

Original Article

Traditional and Adaptive *Papait* Farming Among Smallholders in Central Pangasinan: Practices, Constraints, and Perceptions

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Abstract. Indigenous leafy vegetables contribute to food security and smallholder livelihoods. However, they remain understudied, particularly in the Philippines. Guided by the Perceptions–Constraints–Practices Decision Framework, this study examined the cultivation practices, constraints, and farmer perceptions associated with *papait* farming among smallholders in Central Pangasinan. The study employed a basic qualitative design with semi-structured interviews of 11 farmers selected through purposive and snowball sampling. Data were analyzed using Braun and Clarke's six-phase thematic analysis. The analysis revealed three key domains. Cultivation practices included natural regeneration, manual weeding, and observation-based irrigation alongside other traditional techniques. Perceived constraints comprised environmental pressures from flooding and pests, economic instability from price volatility and limited institutional support, labor intensity, and land scarcity. Farmers' perceptions shape cultivation decisions, centered on economic viability, cultural significance, and ecological adaptability. These findings demonstrate that *papait* cultivation persists through a conservative core of stable traditional practices and an adaptive periphery of flexible responses to environmental shocks. This persistence resolves the documentation gap by showing that indigenous vegetable systems rely on locally transmitted knowledge and adaptive strategies rather than external innovations. The findings also reveal that farmers face interlocking constraints that threaten sustainability. A key limitation is the small sample size, which limits generalizability beyond the study context. Addressing these challenges requires coordinated support, including price stabilization, farmer organization, and climate-adaptive resources tailored to local contexts. The findings contribute to the limited literature on indigenous vegetable systems and demonstrate that low adoption of agricultural innovations in the Global South reflects institutional failure to recognize valued knowledge systems rather than farmer resistance to change.

Keywords: Farmer perceptions; Indigenous leafy vegetables; *Mollugo oppositifolia*; Smallholder farmers; Traditional knowledge.

Smallholder farmers face climate variability, limited capital, and weak institutional support. Adoption of agricultural innovations remains low, particularly in the Global South. Farmer decisions are shaped by knowledge, perceptions, attitudes, and trust as much as by economic incentives. Financial stress limits responses to climate risks even when they are known (Rosário et al., 2022; Touch et al., 2025). Indigenous leafy

vegetables (ILVs) are nutritious, well-adapted to local conditions, and require few external inputs. However, they are underutilized due to market neglect, negative perceptions, and institutional gaps (Ndwandwe et al., 2026). To understand the roots of this underutilization, researchers have examined extension systems and farmer behavior. In Southeast Asia, pluralistic extension services have emerged to bridge such gaps. However, coordination remains poor, and local knowledge is rarely integrated with formal support (Jena, 2025; Mudzielwana et al., 2025). A robust body of work has established that farmer decision-making involves complex trade-offs among economic, cultural, and ecological factors.

The Philippines exhibits these broader patterns. Indigenous communities in the country have long practiced sustainable farming methods. These include soil profiling, multiple cropping, organic farming, and the use of astronomical calendars. These practices are passed down through generations (Sumayao & Dy, 2025). Despite this rich heritage, *papait* (*Mollugo oppositifolia* L.), a traditional leafy vegetable cultivated in Central Pangasinan, exemplifies the understudied nature of indigenous vegetable systems. Locally valued for its culinary and medicinal uses, *papait* lacks systematic documentation of its cultivation practices, barriers, and farmer decision-making. The study area comprises municipalities from Districts 2, 3, 4, and 5 of Pangasinan province. Initial scoping revealed no official records or documented farmer associations for *papait* cultivation. The crop is not listed in municipal agricultural profiles as a cash or cover crop. Further field validation identified four municipalities where *papait* is cultivated by a small number of smallholder farmers. These are concentrated in specific barangays, namely Basista, Bayambang (Ambayat 1st and 2nd), Bautista (Baluyot), and Alcala (Macayo). Cultivation occurs on small portions of farmland, often intercropped with onion, corn, or tobacco.

A key distinction in recent research is between conventional and innovative agricultural practices. Conventional practices emerge from ancient local knowledge passed down over generations. Examples include the use of organic fertilizers, intercropping, and water-saving techniques. Innovative practices are science-based and exogenously introduced. Examples include improved seeds, scientific weather forecasts, and modern irrigation methods (Ngonjock et al., 2025). A recent study found that the majority of farmers still heavily depend on traditional practices. Those who blend traditional and innovative methods achieve greater efficiency. Understanding how farmers choose between traditional and innovative practices is critical for developing appropriate policies. This understanding is lacking for *papait*, and the absence of systematic data means that policy interventions cannot be tailored to local realities. This theoretical gap has real-world consequences. Without documentation, farmers miss opportunities for support, and the crop's potential for nutrition and resilience remains unrealized.

To rectify this critical misfit, this study operationalizes the Perceptions–Constraints–Practices (PCP) Decision Framework. This framework synthesizes three theoretical pillars relevant to the persistence of traditional crops. First, farmer decision-making is understood through the lens of behavioral perception theory. Farmers' choices are shaped by their evaluations of economic viability, cultural significance, ecological adaptability, and operational feasibility (Rosário et al., 2022; Touch et al., 2025). Second, indigenous and local knowledge systems (IKS) provide the foundation for the observed farming practices. These are not static habits. They are dynamic, intergenerationally transmitted repertoires that combine a stable core with adaptive flexibility (Sumayao & Dy, 2025; Ngonjock et al., 2025). Third, a constraints analysis rooted in the sustainable livelihoods perspective recognizes that environmental, economic, institutional, labor, and land pressures constitute interlocking barriers. These barriers filter farmers' options and perceptions (Ndwandwe et al., 2026; Mudzielwana et al., 2025). In the PCP model, the broader socio-ecological context generates a set of perceived constraints. These include environmental, economic, labor-related, and land-access pressures. These constraints shape, and are shaped by, the farming practices that farmers employ, drawing on their traditional knowledge and adaptive strategies. Together, practices and constraints inform the central perceptual lens. Through this lens, farmers assess the economic viability of *papait*, its cultural significance, its ecological adaptability, and the operational feasibility of cultivation. These perceptions, in turn, directly drive the decision to continue, adjust, or abandon *papait* production.

This study pursues two intertwined objectives. The first objective identifies the cultivation practices, barriers, and perceptual drivers of *papait* production decisions. The second objective determines how the resulting empirical baseline and analytical framework can inform pluralistic extension and policy interventions for indigenous vegetable systems. To achieve these objectives, the study aims to document *papait* cultivation practices among smallholder farmers in Central Pangasinan. It also aims to identify the key environmental, economic, and

institutional barriers to production. Finally, it aims to examine how economic viability, cultural significance, and ecological adaptability influence farmers' decisions to sustain or discontinue cultivation. A qualitative approach is essential. Farmer decision-making involves culturally embedded perceptions, tacit knowledge, and context-specific trade-offs that quantitative surveys cannot capture. The findings will contribute the first systematic empirical baseline on *papait* cultivation. They will also offer a transferable analytical framework for studying similarly under-documented indigenous vegetable systems in the Philippines and beyond.

Methodology

Research Design

This study is grounded in an interpretivist-constructivist epistemology, which holds that knowledge is socially constructed through participants' lived experiences and the meanings they assign to farming practices, constraints, and cultivation decisions. This stance aligns with the Perceptions–Constraints–Practices (PCP) Decision Framework that guides the study, as it treats farmers' subjective perceptions, traditional knowledge, and adaptive reasoning as essential sources of insight rather than variables to be measured. Therefore, a basic qualitative design was employed to explore the complex social, economic, and environmental factors that shape *papait* (*Mollugo oppositifolia* L.) cultivation within its natural context. The design is exploratory, inductive, and focused on uncovering patterns of meaning in participants' accounts. The study captures the perspectives of currently or recently active *papait* farmers, not those of households that only forage *papait* or have permanently abandoned cultivation. This boundary is acknowledged to clarify the scope of the decision-making processes examined.

Participants and Sampling Technique

The study was conducted in Central Pangasinan, Philippines. Initial scoping visits to Local Government Unit (LGU) agriculture offices across Districts 2, 3, 4, and 5 confirmed that *papait* (*Mollugo oppositifolia* L.) is absent from municipal agricultural profiles and has no documented farmer associations. Field validation across four municipalities—Basista, Bayambang (Ambayat 1st and 2nd), Bautista (Baluyot), and Alcala (Macayo)—identified a small number of smallholder farmers cultivating *papait* on marginal plots, often intercropped with onion, corn, or tobacco. After applying the inclusion criteria (residency in the identified municipalities, a minimum of three years of farming experience, and at least one cumulative year of *papait* cultivation), 11 farmers from three municipalities—Bayambang, Bautista, and Alcala—participated; Basista yielded no eligible participants.

Both purposive and snowball (chain referral) sampling were employed because the population of *papait* cultivators is hidden, informally recognized, and absent from official records. Purposive sampling was used to select initial information-rich cases who could speak to the full range of practices, constraints, and perceptions captured by the PCP framework. Snowball sampling then leveraged participants' networks to access additional cultivators, ensuring that the final sample represented diverse farming contexts and experiences relevant to the study's objectives. A total of 11 participants were recruited, a number that, together with the iterative data-collection process described in the next section, proved sufficient to reach thematic saturation within the targeted framework dimensions.

The findings presented represent the in-depth experiences of these 11 farmers and are not intended for statistical generalization. Rather, they provide context-rich insights into the cultivation practices, constraints, and decision-making of a previously undocumented group of smallholder *papait* growers.

Research Instrument

A semi-structured interview protocol was developed deductively from the PCP framework to cover its three core domains: (1) farming practices, including land preparation, propagation, irrigation, pest and disease control, weed management, harvest, and post-harvest handling; (2) perceived constraints, such as environmental pressures, market volatility, lack of institutional support, labor intensity, and land scarcity; and (3) farmer perceptions of economic viability, cultural significance, ecological adaptability, and labor-risk trade-offs influencing cultivation decisions. The protocol was prepared in English and Filipino. Participants could respond in Pangasinan, Ilocano, Filipino, or English. A university language teacher validated the Filipino translation, and the instrument was pilot-tested with three corn and onion farmers (no *papait* cultivator was accessible at that time) to assess clarity, flow, and participant comprehension. Ambiguous questions were rephrased before the main data collection.

A document analysis guide directed the systematic review of LGU agricultural profiles, relevant municipal development plans, and Department of Agriculture records on indigenous vegetable programs. The review confirmed *papait*'s formal invisibility—its absence from cash- and cover-crop lists—and the lack of institutional support, directly informing the Socio-Ecological Context and Institutional Constraints nodes of the PCP framework. An observation guide captured field notes on farm layouts, intercropping patterns, and visible tools, although no active *papait* cultivation was observed during fieldwork.

Data Gathering Procedure

Following informed consent, in-depth interviews were conducted with the 11 participants. Each interview was recorded and transcribed verbatim. The researcher, an outsider fluent in Filipino and English, conducted the interviews in the participant's preferred language—Pangasinan, Ilocano, Filipino, or English. Most interviews took place in participants' homes, with some farm lots nearby. Preliminary visits to barangay officials and farmer organizations had secured participant referrals, given the hidden population.

Trust was built directly with participants during the interviews. The researcher explained the study transparently, assured confidentiality, and maintained a neutral, non-judgmental approach. The formal consent process further encouraged candid disclosure. This approach to building trust is consistent with the interpretivist-constructivist epistemology of the PCP framework, which treats the researcher-participant interaction as integral to knowledge co-construction. Responses were transcribed verbatim in the original language and then translated into English. Each participant reviewed the translated version and signed it. This member-checking step enhanced descriptive validity.

Credibility was strengthened through triangulation of three sources. Semi-structured interviews captured the Practices, Constraints, and Perceptions nodes of the PCP framework. Field observations provided contextual evidence for the Practices node; these were limited to farm layouts, intercropping patterns, and visible tools, as no active *papait* cultivation occurred during fieldwork. Document analysis of LGU records and Department of Agriculture materials corroborated the Socio-Ecological Context and Institutional Constraints nodes. As a result, the study relies on participant recall for seasonal practices and real-time weather responses, which is an acknowledged limitation.

Data Analysis Procedure

Data were analyzed using the six-phase thematic analysis framework developed by Braun and Clarke (2006). Data collection and analysis proceeded concurrently so that emerging patterns could inform subsequent interviews. After the ninth interview, no substantially new codes were appearing within the three *a priori* domains of the PCP framework—farming practices, perceived constraints, and farmer perceptions. Two additional interviews were conducted, confirming thematic redundancy. Thus, the final sample of 11 participants was judged sufficient to achieve saturation for the targeted framework dimensions.

The process began with data familiarization through repeated reading of transcripts and field notes. Initial coding was inductive and semantic. Codes stayed close to participants' explicit statements and labelled concrete practices, constraints, and perceptions as they were spoken. No preconceived categories were imposed at this stage. Once the initial code list stabilized, a deductive step was introduced. Codes were systematically sorted under the three *a priori* domains of the PCP framework. This ensured the analysis remained anchored to the study's conceptual model while staying responsive to unanticipated patterns within each domain.

Following this organization, analysis moved from semantic to latent interpretation. Within each PCP domain, codes were examined for underlying patterns and recurring organizing concepts. Themes were developed by grouping related codes and were reviewed iteratively for internal coherence and external distinctiveness. The researcher maintained an audit trail that recorded code definitions, theme maps, and analytical memos documenting the evolution of themes. The final themes were clearly defined and named before being synthesized into a narrative that addressed the research questions. Given the manageable dataset size, the analysis was conducted manually.

Ethical Considerations

The study followed established ethical principles: informed consent, confidentiality, anonymity, non-maleficence, and data privacy. Each participant received an oral and written explanation of the study's purpose, its voluntary

nature, and the right to withdraw at any time. A plain-language consent form was read aloud to ensure comprehension. All participants gave written consent; for those unable to sign, a witnessed verbal consent was documented.

To protect identities while humanizing the presentation, participants are referred to by pseudonyms. A summary demographic table provides ranges for age, farm size, years cultivating *papait*, main intercrops, and land tenure. No individual identifiers are disclosed. This assurance of anonymity and the trust established through the consent process likely encouraged openness, strengthening the data's credibility.

All raw data were stored on a password-protected device accessible only to the researcher. No personal identifiers appeared in any output. Interviews were held at locations chosen by participants for comfort and privacy. No participation incentives were given.

The researcher is independent, with no prior ties to the communities and no farming background. Semi-structured protocols and neutral, non-leading questions were used throughout. Analysis was conducted manually, with interpretations repeatedly verified against participants' statements to remain faithful to the data.

Results and Discussion

Participant Demographics and Farming Profile

Table 1. Aggregated Demographic and Farming Profile of Study Participants (N = 11)

Variable	Category	n
Gender	Female	7
	Male	4
Age Range (years)	31–45	2
	46–60	4
	61 and above	5
	Bautista	5
City/Municipality	Bayambang	1
	Basista	1
	Villasis	1
	Alcala	1
	San Carlos City	1
Land Tenure	Owner	9
	Leaseholder	1
	No formal tenure	1
	Below 5 years	4
Years Cultivating <i>Papait</i>	6–10 years	2
	11–15 years	1
	16–20 years	3
	Over 20 years	1
	Vegetables (squash, string beans, okra, tomato, eggplant, string beans, Chinese cabbage)	5
Main Intercrops	Rice and/or corn	3
	Tobacco	1
	No intercrops	2

Note. Intercrop categories overlap (may report multiple). "No intercrops" denotes exclusive *papait* cultivation.

Table 1 presents the demographic and farming profile of 11 participants. Seven participants were female. Five were aged 61 and above. Five resided in Bautista. Nine were owner-cultivators. Experience ranged from below 5 to over 20 years. Most cultivated vegetable intercrops. The elderly owner-cultivator composition limits generalizability to younger or landless farmers.

Farming Practices

Table 2 presents five common themes of *papait* farming practices. These themes were analyzed using lenses of ecological adaptation, economic rationale, and cultural continuity. The analytic lenses connect the practices to the PCP framework. Ecological adaptation shows how farmers respond to environmental constraints. Economic rationale reveals low-input, cost-saving decisions. Cultural continuity explains intergenerational knowledge and identity. Together, the themes and lenses demonstrate how traditional *papait* cultivation persists under structural constraints. The following discussion elaborates on each theme.

Table 2. *Current Farming Practices for Papait Cultivation Among Smallholder Farmers in Central Pangasinan*

Theme	Description	Sub-Category	Significant Statements
Land and Crop Foundation Practices	Methods for preparing land and establishing <i>papait</i> crops, including soil work, propagation, and planting techniques.	Land Preparation and Soil Management	"We plow it with a carabao, then we flatten it, and then we add fertilizer to the crops." (P07)
		Planting and Propagation Methods	"We would just put it on the ground, the old ones, the old <i>papait</i> plants with flowers. And then they would grow there directly." (P01)
Crop Maintenance and Input Management	Practices for nurturing growing <i>papait</i> through fertilization, watering, pest control, and weed management.	Fertilization Practices	"We utilize sulfate as our primary inorganic fertilizer." (P05)
		Irrigation and Water Management	"Whenever the soil looks dry, we water again." (P04)
		Pest and Disease Management	"Only malathion, we only spray <i>malathion</i> to kill insects." (P09)
		Weed Management	"Pull them out, weed them out... Because they will carry... worms." (P01)
Harvest and Post-Production Protocols	Methods for determining harvest time, harvesting techniques, and post-harvest handling to preserve quality for market.	Harvesting Practices	"You don't get the root, you just cut it." (P01)
		Post-Harvest Handling and Storage	"Just cover it with... a cloth... Because if it's plastic, it's hot, it will cook." (P01)
Farm System Management and Technology	Broader farm management strategies, including crop systems, tool use, and integration with other farming activities.	Cropping System and Crop Management	"Just <i>papait</i> ... it's like continuous because it takes a long time to harvest." (P01)
Local and Intergenerational Knowledge and Adaptive Farming	The role of inherited knowledge, traditional methods, and adaptive strategies in response to farming challenges.	Farming Tools and Technology	"We use a <i>sud-sud</i> (<i>sor-sor</i>), a flat tool with a pointed end." (P06)
		Knowledge and Tradition in Farming	"Traditional. Because we plant it by ourselves." (P03)
		Challenges and Adaptation Strategies	"We manage to overcome them because if the crops are damaged, we replant so that we can earn something." (P07)

Land and Crop Foundation Practices

Farmers prepared land through plowing, leveling, and fertilizing (*Gregorio, Ernesto, Aurora, Roberto*). Propagation relied overwhelmingly on natural self-seeding using mature flowering plants placed on the ground (*Lourdes*). As *Lourdes* stated, "We would just put it on the ground, the old ones, the old *papait* plants with flowers. And then they would grow there directly." The testimony revealed a tension between passive natural regeneration and one farmer's systematic transplanting approach (*Gregorio*).

A foundational reliance on experiential knowledge transmitted across generations is evident. Soil moisture, texture, and color serve as primary decision-making cues that eliminate the need for costly laboratory testing and protect soil from unnecessary disturbance. Avoiding burning and exposing moist sublayers function as low-risk strategies safeguarding seed viability without external inputs. Near-universal self-seeding eliminates seed costs and minimizes planting labor. Seasonal flooding serves as a natural dispersal mechanism (*Ricardo*). Only *Gregorio* practiced systematic transplanting with fifteen-day intervals and afternoon planting to reduce wilting. All other farmers accepted uncontrolled or flexible spacing. This pattern reveals a conservative core of natural regeneration stable across the sample, representing a risk-averse strategy proven reliable across seasons. A peripheral adaptive space accommodates individual experimentation without destabilizing foundational ecological logic. Carabao-drawn ploughs and tractors coexist, illustrating technological pluralism where farmers blend tools according to task needs. The phrase "*just put it on the ground*" frames the practice as uncomplicated and natural. The tense shift from past action to immediate growth reduces human agency, presenting the process as ecologically inevitable.

This interpretation extends indigenous soil knowledge literature by demonstrating visual and tactile assessment as culturally embedded (Martin & Santos, 2021; Sumayao & Dy, 2025). Self-propagation aligns with indigenous seed systems, reducing market dependence (Ndwandwe et al., 2026). The conservative core, adaptive periphery dynamic complicates traditional versus innovative binaries (Quan & Doluschitz, 2021; Ngonjock et al., 2025). This applies primarily to smallholders with limited capital and secure land access. Farmers with greater resources may adopt intensive methods. The absence of systematic yield or demographic data limits the analysis.

Crop Maintenance and Input Management

Farmers applied sulfate and complete fertilizers as primary inorganic inputs. Cow dung served as the preferred organic amendment (*Lourdes, Gregorio, Remedios, Ernesto, Roberto, Consuelo*). Urea was explicitly prohibited due to perceived harshness (*Roberto, Consuelo*). Farmers watered when soil looked dry or turned white (*Lourdes, Gregorio, Remedios*). Pest control centered on malathion sprayed only when worms or insects appeared (*Lourdes, Roberto, Consuelo*). As *Lourdes* stated, "*Pull them out, weed them out... Because they will carry... worms.*" The testimony revealed a tension between labor-intensive manual weeding and complete avoidance of herbicides.

An integrated knowledge system grounded in experiential learning and intergenerational transmission is evident. Urea prohibition, careful fertilizer dilution, herbicide avoidance, and cautious pesticide dosing form a conservative core prioritizing crop safety over input intensity. Each rule addresses specific risks. Resource scarcity shapes every dimension. Farmers use locally available cow dung. They conserve water by irrigating only when the soil signals it needs it. They substitute manual labor for herbicide purchases. The daily weeding routine, while labor-intensive, is perceived as the only safe option. This maintenance schedule positions *papaít* as a subsistence safety net receiving attentive but low-cash care. Costs are measured in time and physical effort. Inherited rules—no urea, no herbicides, water only when soil signals need—are markers of farming identity passed through generations. Maintaining them expresses cultural continuity. Farmers adhere even when labor is scarce because abandoning them would risk intergenerational knowledge. A peripheral adaptive space accommodates variation in fertilizer schedules, irrigation tools, and pest control combinations. *Lourdes's* repetition of "*Pull them out, weed them out*" intensifies the manual imperative. The trailing phrase "*Because they will carry... worms*" collapses reason into unstated consequence, framing weeding as an unavoidable response to implicit threat.

This interpretation extends literature on smallholder knowledge systems showing product-specific rules as informal crop protection protocols (Nuthall & Old, 2018; O'Connell & Osmond, 2022). Observation-based irrigation confirms experiential knowledge in adaptive water management (Berkhout et al., 2020). Reactive pesticide use mirrors agroecological principles (Gonzaga et al., 2021). Manual weeding highlights crop safety versus labor trade-offs (Kumar et al., 2021; Baraibar & Knudsen, 2024). This applies to smallholders with available household labor and strong cultural ties. The analysis is limited by the absence of labor time or yield data.

Harvest and Post-Production Protocols

Farmers determined harvest readiness primarily by plant size and the imminent appearance of flowers. Harvesting was exclusively manual. Farmers cut leafy tops while leaving roots intact to allow regrowth (*Teresita, Ernesto*). As *Lourdes* stated about transport, "*Just cover it with... a cloth... Because if it's plastic, it's hot, it will cook.*" The testimony revealed a tension between immediate sale requirements and perishability constraints.

An experiential knowledge system attuned to phenology and perishability is evident. Pre-flowering size as harvest signal demonstrates understanding of the plant's reproductive cycle and marketability. Regenerative cutting treats *papaít* as a perennial resource, maximizing yield over multiple harvests. This preserves the plant base for future regrowth. Harvest frequency varied. Daily harvesting prevented flowering, which made the crop unsellable (*Lourdes*). Biweekly harvesting accommodated other livelihood activities (*Remedios*). Immediate sale combined with breathable cloth for transport constitutes risk management against extreme perishability. Farmers minimized post-harvest losses by quickly converting produce into cash. Cloth covering addressed cold storage absence. Plastic was avoided because it trapped heat and caused wilting. Early morning starts and extended schedules exacted significant cost (*Aurora*). Core practices—phenological harvesting, regenerative cutting, immediate sale, cloth covering—remained stable across participants. Variation in harvest frequency and bundling accommodated adjustments to labor supply and market conditions. *Lourdes's* "*it will cook*" employs a metaphor of thermal destruction transforming plastic into an active agent of crop death. The contrastive "*cloth... Because if it's plastic*" establishes a lay causal logic in which cloth functions as protective technology.

This interpretation extends research on phenological indicators showing experiential knowledge as culturally embedded (Sumayao & Dy, 2025; Kamakaula & Fenetiruma, 2024). Regenerative cutting aligns with sustainable harvesting principles (ACIAR, 2021; Íñiguez Moreno et al., 2021). Cloth covering represents grassroots innovation addressing cold storage absence (He et al., 2023). Immediate sale illustrates vulnerability where smallholders lose value to intermediaries (Lagunda et al., 2025). This applies to smallholders without cold storage or bargaining power. The absence of market price or income data limits the analysis.

Farm System Management and Technology

Farmers managed *papait* in sole cropping and intercropping arrangements. Some grew it as a continuous monocrop (Lourdes). Others planted it alongside eggplant, Chinese cabbage, or okra (Ernesto, Natividad). Planting followed a cool season calendar from September or October until March or May (Remedios, Ernesto). Tools ranged from tractors to simple hand implements. As Ernesto stated, "*We use a sud-sud (sor-sor), a flat tool with a pointed end.*" The testimony revealed a tension between low-input practices and integration flexibility.

An experiential knowledge system positions *papait* flexibly within the household livelihood portfolio. Intercropping diversifies produce and reduces dependence on a single crop. The seasonal calendar aligns growth with cooler months to manage environmental risk. Pruning maximizes yield per plant over an extended period, addressing land and input scarcity. Tool selection reflects resource-conscious decision-making. Tractors serve labor-intensive land preparation. Manual tools suffice for other operations, keeping capital costs low. The *sud-sud* provides an effective, no-cost harvesting method passed down across generations. An improvised measuring device demonstrates repurposing household items to avoid specialized equipment (Gregorio). *Papait* functions as a low-capital, adaptable crop integrating without displacing other income sources. When land is limited, intercropping accommodates *papait*. When labor is available, pruning extends harvests. When cash is scarce, the low-cost tool set and self-propagation keep production viable. Stable core practices—seasonal planting, pruning, manual weeding, *sud-sud*—remain culturally embedded. Peripheral adaptive space accommodates companion crop choices, occasional tractor use, and tool improvisation.

This interpretation extends crop diversification literature showing intercropping traditional vegetables as risk management (Macusi et al., 2023; Buenavista et al., 2022). Seasonal calendars reflect local phenological knowledge (Sumayao & Dy, 2025; Nagal, 2025). Tool sets illustrate technological pluralism (Quan & Doluschitz, 2021; Ngonjock et al., 2025). This applies to smallholders with limited capital and flexible labor. The absence of income contribution data limits the analysis.

Local and Intergenerational Knowledge and Adaptive Farming

Farmers consistently characterized their methods as traditional and learned from predecessors (Teresita, Gregorio). Challenges centered on weather and pests. Excessive rainfall caused rotting and flooding turned leaves yellow (Lourdes, Gregorio). Pest pressures included worms, black army worms, and domestic animals (Gregorio, Remedios, Ernesto). As Gregorio stated, "*We manage to overcome them because if the crops are damaged, we replant so that we can earn something.*" The testimony revealed a tension between inherited practices and environmental uncertainty.

An intergenerationally transmitted knowledge system stable in core rules yet flexible in responses to shocks is evident. Farmers treat certain elements, such as planting method, as non-negotiable (Gregorio). This adherence functions as a protective strategy against unknown vulnerabilities. Without institutional safety nets, preserving what has worked across generations reduces risk. The system is not rigid. Replanting after losses, applying animal manure to flooded crops, and shifting to dry season constitute adaptive responses (Gregorio, Aurora, Natividad). These draw on experiential knowledge, applying familiar inputs to new problems. Farmers perceive cultivation as inherently uncertain. However, they also perceive that the conservative core, combined with replanting, offers a workable defense. The decision to continue is calculated persistence. Farmers accept that losses will occur and have routinized recovery through replanting. This depends on self-propagation and household labor availability. When labor is abundant and land accessible, the system absorbs shocks. When labor becomes scarce, recovery becomes unsustainable. Replanting exemplifies a low-cost, self-directed recovery mechanism restoring production without external assistance. Gregorio's "*so that we can earn something*" frames replanting as economic necessity tied to income. The repetition of "*we replant*" performs procedural certainty, collapsing weather uncertainty into predictable response.

This interpretation extends indigenous knowledge literature showing adherence to traditional methods carries cultural meaning (Sumayao & Dy, 2025; Nagal, 2025). Adaptive strategies reflect experiential adaptation (Kamakaula & Fenetiruma, 2024). Replanting exemplifies adaptive capacity (Colting Pulumbarit et al., 2018; Landicho et al., 2023). This applies to smallholders with available household labor and secure land access. The analysis is limited by the absence of recovery time or yield data.

Perceived Constraints in Papait Farming

Table 2 outlines four barrier themes. The commonality across all four themes is that each operates as a barrier to

the sustainability of *papait* farming. Each theme creates persistent pressure that the farmer must either absorb, adapt to, or succumb to. The source of pressure varies. Three themes (environmental, economic, land) are structural and outside the farmer's direct control. The fourth theme—labor-intensive and technologically static systems—includes an internal element: resistance to changing core practices, which farmers can directly control. This distinction informs the PCP framework by differentiating between the Constraints node (external barriers) and the Practices node (internal choices about method adherence). Together, the four themes show that *papait* farming faces a mix of structural and behavioral constraints, and any intervention must address both.

Table 2. *Barriers to the Adoption and Sustainability of Papait Cultivation in Central Pangasinan*

Theme	Description	Sub-Category	Significant Statements
Environmental and Biotic Pressures	Uncontrollable natural factors and biological threats that directly damage crops and reduce yield stability.	Environmental and Climatic Risks	"Oh yes, when it floods, the crops get soaked in floodwater and turn yellow." (P04)
		Pest and Animal Infestations	"Black army worms and other pests, sometimes even chickens because they peck at the seeds and plants." (P06)
Economic and Infrastructural Constraints	Financial limitations, market weaknesses, and a lack of institutional support that undermine farming viability and investment.	Economic and Market Constraints	"The price of our <i>papait</i> back then was five pesos per bundle... prices weren't that high back then; they were cheaper." (P07)
		Lack of Institutional Support and Training	"There hasn't been any program for the cultivation of <i>papait</i> ." (P07)
Labor-Intensive and Technologically Static Farming Systems	Farming practices that demand significant manual effort and show resistance to changing certain established methods, while adapting in other areas.	Labor and Operational Difficulties	"My experience with <i>papait</i> farming is really hard because you spend all day cleaning, like plucking the weeds; you clean it every day." (P07)
		Resistance to Changing Core Practices	"We haven't changed our farming methods, nor do we use new technology." (P04)
Land Access and Resource Scarcity	Challenges related to limited or competing uses for land and other essential agricultural resources.	Land and Resource Limitations	"Just in our backyard." (P08)

Environmental and Biotic Pressures

Farmers identified excessive rainfall and flooding as the most severe threats. Rain caused plants to rot when soil became too wet (*Lourdes*). Flooding turned leaves yellow as crops were submerged (*Gregorio*). Storms could destroy entire plantings (*Ricardo*). Alongside climatic risks, pest and animal infestations presented persistent pressures. Worms, including black army worms, prompted regular spraying (*Lourdes*, *Ernesto*). Vertebrate pests such as goats, chickens, and ducks also caused damage (*Gregorio*, *Remedios*, *Ernesto*). As *Natividad* stated, "*The crop is really affected by rain and gets destroyed or rots.*" The testimony revealed a tension between adaptive capacity and uncontrollable environmental threats.

Flooding and heavy rain introduce production uncertainty farmers cannot overcome through agronomic practice alone. The crop's waterlogging sensitivity means even a single intense rainfall can cause yield loss. This vulnerability interacts with low-input, self-propagating characteristics. *Papait* is often cultivated on marginal plots with limited drainage. Pest pressures compound risk. Insect infestations and vertebrate damage erode yields incrementally. They require ongoing labor and chemical input that increase costs. When losses are occasional, farmers absorb them through replanting or dry season production. When pressures intensify or recur quickly, constraints overwhelm coping capacity. This reduces perceived viability and pushes farmers toward reduced engagement or temporary abandonment. *Natividad's* phrase "*really affected*" employs an intensifier elevating rain's impact beyond inconvenience. The tripartite structure "*affected... destroyed... rots*" performs a progression of severity, collapsing environmental exposure into inevitable crop loss, framing rain as an existential threat.

This interpretation aligns with research on climate vulnerability in Philippine rainfed agriculture where farmers face heightened risks with limited formal safety nets (*Landicho et al., 2023; Ocampo et al., 2025*). Waterlogging vulnerability supports findings that excessive moisture constrains leafy vegetable production (*Muthiah et al., 2025*). Pest challenges reflect mixed farming landscape pressures (*Gonzaga et al., 2021*). Farmers continue cultivating *papait* because cultural identity and traditional food significance counterbalance environmental risks. This dynamic applies primarily to smallholders with limited capital and secure land access. Farmers with better

drainage may face different constraints. The findings imply that institutional mechanisms such as crop insurance or flood-tolerant varieties could strengthen adaptive capacity. The analysis is limited by the absence of systematic data on loss frequency or pest damage economic impact.

Economic and Infrastructural Constraints

Farmers faced persistently low and volatile prices. *Aurora* recalled bundles selling for only five pesos, and that prices remained low relative to the labor invested. Financial loss was openly acknowledged (*Aurora*). Primary costs were labor and input. *Lourdes* explained the real investment was in cleaning, weeding, watering, and harvesting, assuming fertilizer was available. Government subsidies were sporadic. *Ernesto* noted receiving subsidies in some years but not the current one. Institutional support specific to *papaít* was entirely absent. As *Aurora* stated, "*There hasn't been any program for the cultivation of papaít.*" The testimony revealed a tension between cultural value and economic precarity imposed by market and institutional neglect.

Chronically low prices interact with high labor demands to compress perceived economic return. Farmers invest substantial physical effort for a meager and uncertain price. Economic viability is assessed as a fragile calculation. Inconsistent subsidies and the absence of crop-specific support remove any institutional safety net. Declining farmer associations further isolate growers. They deny collective bargaining power or shared resources that could stabilize prices or reduce costs. *Roberto* observed their association was "*disappearing*" and officials were becoming lazy. *Gregorio* answered government support with a simple "*No.*" *Papaít* persists not because of economic promise but because of cultural and subsistence value. When prices remain depressed, labor becomes scarce, or institutional support fails, the fragile equation collapses. Farmers weigh bodily cost against modest income. Without collective or government buffers, survival rests on household loss absorption capacity. *Aurora's* "*there hasn't been any program*" employs absolute negation, erasing the possibility of institutional intervention. The tense "*hasn't been*" extends absence from past into present and future, framing neglect as permanent. *Gregorio's* blunt "*No*" collapses hope of state support into a finality syllable.

This interpretation aligns with scholarship on market marginalization and institutional neglect of indigenous vegetables. Low farmgate prices and high labor investment mirror Philippine value chain patterns where intermediaries capture majority of final value (Lagunda et al., 2025). Absent extension programs confirm traditional leafy vegetable underrepresentation (Ndwandwe et al., 2026; Mudzielwana et al., 2025). Weakening farmer associations reflect declining organizational vitality undermining collective action (Sapbamrer & Thammachai, 2021; Candemir et al., 2021). This dynamic applies primarily to smallholders without alternative income sources or collective bargaining structures. Farmers with better market integration may face different constraints. The findings imply price stabilization and institutional recognition could strengthen sustainability. The absence of systematic household income contribution data limits the analysis.

Labor-Intensive and Technologically Static Farming Systems

Farmers described *papaít* farming as physically demanding and technologically unchanged. Weeding consumed entire days. Harvesting and marketing imposed grueling schedules. Farmers woke up early and did not return until afternoon (*Aurora*). Soil preparation was another major labor burden, particularly refining and tilling (*Ernesto*). Fertilizer management required careful attention, as over-application caused leaf yellowing and white spots (*Lourdes*). Alongside these labor demands, farmers expressed marked resistance to changing methods. As *Gregorio* stated, "*We haven't changed our farming methods, nor do we use new technology.*" The testimony revealed a tension between manual labor's physical burden and commitment to inherited practices.

The daily, exhausting routine of weeding, soil preparation, and manual harvesting reflects a knowledge system that prioritizes crop safety and low cash outlay over labor efficiency. Farmers accept this burden because alternatives—herbicides, mechanized weeding, changed methods—are perceived as dangerous, unavailable, or culturally unacceptable. Risk management takes conservative form. Farmers seek stability through proven methods even at high physical cost. Resource scarcity exacerbates this pattern. With limited capital and no institutional technology support, farmers rely entirely on household labor as the primary production input. Resistance to change reflects conviction that inherited methods work and deviation could jeopardize the crop. The absence of external validation for alternative techniques reinforces this conviction. When labor is abundant, the system endures. When labor becomes scarce due to aging, health issues, or competing activities, practices become unsustainable. This pushes farmers toward reduced cultivation or temporary abandonment. *Gregorio's* "*we haven't changed our farming methods*" employs present perfect negation extending absence of change from past through

present. The additive "*nor do we use new technology*" performs a doubling, closing off the possibility of innovation, framing stasis as comprehensive and intentional.

This interpretation aligns with research showing smallholders rely on labor rather than capital for crop maintenance, particularly for agrochemical-sensitive or marginal-land crops (Kumar et al., 2021; Baraibar & Knudsen, 2024). Resistance to modifying core methods aligns with conservative core concepts where practices are held constant through intergenerational validation (Sumayao & Dy, 2025; Nagal, 2025). Native *papaia* preference and refusal to alter planting specifications express tradition-rooted farming identity. Cultural commitment creates technological stasis, functioning as a constraint. Resilience lies in stability and low cash dependency. Fragility lies in the inability to reduce labor demands through safe innovation. This dynamic applies primarily to smallholders with available household labor and strong cultural ties. Farmers with access to labor-saving technology may adopt different strategies. The findings imply that interventions should explore labor-saving innovations that respect traditional knowledge. The analysis is limited by the absence of systematic labor time or household member health data.

Land Access and Resource Scarcity

Land access varied sharply among farmers. The spectrum ranged from complete loss to marginal backyard plots. *Lourdes* reported that a house was being built on the land, leaving no more space to plant. *Ricardo* saw little need to cultivate deliberately because *papaia* grew abundantly on its own in the surrounding area. *Natividad* cultivated the crop only in a backyard, a small domestic space rather than a dedicated field. As *Natividad* stated, "*Just in our backyard*." The testimony revealed a tension between the desire to cultivate *papaia* and the spatial constraints imposed by land conversion and competing land uses.

Land loss forces a shift in the crop's role from a cultivated commodity or managed food source to a purely gathered wild edible. When land is converted to housing, the household's ability to propagate and tend *papaia* disappears. This can push a family from active cultivation to complete abandonment. *Ricardo's* case illustrates an alternative adaptation. Where land is unavailable, or planting is deemed unnecessary because the plant proliferates spontaneously, farmers may transition from cultivators to foragers. This still allows access to the crop but removes the stewardship and control that deliberate cultivation provides. Supply becomes dependent on wild populations that are themselves vulnerable to land use change. Backyard cultivation, as described by *Natividad*, represents a minimal-scale persistence strategy. It keeps the crop within the household's immediate domain, ensuring some access to food even when field land is absent. However, it limits production volume and likely shifts the crop's function entirely toward subsistence. Farmers who lose land may still value *papaia* culturally and nutritionally, but their decision to cultivate is constrained by physical impossibility. Those who forage may perceive cultivation as redundant. Backyard growers adjust their expectations of yield and market participation. The quantity and security of land access shape the decision to continue, adjust, or abandon. The crop's role shifts along a continuum from market good to safety net subsistence to wild food. *Natividad's* phrase "*just in our backyard*" employs the minimizer "*just*" to frame the cultivation space as insignificant and diminished, while the possessive "*our*" asserts a claim of ownership that contrasts with the marginality of the space, performing a tension between pride in cultivation and the reality of spatial limitation.

This interpretation aligns with research on land access, foraging of indigenous vegetables, and the spatial marginalization of traditional crops. The conversion of agricultural land to residential use is a recognized driver of agrobiodiversity loss where traditional crops are often displaced before commercial varieties (Buenavista et al., 2022; Landicho et al., 2023). The reliance on wild or volunteer *papaia* echoes documented patterns across the Philippines where many indigenous leafy vegetables are gathered from field margins, fallow land, and roadsides rather than purposefully cultivated (Buenavista et al., 2022). Backyard cultivation represents a form of household food sovereignty that preserves crop access in the face of land pressure. However, it also signals a retreat from market-oriented production toward purely subsistence use. Cultural identity is deeply interwoven with these land-constrained practices. Even when farmers can no longer plant, the desire to keep *papaia* nearby – whether in a backyard patch or through foraging – reflects the crop's enduring significance as a traditional food. This dynamic applies primarily to smallholders facing land conversion or limited access to agricultural land. Farmers with secure land tenure or larger holdings may face different constraints. The findings imply that land use planning should consider the preservation of spaces for traditional crop cultivation. The absence of systematic data on land tenure security or the size and productivity of backyard plots limits the analysis.

Farmer Perceptions Influencing *Papait* Cultivation Decisions

Table 3 presents the four perception themes – economic viability, cultural significance, ecological adaptability, and operational feasibility – collectively form the Perceptions node of the PCP framework, serving as the cognitive lens through which farmers evaluate whether to continue, adjust, or abandon *papait*. Together, these perceptions translate structural constraints into practical decisions, explaining the crop's persistent yet precarious status in smallholder livelihoods.

Table 3. *Farmer Perceptions Influencing Papait Cultivation Decisions in Central Pangasinan*

Theme	Description	Sub-Category	Significant Statements
Economic Viability and Market Factors	Farmers' perceptions of profitability, market demand, production costs, and income stability that shape their commitment to <i>papait</i> cultivation.	Perceived Economic Viability	"The profit is good if there's a big harvest. The main investment is manpower." (P04)
Cultural Significance and Identity	The role of tradition, heritage, personal consumption, and community practices in maintaining emotional and cultural connections to <i>papait</i> .	Cultural and Traditional Value	"Traditional. Because we plant it by ourselves." (P03)
Ecological Adaptability and Growth Characteristics	Perceptions of <i>papait</i> 's natural growth patterns, resilience, seasonal behavior, and response to environmental conditions.	Ecological and Growth Perceptions	"It really grows a lot and it grows spontaneously. From December to January, there are really a lot of them on the embankments." (P02)
Operational Challenges and Adaptive Strategies	The influence of labor demands, practical feasibility, risk perception, and coping mechanisms on farmers' decisions to continue or abandon cultivation.	Labor and Practical Feasibility Adaptive and Risk-Based Decision Making	"My experience with <i>papait</i> farming is really hard because you spend all day cleaning like plucking the weeds; you clean it every day." (P07) "We manage to overcome them because if the crops are damaged, we replant so that we can earn something." (P07)

Economic Viability and Market Factors

Prices were perceived as historically low and flat. *Aurora* recalled bundles selling for only five pesos and noted that prices remained cheaper than labor warranted. Profitability depended on harvest size. As *Gregorio* stated, "The profit is good if there's a big harvest. The main investment is manpower." The testimony revealed a tension between conditional profitability and cultural value.

Viability is measured through a subjective ledger that weighs modest cash returns against household labor. Farmers recognize that *papait* is not a high-margin crop. However, its low capital character and daily sales rhythm provide a steady income stream within a diversified livelihood portfolio. The conditional nature of cultivation is critical. Production continues only as long as it is profitable. When harvests are large and labor is available, profit justifies continuation. When prices fall, or labor becomes scarce, the same calculus leads to reduced effort. Environmental and market constraints compress profitability. The daily harvest obligation, driven by the crop's phenology, ties economic return to continuous physical availability. *Lourdes* observed that *papait* must be harvested daily because once it flowers, it can no longer be sold. *Gregorio*'s phrase "if there's a big harvest" employs a conditional structure that frames profitability as contingent and uncertain, while "main investment is manpower" elevates labor over capital as the primary economic input.

This interpretation aligns with research showing indigenous vegetables provide accessible market income for resource-poor households (Ndwandwe et al., 2026; Ruben, 2024). Conditional continuation aligns with adoption models emphasizing perceived economic viability as a primary driver (Rosário et al., 2022). The daily harvest cycle exposes farmers to market volatility documented in Philippine vegetable value chains (Lagunda et al., 2025). Cultural identity inflects these perceptions. Compatibility with household labor rhythms and daily income potential are valued as elements of self-reliant identity. This dynamic applies primarily to smallholders with limited capital. Farmers with greater market integration may face different calculations. The findings imply that strengthening market linkages could sustain cultivation. The absence of systematic income data limits the analysis.

Cultural Significance and Identity

Farmers attached deep cultural meaning to *papait*. They described it as a traditional, self-reliant crop. The crop was understood as a shared community resource. *Ricardo* allowed others to take *papait* freely, explaining that it is a vegetable food meant for everyone. Personal consumption reinforced this cultural connection. As *Teresita* stated, "*Traditional. Because we plant it by ourselves.*" The testimony revealed a tension between cultural commitment and economic precarity.

The identification of *papait* as traditional signals an intergenerationally transmitted knowledge system. It is a source of pride and self-reliance. This perception operates as a non-monetary motivator. Farmers derive continuity from growing a crop their predecessors cultivated. The act of sharing transforms *papait* from a private commodity into a communal good. This reinforces social bonds and ensures access to food beyond the household. The practice functions as community-level risk management. The valorization of native identity underscores a cultural preference for authentic, locally adapted crops. Personal consumption cements this cultural value. *Remedios* described cooking the leaves by sautéing them with tomatoes. This creates demand driven by taste, habit, and identity. A farmer may continue planting *papait* even when profits are negligible because the crop embodies tradition and sustains community relationships. *Teresita's* phrase "*Traditional. Because we plant it by ourselves*" employs a causal structure elevating self-reliance as the foundational justification for tradition.

This interpretation aligns with research on moral economies where farmers balance economic gains against heritage and community obligation (Larsson et al., 2022). Food sharing norms are documented in indigenous Philippine communities (Buenavista et al., 2022). Native variety preference echoes agrobiodiversity conservation arguments (Maghirang, 2025). Culinary use underscores food culture in maintaining crop diversity (Macusi et al., 2023). Cultural significance functions as a counterweight to economic constraints. This dynamic applies primarily to smallholders with strong cultural ties. Farmers with weaker attachment may face different motivations. The findings imply interventions should support cultural dimensions of traditional crop cultivation. The absence of systematic data on sharing practices limits the analysis.

Ecological Adaptability and Growth Characteristics

Farmers perceived *papait* as a naturally self-propagating crop with strong seasonal rhythms. *Lourdes* described placing old flowering plants on the ground and watching them grow without further intervention. *Teresita* noted that seeds drop onto the soil and sprout around the same season each year. The crop was seen as persistent. However, ecological adaptability had limits. Farmers recognized *papait* was highly sensitive to excessive moisture. As *Lourdes* stated, "*During the rainy season the plants rot when the soil becomes too wet.*" The testimony revealed a tension between resilient self-propagation and vulnerability to climatic extremes.

The knowledge system is experiential and observational, built on intimate familiarity with the plant's life cycle. Farmers know when *papait* appears, how it reproduces, and what conditions threaten it. Self-propagation and seasonal predictability lower establishment risk and eliminate seed costs. This directly addresses resource scarcity. The perception of persistence reinforces the crop's role as a reliable safety net. Farmers trust that *papait* will reappear without replanting. However, this confidence is balanced by recognition of vulnerability. Sensitivity to waterlogging constrains production during the wet season. Farmers manage this by aligning cultivation with cooler, drier months. The crop is perceived as simultaneously resilient and fragile. It is a hardy self-seeder that cannot withstand excess water. This duality positions *papait* as a low-input, seasonally available subsistence food. *Lourdes's* phrase "*the plants rot when the soil becomes too wet*" employs a plain factual construction collapsing environmental condition into inevitable consequence. The definitive tense "*becomes*" frames wet soil not as a variable but as a certainty.

This interpretation aligns with research showing ethnoecological knowledge enables farmers to manage crops with minimal inputs (Kamakaula & Fenetiruma, 2024; Sumayao & Dy, 2025). Farmers value volunteer crops for reducing labor under resource scarcity (Buenavista et al., 2022). Rain sensitivity awareness informs seasonal calendars as climate risk management (Nagal, 2025). Cultural identity is woven into these perceptions. The characterization of *papait* as native resonates with preference for locally adapted plants. This dynamic applies primarily to smallholders with secure land and established knowledge. Farmers facing erratic rainfall may face different constraints. The findings imply interventions should support existing ecological knowledge. The absence of systematic yield variability data limits the analysis.

Operational Challenges and Adaptive Strategies

Farmers described *papait* cultivation as labor-intensive and operationally demanding. The daily routine of weeding and cleaning consumed entire days (*Aurora*). Harvest and marketing schedules were grueling, with early starts and returns after midday (*Aurora*). Some farmers had paused or stopped due to life stage changes. *Aurora* farmed for 20 years but stopped when children graduated. *Natividad* had farmed for 10 years but did not plant in the current year. Abundant wild growth discouraged deliberate planting. *Ricardo* questioned why they would plant when so much *papait* was already growing around them. As *Gregorio* stated, "*It's a 50/50 gamble, determined by weather conditions.*" The testimony revealed a tension between labor demands and adaptive responses.

The knowledge system is pragmatic and experiential. Farmers learned that *papait* demands consistent physical effort and unpredictable weather can wipe out investment. The "50/50 gamble" perception captures the risk assessment underpinning every decision. In response, farmers developed a repertoire of adaptive practices. Replanting is a low-cost, self-directed recovery mechanism. *Aurora* stated they replant damaged crops so they can still earn something. Animal manure salvages flooded crops by repurposing locally available inputs. Dry season planting reduces exposure to the crop's primary environmental vulnerability. Decisions to stop or pause are shaped by operational feasibility. When household labor is redirected, maintaining *papait* may no longer be justifiable. When wild growth is abundant, deliberate cultivation appears redundant. Farmers shift from cultivators to foragers, adjusting engagement rather than fully abandoning the crop. *Gregorio's* "50/50 gamble" employs a metaphor of chance, framing cultivation as probabilistic. The additive "*determined by weather conditions*" transfers agency from farmer to environment.

This interpretation aligns with research on smallholders viewing production through a probabilistic lens (Touch et al., 2025; Rosário et al., 2022). Replanting exemplifies adaptive capacity in resilience theory (Colting Pulumbarit et al., 2018; Landicho et al., 2023). Animal manure use reflects creative repurposing without formal technical support (Paller et al., 2021). Decisions to pause reveal labor allocation as a central mediating variable. Even when farmers stop planting, they retain knowledge and intention to resume. This dynamic applies primarily to smallholders with flexible labor arrangements. Farmers with more rigid commitments may face different constraints. The findings imply interventions should support flexible engagement. The absence of systematic data on cultivation pause duration limits the analysis.

Conclusion

This study documented the cultivation practices and the barriers faced by *papait* farmers in Central Pangasinan. The literature lacked systematic documentation of indigenous vegetable systems. Municipal agricultural profiles had no record of *papait*, and no official farmer associations existed. This gap left farmers without institutional recognition or support. The qualitative inquiry included 11 smallholder farmers across four municipalities.

The findings converge on a single story. *Papait* cultivation persists not because it is profitable but because it is culturally embedded and ecologically self-sustaining. Farmers maintain traditional practices for land preparation, propagation, fertilization, pest control, and harvest. These demand minimal cash outlay but considerable labor. Environmental pressures (flooding, pests) and economic constraints (price volatility, institutional neglect) compress returns. Labor demands and land scarcity further strain the system. The decision to continue reflects a weighing of these constraints against cultural significance and subsistence value. Farmers persist because *papait* provides a reliable fallback food and embodies intergenerational identity. However, this persistence remains precarious, as the "50/50 gamble" perception indicates.

The theoretical contribution extends the PCP Framework by demonstrating that indigenous knowledge systems operate through a "conservative core" of stable practices and an "adaptive periphery" of flexible responses. This configuration enables persistence under structural constraints but reveals vulnerability. When labor or land is lost, the system can collapse despite cultural attachment. This challenges the traditional-innovative binary. Adaptation occurs through incremental, culturally embedded adjustments. The pragmatic contribution is equally clear. Municipal agriculturists and extension agents should integrate *papait* into vegetable programs by updating agricultural profiles and piloting collective marketing through farmer associations. These minimal-investment actions could improve price stability and reduce farmers' isolation.

The findings must be interpreted within boundary conditions. The qualitative design (N=11, four municipalities)

provides depth but not statistical generalizability. The female-majority sample (63.6%) may not represent male farmers, and permanent abandoners were not included. Their perspectives may differ from current cultivators¹. These limitations do not invalidate the core conclusions. Themes were consistent across participants and reflected the range of reported experiences. Readers should apply these findings cautiously to other geographic contexts, other indigenous vegetable systems, or male-dominated farming populations.

Future research must address these boundary conditions directly. The next study should employ a mixed-methods design across a larger, wider geographic sample. Researchers should track farmgate prices, labor allocation by gender and age, and extreme weather frequency and yield impact across multiple growing cycles. The study should include permanent abandoners. Participatory workshops should co-design interventions including collective marketing, labor-saving technologies, and community-managed post-harvest solutions.

Smallholder farmers in the Global South face climate variability, limited capital, and weak institutional support, and adoption of innovations remains low. The findings demonstrate that low adoption is not a farmer failure but an institutional failure to recognize and support valued knowledge systems and crops. Papait cultivation persists because it is culturally meaningful, ecologically adapted, and practically manageable within existing constraints. Targeted institutional recognition and farmer-led policy dialogue can enhance agrobiodiversity, food security, and livelihood resilience. Sustaining traditional crops requires not replacing indigenous knowledge with external innovations, but strengthening the foundations that already sustain them.

Contributions of Authors

Author 1: conceived the study, gathered and analyzed the data, wrote the proposal, and drafted the report.

Author 2: interpreted the data, ensured quality assurance and auditing, oversaw project implementation, and secured the necessary research permits.

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Conflict of Interests

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