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Learning Sites for Agriculture (LSA) as an Extension Delivery Pathway

Jennifer P. Miranda*[1], Victoriano V. Casco,Ph.D.[2], Jhimcelle V. Salvador[3]
[1,2,3] Isabela State University, Echague Campus, Echague, Isabela, Philippines
*Corresponding Author e-mail: *mirandajenniferp@gmail.com*

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Abstract

Aim: This study aimed to assess the socioeconomic profile, services rendered, capacity-building needs, enabling and limiting factors, and physical development of Rice Competitiveness Enhancement Fund – Learning Site for Agriculture (RCEF-LSA) owner-operators in Isabela. It also sought to evaluate the effectiveness of various nutrient management strategies in rice production.

Methodology: A total of 28 LSA owner-operators in Isabela were surveyed using a structured questionnaire and one-on-one interviews, coordinated with local government units. Data were analyzed to determine profiles, services, challenges, and training needs. To validate findings, a field experiment was conducted at the A.R. Santiago Agri-Fishery Farm & Training Center in San Mateo, Isabela, testing seven nutrient management strategies in rice production. The trial covered a 300 m² area, using a randomized complete block design, and measured yield, income, and return on investment (ROI).

Results: Most LSA operators were male (67.86%), over 60 years old (35.71%), college-educated (78.56%), and had significant agricultural experience (75%). Extension services mainly focused on rice farming, with regular training sessions conducted for farmers, students, and local stakeholders. Enabling factors included strong institutional and family support, while major challenges were limited funding, unfavorable weather, and insufficient technical assistance. Capacity-building needs focused on technical agriculture, leadership, and communication skills, with a preference for face-to-face, hands-on training. While infrastructure was generally adequate, concerns about sustainability and funding remain. In the field trial, the Minus One Element Technique (MOET) produced the highest yield (8,303.27 kg/ha), net income (₱56,278.52), and ROI (66.31%). The Abonong Swak package (T7) offered a cost-effective alternative with a 56.88% ROI. The Farmer's Practice (T1) also showed acceptable results under resource-limited conditions.

Conclusion: The study highlights the critical role of RCEF-LSA owner-operators in agricultural extension and rice production in Isabela. While they exhibit strong potential through established experience, infrastructure, and training activities, significant challenges–particularly in funding, technical support, and sustainability—remain. Addressing these constraints through targeted capacity-building programs and institutional support can enhance the effectiveness and long-term viability of LSAs. Additionally, the field validation underscores the importance of adopting site-specific nutrient management technologies, such as MOET and Abonong Swak, to improve productivity and economic returns in rice farming.

Keywords: Learning Site for Agriculture (LSA), Rice Competitiveness Enhancement Fund (RCEF), Nutrient management, Minus One Element Technique, Zero hunger

INTRODUCTION

Agriculture remains a vital yet challenging sector in the Philippines, facing issues such as population growth, land conversion, climate change, and declining enrollment in agriculture courses (Agricultural Training Institute [ATI], 2017). Despite these challenges, the country continues efforts to ensure food security.

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Agriculture employs approximately 24% of the Filipino workforce and contributes around 8.9% to the national GDP (Philippine Statistics Authority, 2022; World Bank, 2023). Its role in food production, rural development, and poverty reduction underscores its economic and social importance.

The Department of Agriculture (DA) promotes agricultural development, while the Agricultural Training Institute (ATI) leads extension and training efforts. Among ATI's various programs is the Learning Site for Agriculture (LSA), under the Rice Competitiveness Enhancement Fund – Rice Extension Services Program (RCEF-RESP). LSAs are model farms that demonstrate applicable technologies and serve as venues for training, hands-on learning, and extension delivery.

In 2022, ATI launched the EdGE (Educational Grants for Extension Workers) program, supporting agricultural professionals pursuing graduate studies. One focus of the program is research on LSAs under RCEF-RESP, emphasizing the importance of enhancing rice productivity and competitiveness.

This study focuses on RCEF-LSA sites in Isabela, aiming to evaluate their socioeconomic profiles, services, challenges, capacity-building needs, and physical infrastructure. It also includes a field trial on nutrient management technologies promoted by LSAs. The study aligns with several Sustainable Development Goals (SDGs), particularly Zero Hunger (SDG 2), Good Health and Well-being (SDG 3), Responsible Consumption and Production (SDG 12), Climate Action (SDG 13), and Life on Land (SDG 15), by promoting sustainable, efficient, and climate-resilient farming practices.

Objectives

The study assessed the LSAs as an extension delivery pathway of the ATI-RTC2 in the Province of Isabela. The specific objectives are the following:

1. determine the socioeconomic profile of the LSA owner-operators in terms of Age, Sex, Educational Attainment, Years of Experience in Agriculture, LSA owner-operator in the field, Years as LSA, Status of LSA, Farm size, Land ownership, Training, and seminars attended.
2. determine the services rendered and clientele served by the LSA owner-operators.
3. identify the facilitating and hindering factors by the LSA encountered in implementing ATI programs.
4. identify capacity-building needs of the LSAs as agents of extension service delivery.
5. evaluate the productivity and income from rice nutrient management technologies implemented by LSA's, using the data derived from the survey study.

METHODS

Research Design

This study utilized a combination of survey research design and a field experiment. The survey aimed to gather data from RCEF-certified Learning Sites for Agriculture (LSAs) in the Province of Isabela to determine their status, operations, challenges, and capacity-building needs. Meanwhile, the field experiment was conducted to validate the effectiveness of various nutrient management practices in rice farming, as taught by the RCEF-LSAs.

Population and Sampling

The survey covered 28 RCEF-LSAs in Isabela, Region 02, Philippines. These included active and inactive. Despite their varied operational status, all were included to evaluate their strengths, weaknesses, and intervention needs. For the field experiment, one RCEF-LSA—A.R. Santiago Agri-Fishery Farm and Training Center in Barangay Gaddanan, San Mateo, Isabela, was selected as the experimental site due to its suitable location, facilities, and continuous irrigation support.

Instrument

A structured questionnaire was used as the primary research instrument for the survey. It was designed to gather relevant data aligned with the study's objectives, including demographic information, services rendered, operational factors, and capacity-building needs. For the field experiment, standard protocols and kits such as the Minus One Element Technique (MOET) and Rice Crop Manager (RCM) were utilized to assess soil health and guide nutrient management treatments.

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Data Collection

Data for the survey were obtained through one-on-one interviews with the LSA owner-operators. The interviews were coordinated with local government units and barangay officials to ensure availability of the respondent and cooperation. Prior to each interview, the contents of the questionnaire were discussed to facilitate accurate responses. The interview process lasted two months. Field experiment data collection included land preparation, soil sampling and analysis, seedling production, transplanting, and implementation of various fertilizer treatments. Treatments included Farmers' Practice, Soil-Analysis-Based Recommendation, RCM, MOET, Soil Analysis with Leaf Color Chart, and Balanced Fertilization Strategy (BFS) with varying yield targets.

Treatment of Data

All data gathered from the survey were collated, summarized, and subjected to descriptive statistical analysis, focusing on frequencies, means, and percentages to present demographic and operational profiles of LSAs. For the field experiment, quantitative data on crop growth and yield under each treatment were analyzed using appropriate statistical tools to determine the effectiveness of each nutrient management approach.

Ethical Considerations

The researchers sought permission to access data from the Agricultural Training Institute – Regional Training Center 2 (ATI-RTC 2) via a formal request letter. Respondents were informed of the study's purpose, and informed consent was obtained before interviews. Participation was voluntary, and confidentiality of all information gathered was ensured. The research adhered to ethical standards in conducting both the survey and the field experiment.

RESULTS and DISCUSSION

This section discusses the study's findings based on the data gathered from RCEF-LSA respondents in Isabela. It focuses on the socioeconomic profile of the participants. It integrates the results of the experimental design related to nutrient management, which was implemented on the farm of one of the LSA operators. The discussion aims to understand the respondents' background and the practical outcomes observed from the nutrient management interventions.

Socioeconomic Profile of RCEF-LSA Cooperator. The table below presents the socioeconomic profile of the RCEF-LSA operators in Isabela. It reveals that significant trends are relevant to agricultural development and extension programming.

Table 1. Socioeconomic profile of RCEF-LSA operators in Isabela in terms of Profile variables

Profile	**Cluster**	**Frequency (n=28)**	**Percentage (%)**
	21 – 30	3	10.71
Age	31 – 40	1	3.57
	41 – 50	8	28.57
	51 – 60	6	21.43
	Over 60	10	35.71
Sex	Male	19	67.86
	Female	9	32.14
Educational Attainment	High School graduate	1	3.57
	Vocational/ Technical	1	3.57
	Bachelor's Degree	22	78.56
	Less than 5	1	3.57
Years of experience in	5 – 10	6	21.43

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Agriculture	11 – 20	21	75.00
	0.5 – 1.0	161	72.85
	1.1 – 1.5	42	19.00
Status of LSA	Active	24	85.71
	Inactive	4	14.29
	0.5 – 1.0	5	17.86
Farm Size	1.1 – 1.5	2	7.14
	1.6 – 2.0	4	14.29
	2.0 up	14	50.00
	Owned	24	85.71
Land Ownership	Shared	1	3.57
	Government	2	7.14
	others	1	3.57
	Rice	28	100.00
	Livestock	13	46.43
	Corn	10	35.71
Type of Training and Seminars Attended	HVCC	13	46.43
	Fisheries	13	46.43
	Coconut	6	21.43
	Organic	19	67.86
	RCEF	28	100.00
Sources of	Local Government Unit	15	53.57
Technical Support/ Assistance	Department of Agriculture	28	100.00
Availed	Private Companies/ Organizations	4	14.29

Most respondents were aged 41 and above, with 35.71% over 60 years and 28.57% between 41 and 50 years, reflecting the aging profile of Filipino farmers, as the Philippine Statistics Authority (2021) reports an average age exceeding 57 years. Male operators predominated (67.86%), aligning with traditional gender roles in agriculture, where men often control farm ownership and decision-making (Food and Agriculture Organization [FAO], 2019). Notably, 78.56% held a bachelor's degree, higher than the national average for farmers, suggesting favorable conditions for technology adoption and training uptake, as linked by Bordey et al. (2018).

In terms of farming experience, 75% had worked in agriculture for 11 to 20 years, reflecting substantial field knowledge. Most Learning Sites for Agriculture (LSAs) were active (85.71%) and located on farms larger than two hectares (50%), consistent with Department of Agriculture standards for demonstration farms (ATI, 2020). Land ownership was also high (85.71%), a factor associated with greater investment in long-term productivity and sustainability (FAO, 2018).

All respondents were engaged in rice farming—the core of RCEF programs—but many also practiced diversification: livestock (46.43%), corn (35.71%), high-value crops (46.43%), and fisheries (46.43%). This reflects findings by Cuyno et al. (2020) on diversification enhancing income and resilience. Additionally, all had attended RCEF training, with many also involved in organic farming (67.86%) and coconut farming (21.43%), indicating a strong commitment to innovation and capacity-building (Gerpacio et al., 2016). While all received technical support from the Department of Agriculture and over half from local governments, only 14.29% reported private-sector support, suggesting a need to enhance public–private partnerships.

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Services Rendered and Clientele Served by RCEF-LSA Owner-Operators

This section shows the types of services rendered and the clientele served by RCEF-LSA owner-operators in Isabela.

Table 2. Services Rendered and Clientele Served by RCEF-LSA Owner-Operators

Particular	Cluster	Frequency (n=28)	Percentage (%)
Type of Training Conducted For the Clientele	Rice	28	100.00
	Livestock	5	17.86
	Corn	2	7.14
	HVCC	6	21.43
	Fisheries	2	7.14
	Organic	12	42.85
	RCEF	28	100.00
Number of Trainings Conducted	1 – 3	2	7.14
	4 – 5	2	7.14
	5 – 10	5	17.86
	Above 10	19	67.86
Frequency of training conducted	Weekly	28	100
	Others (daily)	10	35.71
Type of participants trained.	Farmers	28	100.00
	Farm Youth	20	71.43
	LGU AEWs	19	67.86
	LGU Officials	18	64.29
	Agency Personnel	15	53.57
	NGOs	14	50.00
	Private Groups	18	64.29
	SUC Personnel	16	57.14
	Students	18	64.29
	Tourist	15	53.57

All respondents conducted rice-related training in alignment with RCEF's objective of improving rice productivity through knowledge dissemination (Department of Agriculture, 2020). Some extended this to livestock (17.86%), high-value crops (21.43%), organic agriculture (42.85%), corn (7.14%), fisheries (7.14%), and coconut farming (0%), showing responsiveness to community needs and promoting integrated, sustainable farming (ATI, 2020).

Most operators (67.86%) had conducted over ten training sessions, all every week, reflecting a strong institutional commitment to farmer-to-farmer extension (Rivera & Alex, 2008). Trainees included farmers, youth, LGU extension workers, NGOs, private companies, students, and tourists, positioning LSAs as multi-sectoral hubs for capacity-building and agri-tourism (Pascual et al., 2019). Youth and academic involvement promote innovation and address generational gaps, aligning with ATI's vision of resilient, empowered rural communities (ATI, 2020).

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Facilitating and hindering factors

This section outlines the key facilitating and hindering factors encountered by RCEF-LSA owner-operators in Isabela.

Table 3. Facilitating and hindering factors encountered by RCEF-LSA owner-operators in Isabela

Particular	Cluster	Frequency (n=28)	Percentage (%)
Facilitating Factors	Supportive organization	17	60.71
	Supportive family	19	67.85
	Supportive LGU	17	60.71
	Support from other agencies	15	53.57
	Available land area of the family	16	57.14
	Adequate land area of the family Technical	14	50.00
	Assistance from LGU	16	57.14
	Financial assistance from LGU	6	21.43
	Favorable weather condition	16	57.14
	Strong personal conviction	18	64.29
	others, please specify	1	3.57
Hindering Factor	Lack of/ no Support from organization	5	17.86
	Lack of/ no Support from family	3	10.71
	Lack of/ no Support from the LGU	5	17.86
	Lack of/ no Support from other agencies	7	25.00
	Inadequate land area for the family	1	3.57
	Lack of/ no support from Technical Assistance from LGU	5	17.86
	Lack of/ no support from Financial assistance from LGU	6	21.43
	Lack of/ no support from Financial assistance from DA	3	10.71
	Unfavorable weather conditions	18	64.29
	Weak personal conviction	1	3.57
	Others, please specify	3	10.71

Key facilitators identified (Table 3) included supportive families (67.85%), strong personal conviction (64.29%), and organizational or LGU backing (60.71%). Technical and financial assistance from LGUs (57.14%) and favorable weather (57.14%) also supported LSA operations and knowledge transfer (Quizon et al., 2004). Conversely, the main constraint was unfavorable weather (64.29%), highlighting climate-related vulnerabilities (Lasco et al., 2011). Other barriers included limited agency support (25%), insufficient LGU aid (21.43%), and technical assistance gaps (17.86%). Few cited weak motivation (3.57%) or family support (10.71%) issues, reinforcing the operators' high intrinsic drive. Land access was not a concern, consistent with data in Table 1.

Capacity-building needs of RCEF-LSA owner-operators in Isabela

This section presents the capacity-building needs of RCEF-LSA owner-operators in Isabela.

Table 4. Capacity-building needs of RCEF-LSA owner-operators in Isabela

Particular	Cluster	Frequency (n=28)	Percentage (%)

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Training or capacity-building programs received	Always	16	57.14
	Sometimes	12	42.86
Effectiveness	Highly effective	22	78.57
	Moderately effective	6	21.43
Specific areas of capacity-building are essential for improving extension service delivery	Technical skills in agriculture	23	82.14
	Communication and interpersonal skills	21	75.00
	Leadership and management skills	21	75.00
	Innovative farming techniques	24	85.71
	Data collection and analysis	17	60.71
	Workshops	25	89.29
	Online courses	5	17.86
	On-site mentoring	20	71.43
	Webinars	4	14.29
Prefer to receive training or capacity-building support	Printed materials/manuals	14	50.00
	Establish technodemo	1	3.57
	Access to funding/grants	20	71.43
	Access to technology and equipment	17	60.71
	Networking opportunities		
	Support from government agencies	11	39.29
Resources or support systems you feel are lacking in your current role as an extension service provider?	Collaboration with research institutions	15	53.57
	Other (Please specify)	8	28.57
	Grants on Machinery to LSA	1	3.57

Table 4 reveals that 57.14% of respondents "always" received training, while 42.86% did so only "sometimes," indicating generally consistent—but improvable—exposure to capacity-building. Most found the training highly effective (78.57%), while others rated it moderately effective (21.43%). Training needs included innovative farming techniques (85.71%), technical skills (82.14%), communication (75%), and leadership (75%), indicating a demand for both technical and soft skills (Rivera & Sulaiman, 2009; Van den Ban & Hawkins, 1996).

Preferred modalities were workshops (89.29%), on-site mentoring (71.43%), and printed materials (50%), while online options such as webinars (14.29%) and online courses (17.86%) were less favored, likely due to rural connectivity challenges (Asian Development Bank [ADB], 2020). A few respondents (3.57%) suggested technology demonstration sites, underlining the value of experiential learning.

Critical support gaps were also noted: limited funding/grants (71.43%), inadequate technology/equipment (60.71%), and weak institutional collaboration (53.57%). Fewer cited weak networking (39.29%) or lack of partnerships with research institutions (28.57%), pointing to the need for broader institutional and resource support to sustain agricultural innovation and extension (Anderson & Feder, 2007; World Bank, 2012). In particular, machinery grants for LSAs are essential to enhance demonstration capacity.

Productivity and income from rice nutrient management technologies.

This section presents the effectiveness of seven nutrient management strategies in rice production.

Table 5. Productivity and income from different rice nutrient management technologies

	MEANS									
TREATMENTS	PLANT HEIGHT	Number of Productive Tillers per Hill	Number of Filled Grains per Panicle	Total Number of Spikelets per Panicle	Spikelet Fertility (%)	Weight of 1000-grains	Yield per hectare	Total cost of production	Net income	ROI
T_1- Farmer's Practice	126.08	153	153	198	77.33	22.06	6,329.61ab	69,985.88	37,617.54	53.75

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T_2 - Soil-Analysis Based Fertilizer Recommendation	120.83	141.67	141.67	182	78	23.81	6,585.57ab	77,357.78	34,597.00	44.72
T_3 – Rice Crop Manager (RCM)	122.17	126	126	177.33	71.33	22	5,323.52b	70,402.45	20,097.34	28.55
T_4 – Minus One Element Technique (MOET)	122.83	128.67	128.67	172	75	23.75	8,303.27b	84,877.03	56,278.52	66.31
T_5 - Soil Analysis with Leaf Color Chart	120.08	128.67	128.67	183.67	70.33	22.61	6,574.26ab	77,793.28	33,969.13	43.67
T_6 – Abonong Swak (7000-8000kg/ha)	119.92	120	120	179	67	22.83	6,650.70ab	77,258.98	35,802.89	46.34
T_7 – Abonong Swak (5000-6000kg/ha)	123.17	116.33	116.33	174.33	66.67	22.74	6,299.16ab	68,260.20	38,825.48	56.88
F- RESULTS	1.02 ns	0.79 ns	2.13 ns	0.34 ns	4.24 ns	2.37 ns	3.23 ns			
C. V. (%)	3.03	9.41	11.53	14.04	5.42	3.58	12.95			

Table 5 presents agronomic and economic data on rice nutrient management technologies. Plant height varied modestly (119.92–126.08 cm) without significant differences, suggesting it may not be a reliable nutrient management indicator (Tabile et al., 2021; Singh et al., 2019). Taller plants may also increase lodging risk (Buresh et al., 2010). Productive tillers ranged from 19.67 (Farmer's Practice) to 22.67 (Abonong Swak), with scientifically guided methods generally performing better, though not significantly, indicating site-specific approaches may confer agronomic benefits (Dobermann & Fairhurst, 2000; Cassman et al., 2002).

Spikelets per panicle ranged from 172 (MOET) to 198 (Farmer's Practice), with no significant differences, likely due to environmental or genetic variation. Despite higher spikelet numbers in T1, site-specific methods like Soil Analysis and LCC performed comparably (Peng et al., 1996; Dobermann & Fairhurst, 2000). Slightly lower counts in MOET and Abonong Swak may suggest nutrient balance issues (Fageria et al., 2011).

Significant variation was observed in spikelet fertility ($F = 4.24$, $p < 0.05$), with the highest rate under Soil Analysis (78.00%) and the lowest under Abonong Swak (66.67%). This highlights the value of site-specific nutrient application during reproductive stages (Dobermann & Fairhurst, 2000; Fageria et al., 2011). Thousand-grain weight varied slightly, from 22.00 g (RCM) to 23.81 g (Soil Analysis), with MOET also yielding well, suggesting balanced nutrient inputs promote grain filling (Fageria, 2007).

Grain yield varied significantly ($F = 3.23$, $p = 0.0397$), with MOET (T4) achieving the highest yield (8,303.27 kg/ha) and RCM (T3) the lowest (5,323.52 kg/ha). T6 and T2 also yielded over 6,500 kg/ha, reinforcing the advantages of tailored nutrient management (Dobermann & Cassman, 2004; Ladha et al., 2005).

Economic data revealed that while MOET had the highest input cost (₱84,877.03), it also produced the highest net income (₱56,278.52) and ROI (66.31%). In contrast, RCM had moderate costs (₱70,402.45) but yielded the lowest ROI (28.55%). Abonong Swak presented a viable, cost-effective alternative (ROI 56.88%), while Farmer's Practice remained competitive (ROI 53.75%), possibly due to local optimization. These findings reflect De Datta's (1981) emphasis on balancing input costs and returns, underscoring the need to integrate agronomic efficiency with economic viability in selecting nutrient management strategies.

Conclusion

The RCEF-LSAs in Isabela serve as crucial platforms for agricultural extension and the dissemination of innovative practices. They have made notable progress in infrastructure development, training delivery, and community outreach. Most operators are well-educated, experienced, and highly committed, supported by key stakeholders such as the Department of Agriculture, local government units (LGUs), and select private sector partners. However, systemic challenges persist, including inadequate financial resources, limited technical capacity, and underutilization of diversified farming practices. Addressing these issues is essential to fully realize the potential of LSAs in advancing rural transformation and sustaining farmer education.

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The study further highlights the significant impact of nutrient management strategies on rice yield and farm profitability. Although high-input treatments like MOET (T4) delivered the highest yield and net returns, cost-effective options such as Abonong Swak (T7) achieved competitive returns on investment (ROI) with minimal capital. The Farmer's Practice (T1) also demonstrated viable outcomes, underscoring the practical value of traditional methods under resource-constrained conditions. Statistical analysis confirmed significant differences in yield across treatments ($p = 0.0397$), though not all pairwise comparisons were statistically distinct, as indicated by the HSD test.

Recommendations

To enhance the effectiveness of RCEF-LSAs, targeted financial support should be allocated for infrastructure development, acquisition of agricultural equipment, and the adoption of modern technologies. Capacity-building initiatives must be broadened to encompass technical, managerial, and communication skills, delivered through practical, community-based training programs that promote farmer-to-farmer learning.

Strengthening collaboration among LSAs, government agencies, state universities and colleges (SUCs), and private sector partners is essential to ensure sustained support, resource sharing, and continuous knowledge exchange.

For nutrient management, the Minus One Element Technique (MOET) is strongly recommended due to its superior performance in terms of both yield and return on investment (ROI) at 66.31%. Abonong Swak (T7) also presents a viable, cost-effective alternative with a competitive ROI of 56.88%, making it suitable for resource-constrained farmers. Conversely, the use of the Rice Crop Manager (RCM) warrants caution, as it underperformed in field trials. Its effectiveness may be improved when integrated with site-specific approaches such as MOET and soil analysis-based recommendations.

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