Case Study

Input Reduction in Agroecological Practices: A Case of Local Practices in Horticulture Production in North-West of Cambodia

Overview

This case study has been documented in the small grant of Agroecology Learning Alliance in South East Asia (ALiSEA) in 2022 under the project titled "Multidimensional Evaluation of Agroecological Performance in Battambang Initiative, Cambodia (MuLAgE)". Locating in north-west of Cambodia, Battambang is a well-know province in agricultural productions especially rice.

The production systems are variable in according to the landscape of the area. In upland area, for instance, cash crops (cassava and maize) and perennial crops (mango and logan) are common system while in the lowland, it is observed mainly paddy rice and horticulture production. Pesticides based production was reported in both areas with production in upland area for off-season and rice rainfed production, especially 2nd cycle of rice production (Kim and Peeters, 2020; Kong and Castella, 2021). It was reported that there were approximately 5-6 applications of pesticides in the 2nd cycle of paddy rice while it was lower in the 1st cycle.

Agroecological practices have also been promoting actively in the area by different institutions and projects at national local levels. For instance, the conservation agriculture mainly focused on innovative practices including reducing tillage, diversification of crops, cover crop promotion and mechanization toward the sustainable intensification implemented by Cambodia Conservation Agriculture and Sustainable Intensification Consortium (CASIC). With these efforts, it is believed that understanding of performance and challenges of the agroecological transition would be both beneficial to the enhancing of interventions and

Objective of the Case

The main objective of this case study is to document and promote the agroecological practices of input reduction of local farmers in the community of Battambang province by highlighting the best practices and challenges in implementation.

Methodology

This case study was considered element "Input Reduction" is one of 13 elements from High-Level Panel of Expert (with level of transition (Gliessman, 2007; HLPE, 2019) (Fig. 1). This element provides valuable insights into optimizing resources usage, enhancing efficiency, and minimizing external inputs while maintaining or increasing productivity.

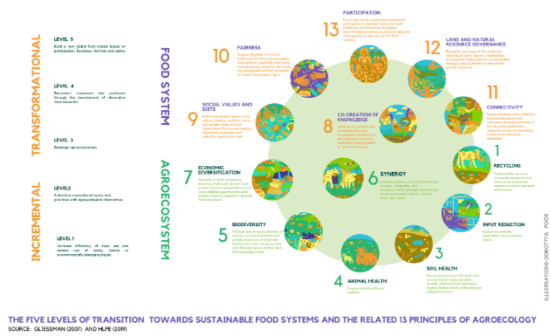

Fig. 1 The five levels of transition towards sustainable food systems and the related 13 principle of agroecology

This study used mixed qualitative and qualitative methods including households' interviews by using Tool for Agroecology Performance and Evaluation (TAPE) (FAO, 2019), key informant interviews, focus group discussion (FGD), field observation, participatory analysis with stakeholders in Battambang province, and interviewed a model farmer as a member of Sustainable Soil for Life Association (SSLA) related to using internal materials at the farms and communities to produce natural fertilizers and bio-pesticides (Fig. 2). It provides insights into effective strategies for optimizing agricultural inputs in agroecology context, contribute to sustainable and resources efficient farming practices.

Fig. 2 Methodology used in the study

Results

Results from TAPE Survey

The overall score of characterization of agroecological transition (CAET) was 37.42% indicating a relatively low levels of element synergies, efficiency, and recycling across the farm assessed (Fig. 3). Specifically, efficiency element obtained lowest meaning that the farms heavily relied on external inputs like fertilizers, pesticides, seeds, labour, rental services, and other sources. Farmers prioritized chemicals over ecological management for production with 78.33% emphasizing their important. In addition, farmers used an average 5.4 types of pesticides and 92.50% not using organic pesticides.

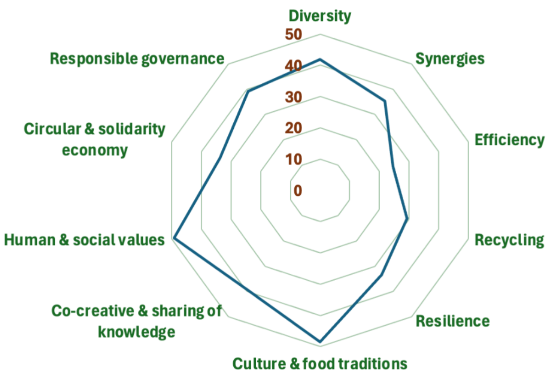

Fig. 3 Characterization of agroecological transition (CAET) in upland and lowland of Battambang

Lower than 10% of farms achieved a CAET score greater or equal 50% (>=50%) expressing that limited reliance on on-farms and/or community-exchanged inputs. Input expenditures (fertilizers, pesticides, and seeds) invested 2,625,400 and 1,286,800 Cambodia riels per hectare per year in 2022 in lowland and upland areas, respectively. With a notable 45% of total expenditures occurred higher expense in lowland. According to FGD, most of farms in upland and lowland applied pesticides for off-season and 2nd cycle of paddy rice with an average 6 application.

Participatory Analysis

During participatory analysis, various key areas identified to improve the situation for independence of external inputs for agricultural production. Stakeholders identified three main activities including ability of farmers to save and recycle nutrients in their own farms, strengthening the agroecological practices to reduce chemical uses, and learning new technologies to maximize the yield and cost (Fig. 4).

Besides these, facilitation of the value chain of the products is important and demanded by the farmers in terms of securing stable demand and enough margins for production. This could be happened from the local and available demanded. In this regard, the products could be produced and consumed in a short value chain. The quality of products requires to be ensured for local consumers where participatory guarantee system (GPS) could be helpful for this exception. The cost reduction could be feasible with mechanization and economic of scales. For stakeholder perspectives, effectiveness of inputs for production via research and development as well as collective actions should be prioritized to facilitate agroecology practices (Fig. 4).

Agroecological practices have promoted and applied by the farmers in farming system with different levels in accordance to their abilities and capacities, while 10% of studied population were in transitional stage toward agroecology.

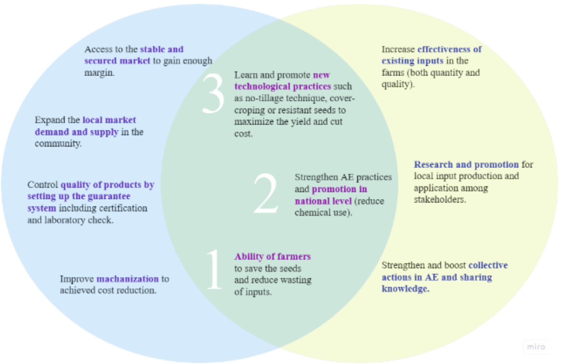

Fig. 4 Participatory analysis with stakeholders in Battambang province

Based on field observation of SSLA's farmer, it was observed that Mr. Sin Sivnourn made his own way to reduce dependency on external inputs for horticulture production (Fig. 5) Living in Kampong Seima village, Wat Kor commune, Battambang city, Battambang province, he would like to be a good farmer producing and applying safe vegetables through PGS. With his commitment, he received varies supports from different organizations in the area to build capacity in agroecology practices. He also designed his small-scale farm to be more autonomous and independent from internal inputs.

According to farming system design by him (Fig. 5), the emphasis is replaced on minimizing external inputs while utilizing a combination of purchased materials/inputs and locally resources. External inputs include fish powder, rice bran, rice husk charcoal, molasse, and other ingredients, obtaining from the markets for producing organic fertilizers and pesticides. Materials such as cow manure, fertile soil from termite nests, and various plants are either collected or exchanged or purchased from other farmers in the community.

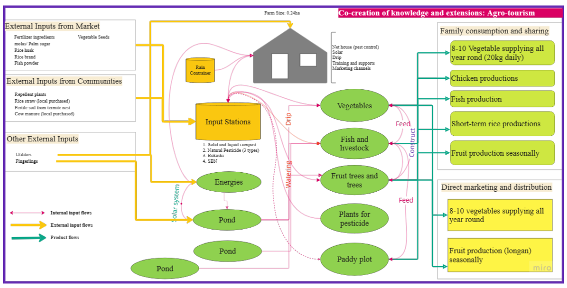

Fig. 5 Farming system design by Mr. Sin Sivnourn to reduce external inputs for horticulture productions

Those materials and inputs sourced from both markets and community, using to create various types of fertilizers and pesticides (solid and liquid compost, bokashi, SBN, and natural pesticides with three types) which suitable for different crops. He applied a strategy and systematic approach in utilizing these self-produced inputs to enhance crop production (Fig. 6).

While 50% of seeds are procured from markets, the remaining seeds are either produced in the farm or save, especially focusing on local varieties of vegetables. This approach ensured a sustainable and self-reliant farming system that minimize reliance on external inputs and maximizing the utilization of locally available resources (Fig. 4).

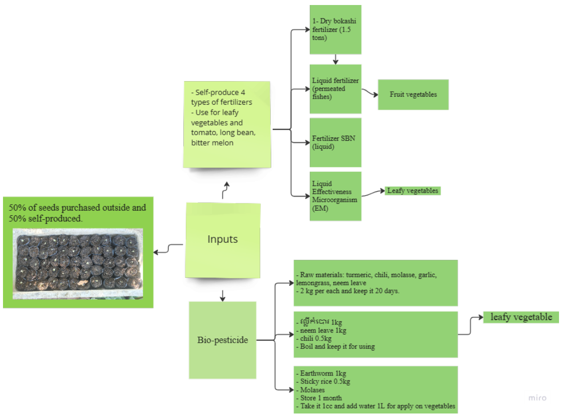

Fig. 6 Raw inputs for supply in the farm of Mr. Sin Sivnourn

Making small-scale farm more efficient and productive required a complex design to ensure the regeneration of the system. There are different scientific evidences indicating various agroecological practices and its impact to the projection system (Drinkwater and Snapp, 2022) (Fig. 7). Each practice described as follow with the management effects on desirable ecosystem services indicating by color, with "Blue" indicating positive effects, "Yellow" indicates mixed or inconsistent effects, "Green" indicates the evidence that strong and reflects consistent results from multiple meta-analytical review. Blank cells indicate ecosystem services for which there are insufficient data points to be include in the meta-analytical review.

1). Vegetable plot crop rotation: Regularly changing the types of vegetable grown in a specific area to improve soil health and reduce pests and diseases. Cover cropping: Incorporating various plants for multiple purposes such as producing pesticides, growing fruit trees, and cultivating vegetable alongside horticultural practices.

2). Cover cropping: Incorporating various plants for multiple purposes such as producing pesticides, growing fruit trees, and cultivating vegetable alongside horticultural practices.

3). Reduced soil bare: Utilizing rice straw or other organic materials to cover the soil surface in vegetable plot. This help retained moisture, suppress weeds, and improve soil structure.

4). Intercropping: Choosing different varieties of vegetables and horticultural plants to diversify the farm's produce and potentially enhance resilience against pests and diseases.

5). Agroforestry: Growing coconut, longan, mango, and other crops suitable for pesticides production along the perimeter of farms compound, possibly serving multiple functions such as providing shade, windbreak, and additional income.

6). Integrated crop-livestock: Rearing chickens, fishes, and cows within the farm compound, likely contributing to nutrient cycling, pest control, and diversification of income sources.

7). Organic soil amendment: Applying compost, bokashi (a type of organic fertilizer produced from fermented organic matter) and rice straw mulching to enrich soil fertility and promote healthy plant growth in both vegetable and paddy rice plots.

8). Integrated organic and inorganic fertilizers: Implementation of combination of bokashi, manure, and chemical fertilizer to nourish paddy rice, suggesting a balance approach to nutrient management.

Farming system of Mr. Sivnourn also reflect the different degree of application of its practices. Overall, this approach emphasized sustainability, biodiversity, and synergies between different elements of the farm to optimize productivity with minimizing environmental impact. This system described a diversified and integrated approaches to farming practices, emphasizing sustainable and organic methods. In this system, it was observed crop rotation, cover cropping, reduced bare soil, intercropping, agroforestry, integrated crop-livestock, organic soil amendment, and integrating organic and inorganic fertilizer (Fig. 7).

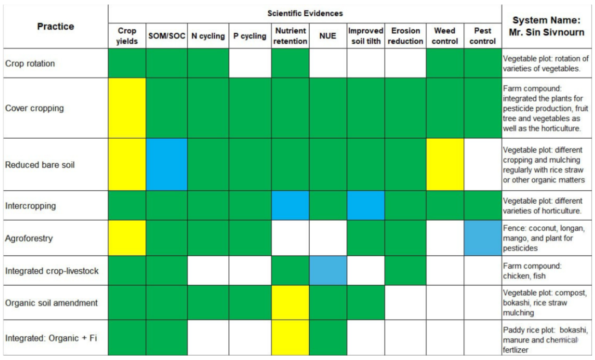

Fig. 7 Ecological Nutrient Management (ENM) practices provide multiple ecosystem services

Conclusions and Recommendations

With safe vegetable production by using microorganism based input and direct marketing, it is both reduce production cost and accessing to local market with higher margin comparatively. Microorganism based input is potential for input reduction. The knowledge of microorganism-based input should be promoted in horticulture production. Designing a farm with critical consideration to reduce cost of inputs and minimizing the external inputs dependency. As financial aspect is one of the main drivers in adoption of new agricultural technologies and practices, capacity building and promotion of agroecological practices should be centered on cost reduction.

Bibliography

Food and Agriculture Organization (FAO). 2019. TAPE tool for agroecology performance Evaluation 2019-Process of development and guidelines for application. Test version. Rome.

Gliessman S., R. 2007. Agroecology: the ecology of sustainable food sys. tems. CRC Press, Taylor & Francis, New York, USA. 384 p

HLPE (2019) Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition. A report by the High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome http://www.fao.org/cfs/cfs-hlpe/en/

Kim, T., and Peeters, A. 2020. FAO-TAPE testing in Cambodia final report. Louvain Coopération Organization, Cambodia.

Kong, R., and Castella, J. C. 2021. Farmers' resource endowment and risk management affect agricultural practices and innovation capacity in the Northwestern uplands of Cambodia. Agricultural Systems, 190 (May 2020), 103067.

Drinkwater L., E. and Snapp S., S. 2022. Advancing the science and practice of ecological nutrient management for smallholder farmers. *Front. Sustain. Food Syst.*, vol. 6, doi: 10.3389/fsufs.2022.921216.

Contact information

Author:

- Mr. Hou Sorith, Project Coordinator of Ecosystem Services and Land Use Research Center (ECOLAND) of Graduate School, Royal University of Agriculture (RUA)
- Ms. Mao Theara, Project Assistant of Ecosystem Services and Land Use Research Center (ECOLAND) of Graduate School, Royal University of Agriculture (RUA)
- Email: ecoland@rua.edu.kh

A model farmer:

- Mr. Sin Sivnourn, A farmer of Sustainable Soil for Life Association (SSLA)
- Tel: +855 (0) 92 941 604

Supported and Funded by

GRET, ALiSEA Agro-ecology Learning alliance in South East Asia, Agroecology and Safe Food System Transitions, UNI4COOP, Eclosio, Louvain Coopération, AFD Agence Française de Développement, Co-funded by the European Union, FFEM Fonds Français pour l'Environnement Mondial, Belgium partner in development