusted R^2 = .013; F(2,417) = 3.654; p = .027.

Knowledge did not significantly predict breeding attitude (β = .069, p = .154), whereas practices had a significant but weak positive contribution (β = .109, p = .025). The model explained 1.7% of the variance. This suggests that farmers' experiences and participation may shape their attitudes more than knowledge alone, consistent with findings on farmers' attitudes toward breeding tools and technologies (Zoma-Traoré et al., 2021).

Multiple Linear Regression Analysis Predicting Practices in Breeding from Knowledge and Attitude in Breeding

Table 10c. Multiple Regression Analysis Predicting Practices in Breeding

Predictor	B	SE	β	t	p	Interpretation
Practices	1.821	0.434	—	4.198	< .001	Significant
Knowledge in Breeding	0.009	0.023	0.02	0.405	0.685	Not Significant
Attitude in Breeding	0.202	0.09	0.11	2.254	0.025	Significant

Dependent Variable: Practices in Breeding

Model Summary: R = .113; R^2 = .013; Adjusted R^2 = .008; F(2, 417) = 2.704; p = .068.

Knowledge did not significantly predict breeding practices (β = .020, p = .685), while attitude showed a significant but weak positive association (β = .110, p = .025). However, the overall model was not significant (p = .068) and explained only 1.3% of the variance. Practical training, demonstrations, accessible breeding services, and technical assistance may therefore be needed to support implementation (Martin-Collado et al., 2021).

FEEDING

Multiple Linear Regression Analysis Predicting Knowledge in Feeding from Attitude and Practices in Feeding

Table 11a. Multiple Regression Analysis Predicting Knowledge in Feeding

Predictor	B	SE	β	t	p	Interpretation
Knowledge	7.17	0.852	—	8.419	< .001	Significant
Attitude in Feeding	0.182	0.187	0.048	0.974	0.331	Not Significant
Practices in Feeding	0.013	0.074	0.009	0.18	0.857	Not Significant

Dependent Variable: Knowledge in Feeding

Model Summary: R = .049; R^2 = .002; Adjusted R^2 = –.002; F (2,417) = 0.492; p = .612.

Neither attitude (β = .048, p = .331) nor practices (β = .009, p = .857) significantly predicted feeding knowledge. The model was not significant and explained only 0.2% of the variance. Previous studies likewise reported gaps between farmers' feeding knowledge and practices, while structured training improved selected knowledge and practices (Vega, 2019.

Multiple Linear Regression Analysis Predicting Attitude in Feeding from Knowledge and Practices in Feeding

Table 11b. Multiple Regression Analysis Predicting Attitude in Feeding

Predictor	B	SE	β	t	p	Interpretation
Attitude	4.28	0.118	—	36.161	< .001	Significant
Knowledge in Feeding	0.012	0.013	0.048	0.974	0.331	Not Significant
Practices in Feeding	0.003	0.019	0.008	0.167	0.867	Not Significant

Dependent Variable: Attitude in Feeding

Model Summary: R = .048; R^2 = .002; Adjusted R^2 = –.002; F(2,417) = 0.490; p = .613.

Knowledge (β = .048, p = .331) and practices (β = .008, p = .867) did not significantly predict feeding attitude. The model was not significant and explained only 0.2% of the variance. This is consistent with studies indicating that knowledge, attitudes, and practices may develop independently and that improvements in knowledge or practice do not automatically change attitudes (Suharto et al.,).

Multiple Linear Regression Analysis Predicting Practices in Feeding from Knowledge and Attitude in Feeding

Table 11c. Multiple Regression Analysis Predicting Practices in Feeding

Predictor	B	SE	β	t	p	Interpretation
Practices	2.652	0.595	—	4.459	< .001	Significant
Knowledge in Feeding	0.006	0.032	0.009	0.18	0.857	Not Significant
Attitude in Feeding	0.021	0.124	0.008	0.167	0.867	Not Significant

Dependent Variable: Practices in Feeding

Model Summary R = .012; R^2 = .000; Adjusted R^2 = −.005; F(2, 417) = 0.032; p = .969

Neither knowledge (β = .009, p = .857) nor attitude (β = .008, p = .867) significantly predicted feeding practices. The model explained virtually none of the variance. Previous research identifies gaps between

knowledge and practice and highlights feed availability, cost, transportation, training, and other practical constraints (Makarabbi et al.,).

HEALTH MANAGEMENT

Multiple Linear Regression Analysis Predicting Knowledge in Health Management from Attitude and Practices in Health Management

Table 12a. Multiple Regression Analysis Predicting Knowledge in Health Management

Predictor	B	SE	β	t	p	Interpretation
Knowledge	6.882	0.777	—	8.853	< .001	Significant
Attitude in Health Management	–0.015	0.159	–0.005	–0.096	0.924	Not Significant
Practices in Health Management	0.064	0.1	0.031	0.639	0.523	Not Significant

Dependent Variable: Knowledge in Health Management

Model Summary: $R = .032$; $R^2 = .001$; Adjusted $R^2 = –.004$; $F(2,417) = 0.218$; $p = .804$.

Attitude ($\beta = −.005$, $p = .924$) and practices ($\beta = .031$, $p = .523$) did not significantly predict health-management knowledge. The model was not significant and explained only 0.1% of the variance. Studies of livestock owners similarly identify gaps among knowledge, attitudes, and practices, indicating that farm experience alone does not ensure adequate health-management knowledge (Lugong et al., 2024).

Multiple Linear Regression Analysis Predicting Attitude in Health Management from Knowledge and Practices in Health Management

Table 12b. Multiple Regression Analysis Predicting Attitude in Health Management

Predictor	B	SE	β	t	p	Interpretation
Attitude	4.521	0.137	—	33.1	< .001	Significant
Knowledge in Health Management	–0.001	0.015	–0.005	–0.096	0.924	Not Significant
Practices in Health Management	–0.066	0.031	–0.105	–2.147	0.032	Significant

Dependent Variable: Attitude in Health Management

Model Summary: $R = .105$; $R^2 = .011$; Adjusted $R^2 = .006$; $F(2,417) = 2.318$; $p = .100$.

Knowledge did not significantly predict health-management attitude ($\beta = −.005$, $p = .924$), while practices showed a weak negative association ($\beta = −.105$, $p = .032$). However, the overall model was not significant ($p = .100$) and explained only 1.1% of the variance. Related studies also report gaps among livestock farmers' knowledge, attitudes, and practices (Escarlos et al., 2016; Vega, 2019; Albios & Olana, 2024; Namgyal et al., 2021).

Multiple Linear Regression Analysis Predicting Practices in Health Management from Knowledge and Attitude in Health Management

Table 12c. Multiple Regression Analysis Predicting Practices in Health Management

Predictor	B	SE	β	t	p	Interpretation
Practices	3.41	0.378	—	9.018	< .001	Significant
Knowledge in Health Management	0.015	0.024	0.031	0.639	0.523	Not Significant
Attitude in Health Management	–0.166	0.077	–0.105	–2.147	0.032	Significant

Dependent Variable: Practices in Health Management

Model Summary: R = .109; R^2 = .012; Adjusted R^2 = .007; F(2,417) = 2.520; p = .082.

Knowledge did not significantly predict health-management practices (β = .031, p = .523), while attitude showed a weak negative association (β = −.105, p = .032). The overall model was not significant (p = .082) and explained only 1.2% of the variance. These results suggest that other conditions, including access to services, resources, training, and technical support, may be more important in determining practice (Albios & Olana, 2024).

HOUSING MANAGEMENT

Multiple Linear Regression Analysis Predicting Knowledge in Housing Management from Attitude and Practices in Housing Management

Table 13a. Multiple Regression Analysis Predicting Knowledge in Housing Management

Predictor	B	SE	β	t	p	Interpretation
Knowledge	6.065	1.039	—	5.838	< .001	Significant
Attitude in Housing Management	0.183	0.229	0.039	0.799	0.425	Not Significant
Practices in Housing Management	–0.168	0.123	–0.067	–1.363	0.174	Not Significant

Dependent Variable: Knowledge in Housing Management

Model Summary: R = .082; R^2 = .007; Adjusted R^2 = .002; F(2,417) = 1.406; p = .246.

Attitude (β = .039, p = .425) and practices (β = −.067, p = .174) did not significantly predict housing knowledge. The model was not significant and explained only 0.7% of the variance. Previous studies indicate that housing practices differ by farm size, facilities, production level, and available resources, supporting the need for farm-specific guidance and training (Alemayehu et al., 2022).

Multiple Linear Regression Analysis Predicting Attitude in Housing Management from Practices and Knowledge in Housing Management

Table 13b. Multiple Regression Analysis Predicting Attitude in Housing Management

Predictor	B	SE	β	t	p	Interpretation
Attitude	4.311	0.093	—	46.559	< .001	Significant
Practices in Housing Management	–0.066	0.026	–0.123	–2.526	0.012	Significant
Knowledge in Housing Management	0.008	0.01	0.039	0.799	0.425	Not Significant

Dependent Variable: Attitude in Housing Management

Model Summary: R = .132; R^2 = .017; Adjusted R^2 = .013; F(2,417) = 3.674; p = .026.

Housing practices significantly but weakly and negatively predicted attitude (β = −.123, p = .012), while knowledge did not (β = .039, p = .425). The model was significant but explained only 1.7% of the variance. The association should be interpreted cautiously; housing conditions and available resources may shape implementation and perceptions more than knowledge alone (Bondoc et al., 2012).

Multiple Linear Regression Analysis Predicting Practices in Housing Management from Knowledge and Attitude in Housing Management

Table 13c. Multiple Regression Analysis Predicting Practices in Housing Management

Predictor	B	SE	β	t	p	Interpretation
Practices	3.218	0.399	—	8.058	< .001	Significant
Knowledge in Housing Management	–0.026	0.019	–0.066	–1.363	0.174	Not Significant
Attitude in Housing Management	–0.229	0.091	–0.123	–2.526	0.012	Significant

Dependent Variable: Practices in Housing Management

Model Summary R = .142; R^2 = .020; Adjusted R^2 = .015; F(2, 417) = 4.293; p = .014

Knowledge did not significantly predict housing practices (β = −.066, p = .174), while attitude showed a weak negative association (β = −.123, p = .012). The overall model was significant but explained only 2.0% of the variance. The negative association does not establish that favorable attitudes cause poorer practices; implementation may be constrained by farm size, income, facilities, and other resources (Suharto et al., 2025).

BIOSECURITY

Multiple Linear Regression Analysis Predicting Knowledge in Biosecurity from Attitude and Practices in Biosecurity

Table 14a. Multiple Regression Analysis Predicting Knowledge in Biosecurity

Predictor	**B**	**SE**	**β**	**t**	**p**	**Interpretation**
Knowledge	7.472	0.573	—	13.041	< .001	Significant
Attitude in Biosecurity	–0.151	0.13	–0.057	–1.160	0.247	Not Significant
Practices in Biosecurity	–0.057	0.098	–0.028	–0.581	0.561	Not Significant

Dependent Variable: Knowledge in Biosecurity

Model Summary: R = .064; R^2 = .004; Adjusted R^2 = –.001; F(2,417) = 0.868; p = .420.

Attitude (β = −.057, p = .247) and practices (β = −.028, p = .561) did not significantly predict biosecurity knowledge. The model was not significant and explained only 0.4% of the variance. Related studies also report differences among knowledge, attitudes, and practices, supporting the need for direct education and practical training on quarantine, animal movement, sanitation, disinfection, and disease prevention (Escarlos et al., 2016).

Multiple Linear Regression Analysis Predicting Attitude in Biosecurity from Knowledge and Practices in Biosecurity

Table 14b. Multiple Regression Analysis Predicting Attitude in Biosecurity

Predictor	**B**	**SE**	**β**	**t**	**p**	**Interpretation**
Attitude	4.213	0.152	—	27.788	< .001	Significant
Practices in Biosecurity	0.027	0.037	0.035	0.72	0.472	Not Significant
Knowledge in Biosecurity	–0.021	0.018	–0.057	–1.160	0.247	Not Significant

Dependent Variable: Attitude in Biosecurity

Model Summary: R = .068; R^2 = .005; Adjusted R^2 = .000; F(2,417) = 0.959; p = .384.

Neither practices (β = .035, p = .472) nor knowledge (β = −.057, p = .247) significantly predicted biosecurity attitude. The model was not significant and explained only 0.5% of the variance. Research similarly indicates that farmers' perceptions and actual implementation of biosecurity measures do not always align and may be shaped by perceived benefits, responsibilities, and farm circumstances (Renault et al., 2021).

Multiple Linear Regression Analysis Predicting Practices in Biosecurity from Knowledge and Attitude in Biosecurity

Table 14c. Multiple Regression Analysis Predicting Practices in Biosecurity

Predictor	B	SE	β	T	p	Interpretation
Practices	1.893	0.327	—	5.783	< .001	Significant
Knowledge in Biosecurity	–0.014	0.024	–0.028	–0.581	0.561	Not Significant
Attitude in Biosecurity	0.047	0.065	0.035	0.72	0.472	Not Significant

Dependent Variable: Practices in Biosecurity

Model Summary: R = .047; R^2 = .002; Adjusted R^2 = –.003; F(2,417) = 0.453; p = .636.

Knowledge (β = −.028, p = .561) and attitude (β = .035, p = .472) did not significantly predict biosecurity practices. The model was not significant and explained only 0.2% of the variance. Consistent implementation may require suitable facilities, resources, training, veterinary services, and technical support, beyond knowledge and favorable perceptions alone (Brennan & Christley, 2013).

RECORD KEEPING

Multiple Linear Regression Analysis Predicting Knowledge in Record Keeping from Attitude and Practices in Record Keeping

Table 15a. Multiple Regression Analysis Predicting Knowledge in Record Keeping

Predictor	B	SE	β	t	p	Interpretation
Knowledge	5.568	0.497	—	11.214	< .001	Significant
Attitude in Record Keeping	0.213	0.119	0.087	1.791	.074	Not Significant
Practices in Record Keeping	–0.049	0.118	–0.020	–0.416	.678	Not Significant

Dependent Variable: Knowledge in Record Keeping

Model Summary R = .090; R^2 = .008; Adjusted R^2 = .003; F(2, 417) = 1.698; p = .184

Attitude (β = .087, p = .074) and practices (β = −.020, p = .678) did not significantly predict record-keeping knowledge. The model was not significant and explained only 0.8% of the variance. Studies report that farmers may have some knowledge but use informal or inconsistent records; systematic record keeping also depends on skills, suitable tools, training, and technical support (Arugay et al., 2020).

Multiple Linear Regression Analysis Predicting Attitude in Record Keeping from Knowledge and Practices in Record Keeping

Table 15b. Multiple Regression Analysis Predicting Attitude in Record Keeping

Predictor	B	SE	β	t	p	Interpretation
Attitude	3.591	0.152	—	23.581	< .001	Significant
Practices in Record Keeping	–0.009	0.049	–0.009	–0.185	0.853	Not Significant
Knowledge in Record Keeping	0.036	0.02	0.087	1.791	0.074	Not Significant

Dependent Variable: Attitude in Record Keeping

Model Summary R = .088; R^2 = .008; Adjusted R^2 = .003; F(2, 417) = 1.628; p = .198

Practices (β = −.009, p = .853) and knowledge (β = .087, p = .074) did not significantly predict record-keeping attitude. The model was not significant and explained only 0.8% of the variance. Formal record keeping

remains limited in some smallholder settings, and attitudes may also reflect perceived usefulness, farm scale, available systems, and technical support (Romero-Zúñiga et al., 2026).

Multiple Linear Regression Analysis Predicting Practices in Record Keeping from Knowledge and Attitude in Record Keeping

Table 15c. Multiple Regression Analysis Predicting Practices in Record Keeping

Predictor	B	SE	β	t	p	Interpretation
Constant	1.603	0.221	—	7.25	< .001	Significant
Knowledge in Record Keeping	–0.008	0.02	–0.020	–0.416	0.678	Not Significant
Attitude in Record Keeping	–0.009	0.049	–0.009	–0.185	0.853	Not Significant

Dependent Variable: Practices in Record Keeping

Model Summary $R = .023$; $R^2 = .001$; Adjusted $R^2 = -.004$; $F(2, 417) = 0.111$; $p = .895$

Knowledge ($\beta = -.020$, $p = .678$) and attitude ($\beta = -.009$, $p = .853$) did not significantly predict record-keeping practices. The model was not significant and explained only 0.1% of the variance. Studies likewise report limited use of formal records among smallholder farmers and emphasize the value of simple, organized recording systems, appropriate technology, and technical assistance (Miranda-Quibot et al., 2017).

Training Modules on Different Cattle Management Practices

The proposed training modules were developed based on the results of the Knowledge, Attitude, and Practices (KAP) assessment. Findings revealed that although cattle raisers generally have favorable knowledge and positive attitudes, these are not consistently reflected in their actual farming practices. Areas needing improvement include breeding, feeding, health management, housing, biosecurity, and record-keeping.

A five-day training program is proposed to provide sufficient time for discussions, practical demonstrations, guided activities, and farm-based exercises covering the six priority areas. The training aims to strengthen farmers' knowledge and practical skills, encourage the application of proper management practices, and improve the overall welfare and productivity of smallholder cattle farms.

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