ALiSEA
AGROECOLOGY LEARNING ALLIANCE IN SOUTH EAST ASIA

ECOLAND

ALiSEA Research Brief

ALiSEA Small Grant Facility 2022

INPUT REDUCTION IN AGROECOLOGICAL PRACTICES: A CASE STUDY OF LOCAL PRACTICES IN HORTICULTURAL PRODUCTION IN NORTHWEST CAMBODIA

KEY TAKEAWAYS

- Microorganism-based inputs are vital in horticulture production as they are cost efficient and improve access to local markets. By incorporating knowledge of bio-input production and farm design, horticulture farmers could achieve external input reduction according to agroecological principles.
- External input reduction may be enhanced when farmers are informed about agroecological principles, thus knowledge sharing and extensions can be seen as the foundation of agroecology transition. This case study calls for participatory engagement and capacity building in agroecology for farmers.

Your Project Name

📍 Location: Cambodia 🇰🇭
📅 Duration: 2022-2024
🤝 Implemented by: GRET & CIRAD

Agricultural system: Lowland - Horticulture

Altitude: 0-100m

Agroecology Principles: (delete non-relevant)

Recycling | Input Reduction | Soil health | Animal Health | Connectivity | Biodiversity | Economic Diversification | Synergy | Co-creation of Knowledge | Land & Natural Resource Governance | Social Values & Diets | Fairness | Participation

ALiSEA Knowledge Product Categories:

Animal health | Biodiversity | Climate | Collaboration | Economy and income | Equity | Input reduction and recycling | Integrated systems | Knowledges and values | Natural resource governance | Nutrition and diets | Seed management | Soil health | Supportive policies | Sustainable food system | Water management

CONTEXT

Located in northwest Cambodia, Battambang is a well-known province in agricultural productions, especially rice. Pesticide use is prevalent in both upland and lowland rice production in the region, with approximately five to six applications, primarily during the second cycle. Use is reportedly lower in the first cycle (Kim and Peeters, 2020; Kong and Castella, 2021). In response to these actions, agroecological practices have been promoted actively in the area by various institutions and projects working at national and local levels.

For instance, the conservation agriculture mainly focused on innovative practices, such as reduced tillage, crop diversification, cover cropping, and mechanization for sustainable intensification, implemented by the Cambodia Conservation Agriculture and Sustainable Intensification Consortium (CASIC). The goal is to improve these interventions, by understanding the indicators and challenges of disseminating agroecological practices.

METHODOLOGY

This case study took place in Battambang province, and use mixed qualitative and quantitative methods, such as household interviews conducted using the Tool for Agroecology Performance and Evaluation (TAPE) (FAO, 2019), key informant interviews, focus group discussions (FGDs), field observation and a participatory analysis with stakeholders. The study also included an interview with a model farmer, Mr. Sin Sivnourn, a member of the Sustainable Soil for Life Association (SSLA), who uses internal materials on farms and in communities to produce natural fertilizers and biopesticides.
It provides insights for effective strategies to optimize agricultural input use within an agroecological context, contributing to sustainable and resource-efficient farming practices.

Data collection by the ECOLAND team

RESULTS

TAPE SURVEY

The TAPE survey showed an overall score of **37.4%** for the **Characterization of AgroEcological Transition (CAET).** This score reveals low levels of elements Recycling, Synergies and Efficiency, as well as Resilience (Fig. 1).

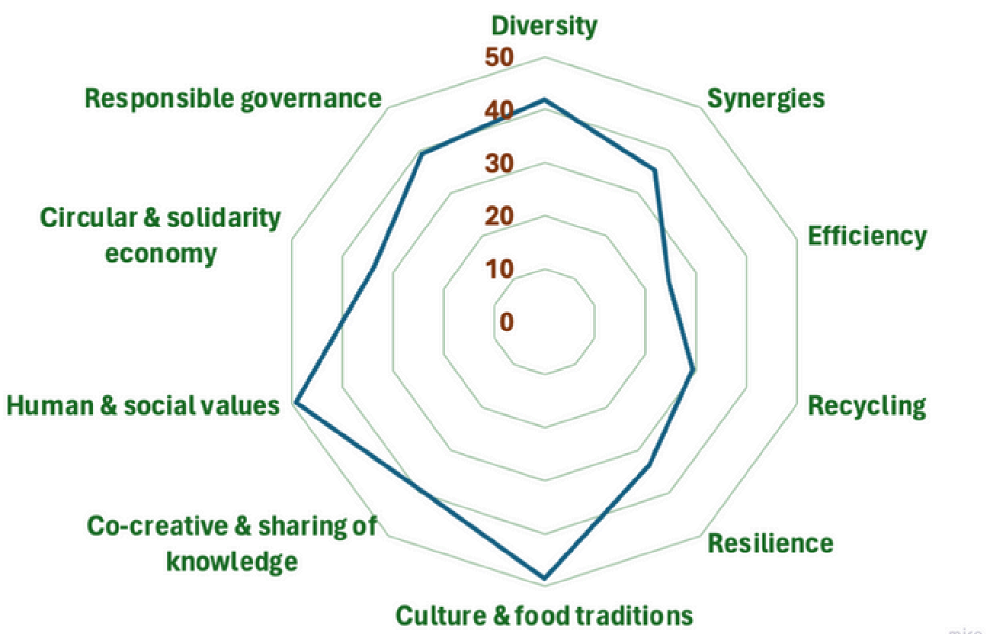


Fig. 1: Characterization of AgroEcological Transition (CAET) in upland and lowland of Battambang and recycling across the farm assessed

The efficiency criteria received the lowest score, indicating the farms heavily relied on external inputs, such as fertilizers, pesticides, seeds, labour, rental services, and other resources. Farmers prioritized chemical inputs over ecological management for production, with 78 % emphasizing the importance of chemical inputs. Farmers used an average of 5 types of pesticides, and 92.5% of them did not use organic pesticides. Fewer than 10% of farms achieved a Characterization of AgroEcological Transition (CAET) score greater than or equal to 50%, revealing the limited reliance on-farm and/or community-exchanged inputs.

Input expenditures (fertilizers, pesticides, and seeds) amounts to 2,625,400 riels (640 USD) and 1,286,800 riels (316 USD) per hectare per year in 2022 in lowland and upland areas respectively. This represents almost 45% of farmers' total expenditure.

FOCUS GROUP AND PARTICIPATORY ANALYSIS

According to **Focus Group Discussions**, most farms in upland and lowland areas applied pesticides during the off-season and the second rice cycle, with an average of six applications.

During the **Participatory Analysis**, various key areas were identified to reduce the dependency on external inputs, including three main activities (see Fig. 2) :

- Improving farmers' ability to save and recycle nutrients in their farms.
- Strengthening agroecological practices to reduce chemical use.
- Learning new technologies to maximize yields and minimize costs.

Agroecological practices have been promoted and implemented by farmers in their farming systems at different levels, according to their abilities and capacities. Around 10% of the studied population was in a transitional stage toward agroecology.

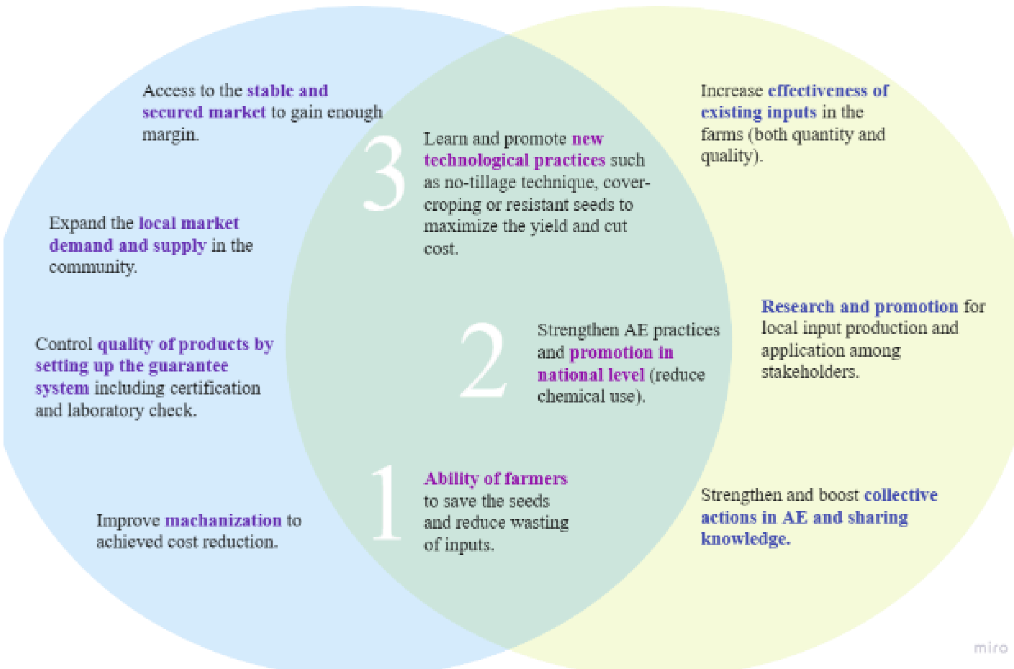


Fig. 2: Participatory analysis of key actions to be taken to reduce external input

EVIDENCES ON AGROECOLOGICAL TECHNIQUES

Most of the agroecological technics applied by the farmer are grounded in academic and scientific evidence, as shown in Figure 3. Based on academic paper of Drinkwater, L. E., & Snapp, S. S. (2022), the positive impacts of the agroecological techniques applied by the farmer have been demonstrated for the most part as crop yields, weed and pest control, soil quality and erosion reduction, Nitrogen and Phosphorus cycling, etc. The positive impacts are mainly true for crop rotation, cover cropping, reduced bare soil and intercropping while some data are still missing concerning the other techniques. However, although the paper identifies certain techniques, such as cover cropping and covering bare soil, as ineffective for increasing crop yields, the farmer still applies these techniques despite their limited documented impact on yields. While most of the agroecological techniques are therefore effective, it would be beneficial to guide farmer in his choice of technique on the basis of impact measurements.

The described agroecological techniques are :

- **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.
- **Reduced bare soil:** Utilizing rice straw or other organic materials to cover the soil surface in vegetable plot. This helps retain moisture, suppress weeds, and improve soil structure.
- **Intercropping:** Growing different varieties of vegetables and horticultural plants to diversify the farm's produce and potentially enhance resilience against pests and diseases.
- **Agroforestry**: Growing coconut, longan, mango, and other crops suitable potentially serving multiple functions such as providing shade, providing pesticide, windbreaks, and additional income.
- **Integrated crop-livestock**: Rearing chickens, fish, and cows within the farm compound, contributing to nutrient cycling, pest control, and diversification of income sources.
- **Organic soil amendment:** Applying compost, bokashi (a type of organic fertilizer produced from fermented organic matter), and rice straw mulch to enrich soil fertility and promote healthy plant growth in both vegetable and paddy rice plots.
- **Integrated organic and inorganic fertilizers:** Using a combination of bokashi, manure, and chemical fertilizers to nourish paddy rice, representing a balanced approach to nutrient management.

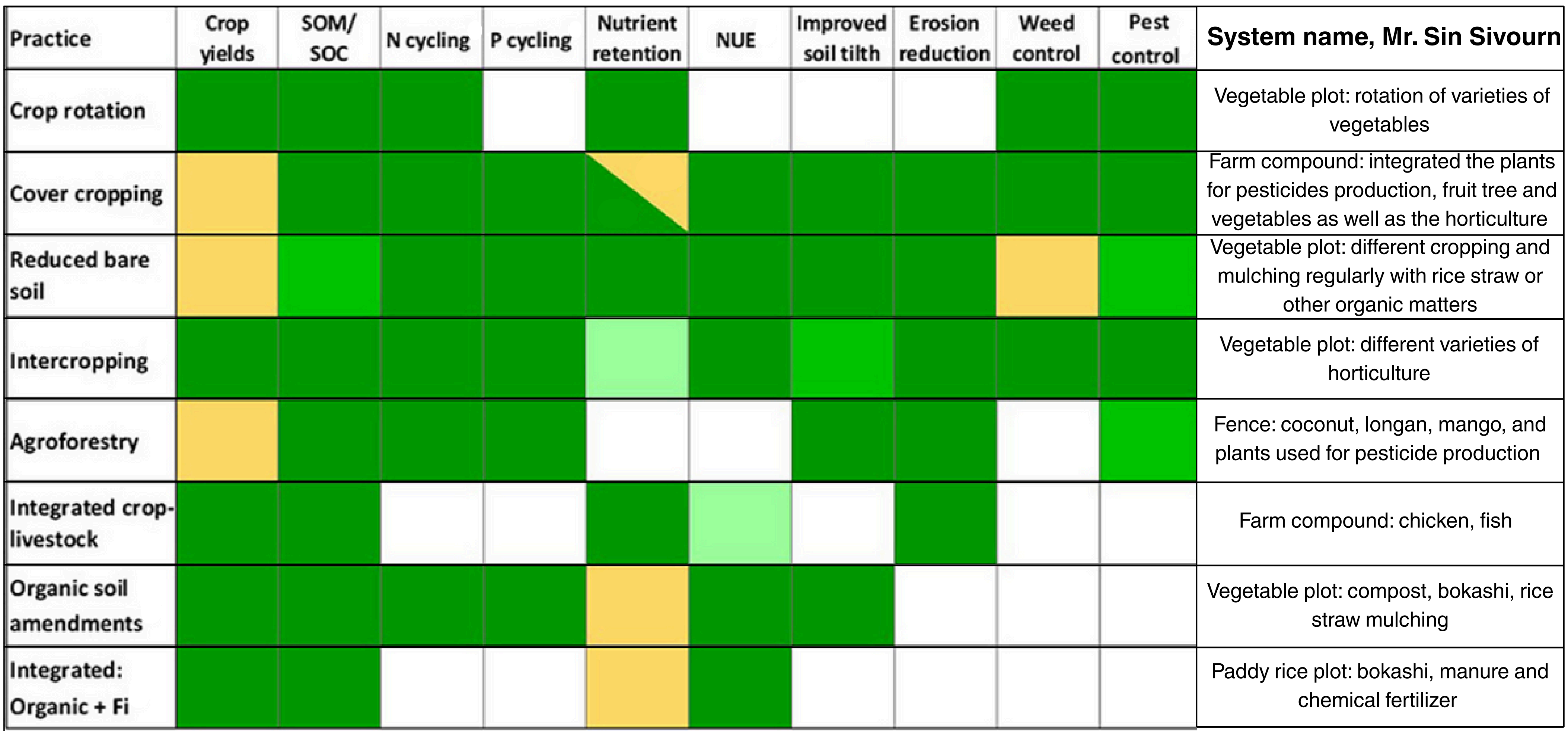


Fig. 3 Summary of Evidence on Ecological Nutrient Management and Ecosystem Services
From Drinkwater, L. E., & Snapp, S. S. (2022)

Positive effects with strong evidence (several meta-analyses)

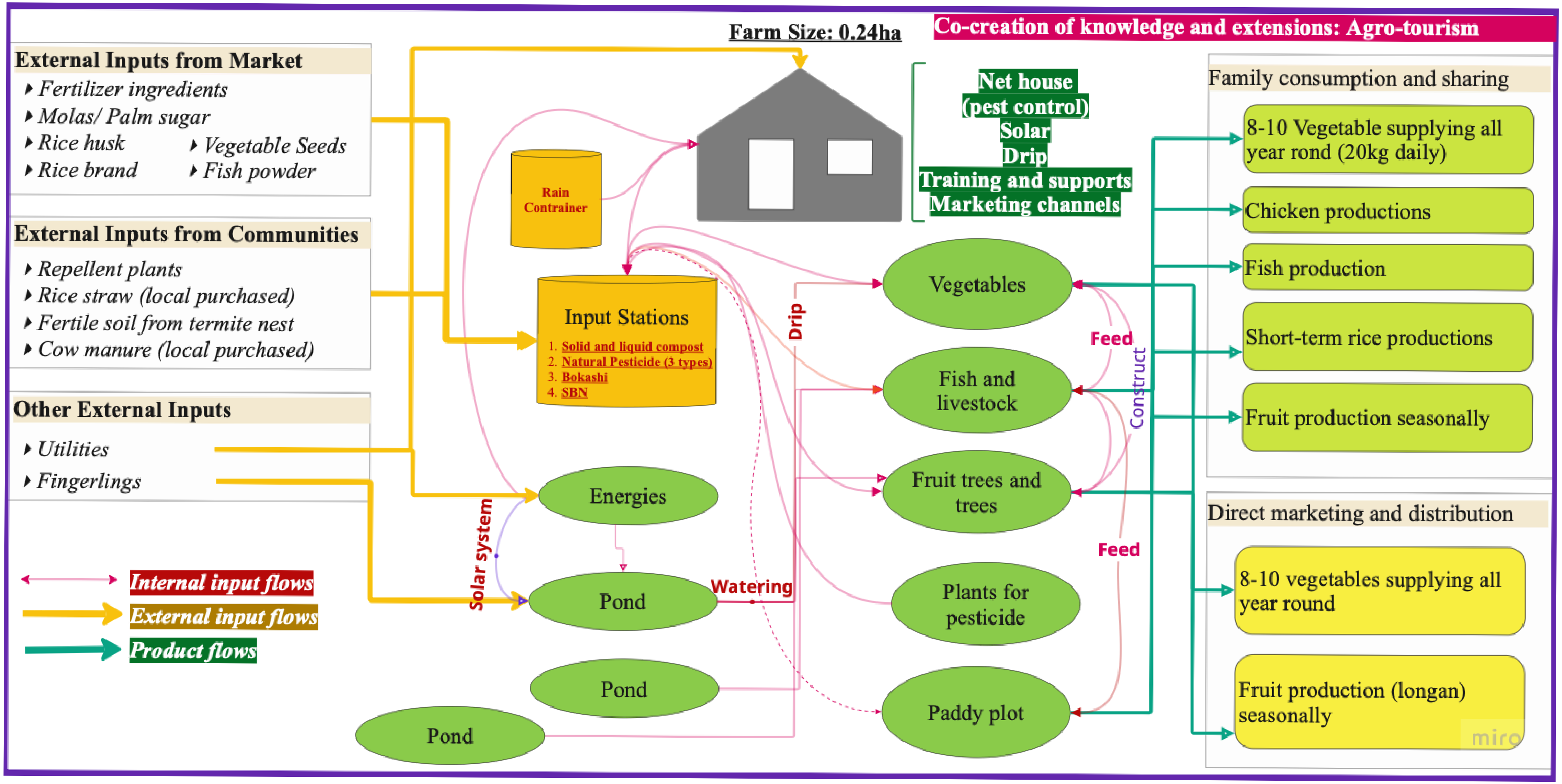
Positive effects with moderate evidence (fewer studies)

Positive effects with limited evidence (often single studies)

Mixed or inconsistent results

No studies yet

Fig. 4 :Farming system designed by Mr. Sin Sivnourn to reduce external inputs for horticulture productions
You can find this diagram in a larger format at the end of the document.



INTERVIEW WITH THE MODEL FARMER, MR SIN SIVNOURN

SMALL SCALE FARMING SYSTEM

Mr. Sin Sivnourn lives in Kampong Seima village, Wat Kor commune. His goal is to produce safe vegetables and apply for PGS certification by becoming more autonomous and independent from external inputs for horticultural production. To achieve this, he received various forms of support from organizations to build his capacity in agroecological practices.

According to the small-scale farming system he designed (Fig. 4), the emphasis was placed on minimizing external inputs while utilizing a combination of purchased materials/inputs and local resources. This includes fish powder, rice bran, rice husk charcoal, molasses, and other ingredients, which he obtains from the markets.
Other materials such as cow manure, fertile soil from termite nests, and various plants are either collected, exchanged, or purchased from other farmers in the community.

Those materials and inputs are used to create various types of fertilizers and pesticides (solid and liquid compost, bokashi, SBN, and three types of natural pesticides), that are suitable for different crops. He applied a strategic and systematic approach to utilizing these self-produced inputs to enhance crop production (Fig. 5).

While 50% of seeds are procured by markets, the remaining seeds are either produced at the farm or saved, especially focusing on local varieties of vegetables. This approach fostered a sustainable and self-reliant farming system by minimizing reliance on external inputs and maximizing the utilization of locally available resources.

RAW INPUTS FOR SUPPLY IN THE FARM OF MR. SIN SIVNOURN

Mr. Sin Sivnour's approach combines self-production of seeds, natural pest control, and diverse organic fertilizers to maintain soil fertility and plant health. In fact, the farm secures its planting materials by sourcing about 50% of the seeds externally while producing the remaining 50% on-site. This practice not only helps farmers save money but also allows them to select seeds that are well-adapted to local conditions, ensuring better yields season after season.

To manage pests, the farm relies on bio-pesticides made from locally available raw materials such as turmeric, chili, garlic, molasses, lemongrass, neem leaves, wild grapes, and vine. These ingredients are prepared in different ways: some are fermented for a certain number of days, others are boiled or mixed with sticky rice or molasses. Each biopesticide blend is chosen based on the type of vegetable being protected. For example, leafy vegetables may require a boiled chili-based solution stored for later use, while fruiting vegetables might benefit from a neem leaf and wild grape mixture. This careful use of natural pest repellents reduces the need for chemical pesticides, making the vegetables safer for consumption and the environment.

Fertilization is another key element of this system. The farm self-produces four different types of fertilizers tailored to the nutritional needs of both leafy and fruit vegetables. Dry bokashi fertilizer, produced in large quantities, improves the soil's organic matter content and nutrient availability. Liquid fertilizers, such as those made from permeated fish, add readily available nutrients and support plant growth. Additional inputs like Liquid Effectiveness Microorganisms (EM) help maintain a healthy balance of soil microbes, which enhances nutrient cycling and disease resistance. Fertilizer SBN, a liquid solution, complements these efforts by providing extra nourishment, especially for crops like tomatoes, long beans, and bitter melon that have higher nutrient demands.
By combining these practices, the farm builds a resilient and circular system. Seeds are partly reused and improved on the farm; biopesticides are made from affordable, local materials; and fertilizers are produced using simple techniques that recycle organic waste. This integrated input management not only cuts production costs but also protects soil health and biodiversity, contributing to long-term productivity. In doing so, the farmers are less exposed to market fluctuations for seeds, fertilizers, and chemical pesticides, and they strengthen their capacity to farm in harmony with the agroecological principles.

CONCLUSION/RECOMMENDATIONS

Producing safe vegetables using microorganism-based inputs and direct marketing offer the dual benefits of reduced production costs and access to local markets with comparatively higher profit margins. Microorganism-based inputs demonstrate potential for input reduction, and knowledge of these inputs should be promoted in horticultural production.

Thus, to guide and prioritize technical choices on an integrated farm, it can be useful to advise the farmer based on measurements of the impacts of agroecological techniques.

Farmer applying natural bio-pesticides

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