Southeast Asia Regional Initiatives for Community Empowerment

SwedBio

AGROECOLOGY: Farmers' Practices in Southeast Asia

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Southeast Asia Regional Initiatives for Community Empowerment (SEARICE)
First Printing, 2021.

RECOMMENDED CITATION
SEARICE. 2021. Agroecology: Farmers' Practices in Southeast Asia.157 pp.

Reviewers:
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All photos were provided by the contributors of the articles, partner organizations and SEARICE staff.

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This publication was produced with assistance from SwedBio. The contents herein are the sole responsibility of the Southeast Asia Regional Initiatives for Community Empowerment (SEARICE) and do not necessarily reflect the views of SwedBio.

About the Publishers

The **Southeast Asia Regional Initiatives for Community Empowerment (SEARICE)** is a regional non-government organization that promotes sustainable and resilient food systems through ecological agriculture with emphasis on the conservation and development of agricultural biodiversity; and advocates for policies that support, strengthen, and institutionalize community initiatives on sustainable and resilient food systems. It works in partnership with farming communities, local and national government units, civil society organizations, and academic and research institutions in Southeast Asia.

SEARICE is registered with the Philippines' Securities and Exchange Commission (SEC) as a non-stock and non-profit organization.

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SwedBio is a development programme that works to advance sustainable and equitable governance of biodiversity knowledge and policy. It is a knowledge interface at Stockholm Resilience Centre contributing to poverty alleviation, equity, sustainable livelihoods and social-ecological systems rich in biodiversity. SwedBio enables knowledge generation, dialogue and exchange between practitioners, policy makers and scientists for development and implementation of policies and methods at multiple scales

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The **Indonesian Peasants' Alliance (API)** is a national-level farmer organization established by agreement between independent farmer organizations in Java and Sumatra. The establishment of this organization is based on the interests of the peasants' movement to become a pressing force against unfair policies that marginalize the lives of millions of farmers in Indonesia.

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Bina Desa

Bina Desa is a non-government organization established as an independent, non-partisan and non-profit institution in Purwakarta, West Java, Indonesia on June 20, 1975. Its work is focused on human resource development at the local level. Bina Desa was born based on the advocacy for rural marginal societies which become more sidelined amid the development process which concentrates on growth but without equal distribution. In realizing the vision to attain a life and social order that pay attention to gender equality in a holistic, democratic, just and thorough manner, Bina Desa has focused its work on specific issues that affect rural peoples' lives by:

(i) promoting usyawarah (dialogue of life), agrarian reform, food sovereignty, gender and ecological justice, and village economic activities; (ii) advocating village laws; (iii) empowering rural people's organizations (RPOs) in development of village economic and organizational management; and (iv) addressing climate crisis through strengthening adaptation and mitigation process.

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FKMM-
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The **Malaysian Food Security and Sovereignty Forum (FKMM)** is a network of civil society organizations that promote sustainable agricultural practices so that agricultural production truly adheres to ecological, economic and social sustainability. FKMM also actively promotes awareness and training programs on the importance of understanding indigenous knowledge to ensure agricultural production that meets the needs and culture of the local community.

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ICERD

The **Center for Initiatives on Community Empowerment and Rural Development (ICERD)** is a Vietnamese civil society organization supporting poor rural communities to sustainably manage their own livelihoods. Founded in June 2012, under the auspices of the National Programe on Integrated Pest Management (IPM)/FFS – Ministry of Agriculture and Rural Development (MARD), it is officially registered as member organisation of the Vietnam Union of Science and Technology Associations (number 353/QĐ-LHHVN dated 01 June 2012). Its success is underpinned by holistic approach to development, spanning from grassroots capacity building to national advocacy. ICERD has played a prominent role in capacity-building for sustainable agriculture in Vietnam.

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Metta Development Foundation

Metta Development Foundation was founded as a non-profit organization in October 1998 under the Ministry of Home Affairs with the initial aspiration of complementing the peace processes of the various armed ethnic nationality groups and the government of Myanmar. Metta has been known to work best in difficult operating environments, reaching and 'putting the last first', covering the neglected, disadvantaged groups in the border areas and in inaccessible areas. Metta has established strategic partnerships and engagement with multiple stakeholders (national and local government, universities, non-state actors, private sector, international organisations and especially rural communities and a vast network of Civil Society Organization partners) in Myanmar, supporting an extensive range of development projects.

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NAFRI

The **National Agriculture and Forestry Research Institute (NAFRI)** of Laos was established in 1999 in order to consolidate agriculture and forestry research activities within the country and develop a coordinated National Agriculture and Forestry Research System. NAFRI is part of the Ministry of Agriculture and Forestry (MAF) and is equal in status with other technical departments under MAF.

NAFRI is mandated to undertake integrated agriculture, forestry and fisheries research in order to provide technical information, norms and results which help to formulate strategy in accordance with the government policies. NAFRI has four main functions including: carrying out adaptive research, developing methods, tools and information packages, providing policy feedback, and coordinating and managing research.

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RAEBIA

The **Resilient Agriculture and Economy through Biodiversity Action or RAEBIA** is a Timorese Non-Government Organization engaging communities on sustainable land use to provide food security, specifically in remote areas, and build resilient communities by ensuring that resources are well managed so the future generations of Timorese can thrive in a healthy, happy and productive environment. Applying and promoting the concepts of conservation agriculture and agrobiodiversity, RAEBIA's interventions are seen to impact on the livelihoods of the Timorese people. RAEBIA is also strongly involved in policy and advocacy work promoting farmers' rights.

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SRD

The **Centre for Sustainable Rural Development (SRD)** is a Vietnamese non-government organization committed to working for the development of disadvantaged rural communities, supporting them to improve their lives and manage sustainable resources. SRD inherited 28 years of experience from the International Cooperation for Development and Solidarity (CIDSE Vietnam), an international non-government organization that successfully implemented many development projects in Vietnam in the period of 1975-2005. In 2005, when CIDSE Vietnam achieved its goal of transferring its development activities to its Vietnamese partners, SRD was born to continue pursuing the goal of supporting poor rural communities in Vietnam.

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SWISSAID
(Myanmar)

SWISSAID works in nine countries in Asia, Africa, and Latin America, with head office in Switzerland. Working in partnership with local organisations, and inspired and motivated by a vision of a just and peaceful world, SWISSAID works for a future without hunger, poverty, violence and war. To this end, the focus of its projects are ecologically sustainable agriculture; natural resource management; increased incomes and fair markets; secure water supply; research; and advocacy. Women receive special support in these project areas. In agroecology, SWISSAID works on five core themes: gender and women small-holder farmers; agrobiodiversity/seeds; economic diversification and income; adaptation to climate change; and co-creation of knowledge, knowledge transfer and advocacy.

In Myanmar, SWISSAID works with local civil society organisations and rural communities to provide smallholder families with a better and more resilient livelihood. Agroecological agriculture, improved market access for small producers, better secured forest use rights and the promotion of social responsibility are helping to achieve this. Gender equality and the empowerment of women are central elements.

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Preface

Smallholder farmers have always understood that in taking from the generosity of nature, there must also be giving back. Thus, farmers carefully nurtured crops and animals according to the dictates of agroecological farming, which put a premium on sustainability.

But the modern technologies that were introduced to agriculture to supplement the dwindling food supply amidst the growing global population was completely the opposite of agroecological farming. These technologies led farmers to deviate from what they have been practicing, and what they learned from their ancestors and local communities that their own experiences took a back seat. They were promised abundant harvests, but they had to feed the soils with chemical fertilizers. They were made to believe that they had to use genetically modified seeds to produce the best varieties and crops. And that the science of plant breeding was best left to scientists and university-educated professionals.

The solutions offered by proponents of modern technology have led to more problems and aggravated conditions in global agriculture in the long term. And they have shown that they are no match to the continuous onslaught on the food systems – from climate change to global health crises to inappropriate policies which further weaken smallholder farming communities and their capacity to make food available and accessible to all.

As the world stood still due to the COVID-19 pandemic, farmers continued producing food. They were at the front and center of efforts, ensuring that there was food not only for their families but for their neighbours and communities. COVID-19 highlighted the fragility of industrial food production systems, and the need for reclaiming and strengthening local food systems.

This chronicle tells several experiences of our farmer-partners - their efforts, challenges, and perseverance and the rewards they receive from agroecological practices. We tell their stories to show their hard work and share their wisdom as evidence that efforts on the ground are the most relevant and responsive initiatives that can provide food security especially in times of crisis.

Acknowledgements

Producing this chronicle of agroecological farming practices amidst the COVID-19 pandemic seemed almost impossible to achieve. But together with our partner organizations and networks, we were able to pull through at a time when fieldwork was still restricted and communication means were limited.

To our partners for accepting our call for accounts of experiences on the ground and helping us to facilitate the completion of this publication:

Aliansi Petani Indonesia (API), Bina Desa, Center for Initiatives on Community Empowerment and Rural Development (ICERD), Centre for Sustainable Rural Development (SRD), Frangipani Natural Farm School, Malaysian Food Security and Sovereignty Forum (FKMM), Metta Development Foundation, Resilient Agriculture and Economy through Biodiversity Action (RAEBIA), and SWISSAID Myanmar;

to our farmer-partners who have shared their stories with us, and continue to show the way to sustainable and resilient food systems

and to Swedbio for their continued trust and support through many years of collaboration,

Thank you for supporting this challenging task of putting together evidence that food security starts with strengthening our smallholder farmers and community food systems.

Contents

Introduction

Agriculture has a significant role in eradicating hunger and poverty, providing food security and nutrition, improving livelihoods, managing natural resources, protecting the environment, and achieving sustainable development. As per the most recent available data, more than 730 million people are living in extreme poverty (World Bank, 2020a), and 690 million people are still affected by chronic hunger (FAO et al, 2020). Agricultural development is essential to meet the many challenges arising from ongoing changes in biophysical, socio-political, economic, and cultural setting of the developing world. Growth in agricultural productivity is crucial for stimulating growth in other parts of the economy and for overcoming widespread poverty.

However, management of global agricultural production is a precarious balancing act between food, feed, fiber, and fuel production on one hand, and non-commodity ecosystem services, ecological stability, and human well-being on the other. This has become more difficult to do as world population and food consumption progressively explode. Growth in agricultural output is significantly influenced by increase in inputs used (including land, labor capital - animals and machinery, fertilizer use) which come from either increases in farm productivity (agricultural intensification) or expansion of production area (agricultural expansion).

Agricultural intensification refers to the increasing reliance on irrigation and other production inputs such as chemical fertilizers, herbicides, and pesticides along with high yielding seed varieties. It involves all factors that contribute to an increase in crop yields including the development of double annual cropping – rice, in particular. Agricultural expansion refers to the opening of new lands especially forest lands for agricultural cultivation. While this is primarily done for commercial crops such as oil palm, it likewise concerns food crops, even vegetables and fruits.

Slowing gains in agricultural productivity, increasing scarcity of water and other non-renewable natural resources, over-exploitation of resources, environmental degradation, and climate change are some of the critical concerns on how agriculture is being practiced today.

Agriculture has incurred its own environmental costs. It draws an increasing proportion of its energy supplies from non-renewable sources, depends upon a narrow genetic base, and fosters decline in biodiversity and wildlife habitats. Water is being withdrawn more than the renewable capacity of the natural hydrological cycle. Prevailing modes of agricultural development are also associated with the effects of pollution and agrochemicals on human health.

Extreme climatic events have been hitting hard on agriculture and food output, disrupting production cycle and destroying yields. There is accumulating empirical evidence that rising average temperatures, extreme heat events, rising atmospheric ozone levels, and other climate-related phenomena are adversely affecting agricultural productivity.

The challenge to align agricultural systems with ecological principles is immense, especially in the current context of agricultural development where specialization, short-term productivity, and economic efficiency are emphasized. Closing of yield gaps and the intensification of production processes are projected to be the most significant drivers of production growth. However, with climate change and other environmental concerns becoming more relevant each day, it would be more strategic to realize increases in production through sustainable agricultural systems.

Achieving agricultural sustainability also lies at the heart of the Sustainable Development Goal (SDG) process. According to the Convention on Nuclear Safety-Food and Agriculture Organization (CNS-FAO) in 2019, agricultural sustainability is directly or indirectly necessary for reaching all of the 17 goals, but especially for reaching SDG 1 - no poverty; SDG 2 - zero hunger; SDG 12 - responsible consumption and production; and SDG 15 - life on land. Meeting the SDGs requires locally adapted agricultural practices that foster productivity and human health, maintain environmental sustainability, and promote rural livelihoods and social stability.

Agriculture in Southeast Asia

Southeast Asia comprises of countries at varying levels of development and resource endowments. Nine countries - Cambodia, Indonesia, Timor Leste, Lao People's Democratic Republic (PDR), Malaysia, Myanmar, the Philippines, Thailand, and Vietnam - are considered relevant in the discussion on agricultural development in the region. Singapore and Brunei are excluded in the discussion because of their insignificant agricultural production compared to other countries in the region.

Agriculture in Southeast Asian countries have undergone significant structural changes over time. The relative importance of the sector in Gross Domestic Product (GDP) and employment have declined in most countries between 1996 and 2014. Agricultural production is projected to fall from a growth rate of close to 6.5% over the past 15 years to around 2% over the next ten years. But although the agriculture sector in Southeast Asia also creates much lower value added than non-agricultural sectors, it employs a greater number of the workforce.

Despite projections suggesting that overall Southeast Asia will see continued decline in the numbers of undernourished individuals, the improvements witnessed will not be sufficient to overcome food insecurity. All countries will attain individual progress in reducing undernourishment over time, with Indonesia, Thailand, and Vietnam all on target to achieve Sustainable Development Goal number 2 by 2030 (i.e., less than 5% of the population being undernourished). But for the remaining countries and for the region in aggregate, the projected changes over the medium term will not be sufficient to overcome food insecurity (Mwang and Yu, 2015). With current high levels of food insecurity, for the Philippines, the current stagnation in undernourishment improvements is projected to continue while Cambodia, Lao PDR and Myanmar are projected to be furthest away from meeting the SDG target.

Projection results, however, indicate that the fundamental problem behind food insecurity is not the lack of available food but rather the lack or ineffective access to that food. Further policy efforts are required to overcome food insecurity. In the context of having markets deliver better food security outcomes, a key factor will be removing distortions in agricultural and food markets. Actions taken to improve access of poorer households to food through measures such as social safety net payments, have also been found to be able to significantly reduce rates of undernourishment over the medium term (OECD/FAO, 2017).

Rice-centric

Agricultural policies in Southeast Asia are interlinked with food security policies in a number of countries. In general, agricultural and food security policies can be characterized as "rice-centric". Self-sufficiency policies are often supported by production targets for a particular commodity or a set of commodity - rice for Malaysia, Lao PDR and Vietnam, rice and maize for the Philippines, and rice, maize and soybeans for Indonesia (Mwang and Yu, 2015). However, the contribution of rice to total gross agricultural production value has fallen since the early 1990s- from around 40% to 30% in 2013. The Philippines is the only country where the share of rice in its total agricultural production has increased.

Because of its political, economic, and social significance in the nine countries, rice remains the most important crop in the region. The greatest levels of productivity are found in irrigated rice where more than one crop is grown per year and yields are high. Approximately 42 million hectares of 45% of Southeast Asia's cropped land is planted to rice in irrigated (18M ha), rainfed (18M ha) deepwater (3 M ha), and upland (3 M ha) cropping systems (Mutert and Fairhurst, 2002).

Small family farms

Farm sizes in Southeast Asia remain relatively small and may remain so over the medium term (FAO, 2015). The time series data in Indonesia, the Philippines, and Thailand indicate a generally falling average farm size. In contrast, Myanmar and Vietnam appear to have exhibited trends of increasing farm size. Farm size distribution indicates the domination of farms less than one hectare. Myanmar and Thailand, however, stand out as countries with relatively higher number of producers who farm two and five hectares (Mwang and Yu, 2015).

Rapid growth of populations results in severe fragmentation of lands. Decreasing farm size poses a

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major constraint to agricultural productivity and adoption of agricultural knowledge, science and technology (AKST). Further, small farm size limits labor productivity and machine efficiency.

Vulnerable to climate change

Southeast Asia has been identified as one of the most vulnerable regions worldwide. Agricultural production within the region is heavily affected by changes in climatic conditions, and extreme climate events (cyclones, floods and droughts) are expected to amplify in frequency and severity.

Climate change radically alters agro-eco systems with negative impacts on crop production and distribution. Simultaneously occurring with increasing demand for food, feed, fiber, and fuel, climate change has the potential to irreversibly damage the natural resource base on which agriculture depends.

The changing climate is predicted to have a wide range of adverse effects on plant physiology metabolism, soil fertility and carbon sequestration, microbial activity and diversity. These effects in turn will limit plant growth and productivity, and ultimately food production. The climate crisis requires a new way of looking at soil and water management to cope with the impacts of more and extreme precipitation, higher intra- and inter-seasonal variations, and increased rates of evapotranspiration in all types of ecosystems. Increasing evapotranspiration will make more water available in the atmosphere for storms but will contribute to drying over some other areas. These changes have implications for agricultural production systems and due to the pressures created are likely to lead to further conflicts between environmental outcomes and food production.

Environmentally degrading

With the serious challenges that climate change is exhibiting, there is a very urgent need to better manage the regions' natural resources and make agricultural production more sustainable. Natural resources are increasingly being subjected to serious pressure from competing sectors. Along with a continuing increase in agricultural production, intensive agriculture, and overuse of agrochemicals will worsen current trends of degradation of soil and water quality as well as loss of biodiversity in many parts of the region.

Further increases in agricultural production are also likely to place further pressure on the environment. Over-extraction of groundwater can result in water declining beyond the economic reach of pumping technology. Groundwater depletion is a widespread problem in many areas in the region, especially in the semiarid areas. Poorer farmers are hit the most. When near the sea or in proximity to saline groundwater, over-pumped aquifers are prone to saline intrusion. Groundwater quality is also threatened by the application of fertilizers, herbicides, and pesticides that percolate into aquifers. These nonpoint sources of pollution from agricultural activity often take time to become apparent, but their effects can be long lasting, particularly with persistent organic pollutants (IAASTD, 2009).

Southeast Asia has placed significant pressure on its natural base during its past development and thus finding ways to sustainably produce is imperative. It is further extremely critical to develop systems that better inform producers about more sustainable practices and regulations that ensure externalities are controlled.

Disaster-prone

Environmental degradation also increases the impacts of floods and landslides, just as disasters such as wildfires, droughts, and floods cause serious damage to forests, farmlands, and livestock. Southeast Asia is rich in natural resources and biodiversity but is vulnerable to disasters and faces losing its biodiversity. The frequent natural disasters further result in human and economic losses and make agriculture and land-based production in Southeast Asia a high-risk venture. The livelihoods of communities dependent on agriculture and natural resources and with limited diversification are vulnerable.

Natural disasters of hydro-meteorological (floods, wave surges, storms, droughts, extreme temperatures, forest and scrub fires, landslides and avalanches), geophysical (earthquakes, tsunamis and volcanic eruptions), and biological nature (epidemics and insect infestations) which are regularly occurring in the region (Lasco, et al., 2011) are further obstacles to overcome in trying to reduce poverty and achieve sustainability. In the region, increasing emphasis has been placed on early warning systems for disaster, information access for local disaster-prone communities, community approaches in disaster management and risk reduction; exploration of strategies to improve agriculture extension; and local government support for community approaches.

Agriculture and Ecology

Agricultural Ecology

According to the Food and Agriculture Organization (FAO), 2018, agroecology is an integrated approach that simultaneously applies ecological and social concepts and principles to the design and management of food and agricultural systems. It seeks to optimize the interactions between plants, animals, humans and the environment while taking into consideration the social aspects that need to be addressed for a sustainable and fair food systems.

Agroecological innovations are based on the co-creation of knowledge, combining science with the traditional, practical, and local knowledge of producers. By enhancing their autonomy and adaptive capacity, agroecology empowers producers and communities as key agents of change. Agroecology is fundamentally different from other approaches to sustainable development in that it is based on bottom-up and territorial processes, helping to deliver contextualized solutions to local problems.

Agroecology seeks to transform food and agricultural systems, addressing the root causes of problems in an integrated way and providing holistic and long-term solutions. This includes an explicit focus on social and economic dimensions of food systems. Agroecology places a strong focus on the rights of women, youth, and indigenous peoples. Further, agroecology recognizes the great potential of collective action processes to foster knowledge sharing, and deepened understanding that enable behavioral changes in food systems that are required for the realization of sustainable agriculture.

The FAO, through multi-actor regional meetings conducted on agroecology from 2015 to 2017, developed ten elements of agroecology.[1] The ten elements can help countries to operationalise agroecology by identifying important properties of agroecological systems and approaches, as well as key considerations in developing an enabling environment for agroecology.

The ten elements include the common characteristics of agroecological systems: diversity; synergy; efficiency; recycling; resilience; foundational practices and innovation approaches - co-creation and sharing of knowledge; context features - human and social values; culture and food traditions; and enabling environment - responsible governance and circular and solidarity economy.

[1] The ten elements were based on seminal scientific literature on agroecology – in particular, Altieri's (1995) five principles of agroecology and Gliessman's (2015) five levels of agroecological transitions. The elements incorporated civil society values on agroecology, and subsequently, several rounds of revision by international and FAO experts.

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Agriculture and Ecology

The Ten Elements of Agroecology

DIVERSITY	**CO-CREATION AND SHARING OF KNOWLEDGE**
Diversification is key to agroecological transitions to ensure food security and nutrition while conserving, protecting and enhancing natural resources.	Agricultural innovations respond better to local challenges when they are co-created through participatory processes.
SYNERGY	**HUMAN AND SOCIAL VALUES**
Building synergies enhances key functions across food systems, supporting production and multiple ecosystem services.	Protecting and improving rural livelihoods, equity and social well-being is essential for sustainable food and agricultural systems.
EFFICIENCY	**CULTURE AND FOOD TRADITIONS**
Innovative agroecological practices produce more using less external resources.	By supporting healthy, diversified and culturally appropriate diets, agroecology contributes to food security and nutrition while maintaining the health of ecosystems.
RECYCLING	**RESPONSIBLE GOVERNANCE**
More recycling means agricultural production with lower economic and environmental costs.	Sustainable food and agriculture requires responsible and effective governance mechanisms at different scales – from local to national to global.
RESILIENCE	**CIRCULAR AND SOLIDARITY ECONOMY**
Enhanced resilience of people, communities and ecosystems is key to sustainable food and agricultural systems.	Circular and solidarity economies that reconnect producers and consumers provide innovative solutions for living within our planetary boundaries while ensuring the social foundation for inclusive and sustainable development.

Source: FAO 2018

Agroecosystems Management

Agriculture is traditionally associated with maximizing the provisioning services of ecosystems. It provides humans with food, feed, fiber, fuel, forage, medicines, etc. Agricultural ecosystems are also key providers of regulating and supporting cultural ecosystem services. They provide and benefit from the suppression of pests, pollination, availability of water in appropriate quantity and quality, and maintenance of soil fertility and a favorable soil structure.

However, depending on the management of ecosystems services, agriculture can also be the source of numerous ecosystem disservices which include reduction of species and functional diversity, loss of wildlife habitat, nutrient runoff, sedimentation of waterways, greenhouse gas emissions and pesticide poisoning of humans and non-target species. Agriculture affects ecosystem services by altering the land habitat, modifying the ecosystem structure, or changing the biogeochemical cycle. The pressures arising from agricultural practices on ecosystem services depend on farm inputs such as seed, fertilizer, and labor/machinery as well as on associated farming systems and practices. Hence, it is possible and essential to improve ecosystem services provision from agriculture through agroecological farm management practices.

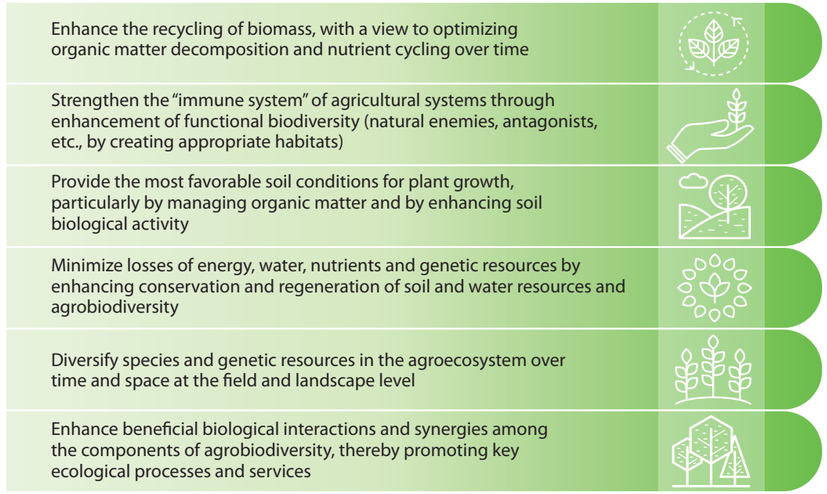
Agroecological Farming

Agroecological farming involves agricultural practices that aim to produce significant amounts of food while at the same time recognizing the importance of integrating ecological processes and ecosystem services as fundamental elements in the development of the practices. It is a way of farming that is holistic in its nature with the goal of improving the sustainability of agroecosystems and bringing economic as well as environmental benefits to farmers and communities.

Agroecological farming maximizes reliance on farm-derived renewable resources and the management of ecological and biological processes and interactions to provide acceptable levels of crop, livestock and human nutrition, protection from pests and diseases and an appropriate return to the human and other resources. It includes farming practices based on agroecological principles that emphasize diversity, synergy, recycling and integration, and on social processes that value community involvement and empowerment. When agroecological principles are adopted, yield enhancement and stability of production are also achieved.

Agroecological farming considers ecosystems management criteria like regeneration, substitutability, assimilation and irreversibility. Renewable resources should be used efficiently and their use should not be allowed to exceed their long-term rates of natural regeneration. Non-renewable resources, on the other hand, should be used efficiently and their use limited to levels which can be offset by substitution with renewable resources or other forms.

Nichols et al., 2016 indicate that agroecology uses well established ecological principles for the design and management of agricultural ecosystems where external inputs are replaced by natural processes such as natural soil fertility, allelopathy and biological control. Agroecology does not promote technical recipes but rather principles, which when applied in a particular area take different technological forms depending on the prevailing socioeconomic and biophysical circumstances of farmers. Each practice is linked to one or more principle thus contributing to its manifestation in the function of the agroecosystems. The applied practices set in motion ecological interactions that drive key processes for agroecosystem functions.



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Agroecological farming focuses on increasing biodiversity and improving soil fertility. It involves farming practices that prevent soil erosion and generate soils that are able to effectively retain water and nutrients. It also includes farming practices that facilitate crop diversification, natural regulation of pests, soil and water conservation, biodiversity conservation and carbon sequestration. Agroecological farming further emphasizes diversification, mixed cultivation, intercropping, cultivar mixtures, habitat management techniques for crop-associated biodiversity, biological pest control, improvement of soil structure and health, biological nitrogen fixation, and the recycling of nutrients, energy, and "waste" as inputs to the production process.

At its best, agroecology can use a multitude of suitable solutions, including new technology and traditional techniques, improved inputs and outputs, and applying unique localized knowledge-based practices not only at field level but also in terms of processing and marketing of food. It aims at holistic and system-oriented farm management practice, including social, cultural, and political principles. Agroecological farming supports the development of best practices, integrated solutions, and techniques that allow agriculture to minimize its ecological footprint. Common best practice approaches include wide crop rotation, mixed crop-livestock systems, polycultures, inter-cover, and mixed cropping, natural corridors, and local marketing and value creation (TWN & SOCLA, 2015). Further important aspects are local breeding programs, the use of locally-adapted open-pollinated varieties, traditional cultivars and re-using resources from local agroecosystems (Gliessmann, 2015).

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Climate resilient agriculture (CRA) is a sustainable approach for converting and reorienting agricultural systems to support food security under the new realities of climate change through different adaptation and mitigation mechanisms. Agricultural systems are extremely vulnerable to climate change, given their sensitivity to variations in different threats like temperature, precipitation and incidence of natural events and disasters such as droughts and floods with this on an average the extreme weather patterns can impact farm incomes in the range of 15-18 %. Threats can be reduced by increasing the adaptive capacity of farmers as well as increasing resilience and resource use efficiency in agricultural production systems.

Source:
https://www.researchgate.net/publication/353716127_CLIMATE_RESILIENT_AGRICULTURE_An_approach_to_reduce_the_ill-effect_of_climate_change

Climate Resilient Agriculture:

A change in perspective leads to gaining confidence

Bac Thi Bien and SRD Staff

Ms. Bac Thi Bien has been practicing climate resilient agriculture (CRA) since 2018.

Initially, she was uncertain about the techniques of CRA taught by the Centre for Sustainable Rural Development (SRD) because they were completely different from how she and many other families in her village, Keo Phay village, Bon Phang commune, Thuan Chau, Son La, cultivated their rice fields. But she decided to give it a try as the rice farming systems that they practiced required large amount of capital and a lot of effort but resulted in low productivity. Worse, the conventional method posed health hazards due to the herbicides and other crop protection chemicals that they used.

After learning the new method, she became determined to apply these in her family's farm with the simple hope of making farm work less tiring and producing more rice for the household. But she faced opposition from her husband and parents in-law, who asked what good it would do if they changed their method of farming when they have been managing with the old ways for years. They wondered if the changes would truly increase their income or would they just be wasting time and resources.

Because of her persistence, she was able to convince her parents-in-law to give her a 100 square meter lot to grow rice using the new method. She made an agreement with her in-laws that if her way did not work out, she would revert to doing the old way of farming. But if her efforts produced better results, they would let her apply the new method in all of their fields. She considered this negotiation as her first success as she seldom got the chance to make such a big decision.

In 2018, she began growing rice, transplanting only one to two seedlings. Instead of the usual 50-60 clumps, she used only 40 clumps per square metre, with five to six seedlings per clump. She used fertilizer sparingly, and only when the rice plants needed it the most, and decreased the use of chemical spray. She visited her farm more regularly to observe the progress of the crops. As time progressed, she grew more confident with this new farming method that she was practicing.

After less than a year, her parents-in-law and husband saw the benefits of her efforts and supported her participation in the project. She was able to participate in the project's activities as her husband took care of the children during those times. However, when she was busy with other work, her husband took her place and actively participated in the activities. All the members of her family have been involved in the project since 2019.

One of the benefits that Ms. Bac gained from the project was the opportunity to participate in training courses on women's empowerment. Between those sessions and her involvement in the village savings group, she has learned how to take care of herself, became more open and more confident around others, and eager to share her learnings on the new farming methods with everyone in her village. In 2020, the project sent her to the villages of Muoi Noi commune to share her experience. This occasion gave her more confidence to be able to do more for herself, her family and others as well. She says of her experience: "Changing your perspective is very difficult but as long as you are determined and have a good plan, you will be able to achieve anything."

Agroecological Farming Practices

The climate resilient agriculture (CRA) practices that were introduced in the community are centered on nature-based approach leading towards organic farming. The practices include using indigenous crop species/varieties and animal breeds, promoting the use of organic inputs such as manure and compost from agricultural by-products, intercropping crops with legumes to improve and maintain the quality of arable land, reducing the use of chemical fertilizers and plant

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Farmers' Practices in Southeast Asia

protection chemicals, feeding animals with agricultural by-products to save input costs and protecting the environment. The CRA farming approach saves input costs and increases household income while still protecting the environment.

Practicing CRA also helps local people to create quality products, reduce emission of greenhouse gases such as nitrogen oxide (N20), ammonia (NH4), methane (CH4) by minimizing the use of hybrids, plant protection chemicals and industrial animal feed. Moreover, the CRA models contribute to increasing the diversity of natural enemies in the field, protecting crops naturally, and reducing chemical residues in the soil and water.

Farmers' Adaptation

The Centre for Sustainable Rural Development (SRD) is a national NGO working in the uplands of Vietnam since January 2018. SRD has reached 264 poor and near-poor ethnic households in eight villages of Muoi Noi and Bon Phang communes, Thuan Chau district, Son La province, Tay Bac region of Vietnam

The project provides on-farm trainings on CRA farming techniques and sets up demonstration models to build the capacities of farmers. Farmers' interest groups are formed to apply CRA models and later share their experiences in the application process through the facilitation of trainers from local partners and the staff of SRD.

Among the gains derived from the project are increase in income, reduction of food shortage, and increase in the capacity to reinvest in the household's production. There are also impressive social impacts - strengthening of community relations, raising of gender awareness, increasing people's confidence, especially of the poor and women, and improving relationships between the villagers and local authorities at all levels.

Further, the project has increased the capacity of the people in terms of knowledge of farm management and production planning. The improvement of the technical knowledge in rice production and coffee farming is very impressive. Practices such as raising of chickens in cages, reduction in the use of chemical fertilizers, plant protection chemicals and herbicides and use of composted manure in rice and coffee production contribute in protecting the environment.

Farmers' Practices • Climate Resilient Agriculture

Challenges and Lessons Learned

Farmer interest groups are established so that the poor and near-poor households will be given priority for project participation. Community mobilization for the establishment of these groups encountered many difficulties because of the limited capacity and awareness of poor households.

The use of popular language and the lack of equipment and facilities to visualize content affect training effectiveness for some people who do not understand the Vietnamese language well yet. Most of them are the old and most old people have not learned to apply the new techniques. Furthermore, the risks of diseases and extreme weather events such as drought, frost, etc., reduce the effectiveness of the interventions for livelihoods.

SRD plans to adjust their mobilization approach by encouraging the participation of households from different socio-economic status in the interest groups so that they can share and support each other in the implementation process to increase the success of the project. They will contact and regularly discuss with local partners to cooperate in supporting the farmers in the project areas to apply the CRA model successfully. SRD will also continuously build the capacities of young farmers so that they can confidently guide and support the villagers in using the CRA methods. This is one way of helping ensure the sustainability of the outcomes beyond the project's life.

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Composting converts crop residues and other organic materials into organic fertilizer. Although composts from rice straw are often low in major nutrients such as nitrogen (N) and phosphorus (P), they can be highly beneficial to crop growth and soil health because they contain a range of micronutrients, enzymes and micro-organisms. Composting concentrates the nutrients in otherwise poor quality rice straws and other crop residues.

Composts from organic materials, such as rice straw, corn stalks, rice hull and sawdust help improve the physical and biological properties of the soil. Nutrients in compost are released slowly and are less likely to be lost by leaching.

Composting is an effective method for promoting the utilization of organic wastes. It also helps address the many risks associated with chemical fertilizers which are not only expensive but harmful to the environment and human health. Composting possesses many benefits such as reducing waste volume, reducing surface and groundwater pollution, reducing transportation costs, reducing air pollution from waste burning, providing better waste management and increasing material recycling.

Source: Fangsoto, 2012

COMPOSTING:
A simple and easy technique brings many rewards

SWISSAID Staff

U Myint Lwin is a 49-year-old farmer from Shan Ywar village, Pindaya Township, Shan State, Myanmar. He is married with four children and has been farming for 33 years.

With the help of his wife, he grows chili, rice, tea, cabbage, and sesame in a 3.21 hectare rain fed farm. Chili occupies more than a third of the land (1.21 hectares). He cultivates most of the crops only during the rainy season (May - December).

U Myint has been practicing composting since 2018 to improve the fertility of the soil in his vegetable farm and to produce healthy and safe food at lower costs.

Agroecological Farming Practices

Composting is a simple and easy technique that can be performed with minimal costs. U Myint makes compost using crop residues, cow dung, rice straw and water. He can easily access the resources needed in making compost from nearby places, even in his own home, backyard and farm. According to him, compost application changes the soil's structure and color. Hard soil with low water retention capacity becomes more friable and porous with better water infiltration. It also prevents soil degradation caused by continuous use of agrochemicals. Adding compost in his farm helps in providing different nutrients to the soil, making both the soil and crops healthier.

U Myint further observed that the crops applied with composts are more tolerant to pests and extreme weather conditions during the vegetative stage. They also have longer shelf life compared to crops produced with the use of agrochemicals. Naturally-produced commodities with longer shelf life have high demand in the market. These are the rewards that motivate other farmers to produce crops naturally.

Farmers' Adaptation

U Myint has attended trainings on making natural pesticides and transitioning to ecological farming sponsored by Shwe Danu Self Help Group, a local NGO in Southern Shan State, and SWISSAID Myanmar. Based in Pindaya Township, Shwe Danu implements projects in 23 villages in nine village tracts in the Township and includes poor men and women farmers. Shwe Danu develops the capacities of local communities to improve their livelihood and make them self-reliant. Among the capacity development trainings they provide are on agroecology, livelihood, financial management, value addition with market linkages and land rights awareness. They also provide farming inputs, farm machineries and storage facilities, and capital to encourage farmers to have practical experiences for their livelihood and apply agroecological farming. Social responsibility, gender equality and the empowerment of women are central elements of their work.

U Myint's thirst for knowledge is a key factor in being able to manage his farm efficiently as he transitions to natural farming. Aside from learning how to turn wastes into composts, he has also gained knowledge on variety selection and production of cabbage, cauliflower and rice. All the learnings U Myint acquired have paved the way to become active and to engage with members in his community as he shares his experiences with them. Currently, he is the farmer-to-farmer extension officer of his farmers' group, the treasurer of a tea farmers' group and secretary of his village committee.

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Farmers' Practices • Composting: A simple and easy technique brings many rewards

A **diversified farming system** intentionally includes functional biodiversity at multiple spatial and/or temporal scales, through practices developed via traditional and/or agroecological scientific knowledge. At the plot (i.e., within-field) scale, diversified farming systems (DFS) may include multiple genetic varieties of a given crop and/or multiple crops grown together as polycultures, and may stimulate biodiversity within the soil through addition of compost or manure.

At the field scale, DFS may include polycultures, non-crop plantings such as insectary strips, integration of livestock or fish with crops (mixed cropping systems), and/or rotation of crops or livestock over time, including cover cropping and rotational grazing.

Components of the agrobiodiversity within DFS interact with one another and/or the physical environment to supply critical ecosystem services to the farming process, such as soil building, nitrogen fixation, nutrient cycling, water infiltration, pest or disease suppression, and pollination, thereby achieving a more sustainable form of agriculture that relies primarily upon inputs generated and regenerated within the agroecosystem, rather than primarily on external, often non-renewable, inputs (Pearson 2007, Shennan 2008).

Source:

Kremen, C., A. Iles, and C. Bacon. 2012. Diversified farming systems: an agroecological, systems-based alternative to modern industrial agriculture.Ecology and Society 17(4): 44. http://dx.doi.org/10.5751/ ES-05103-170444

Integrated farming refers to combined growing of crop, livestock, poultry, fish, tree crops, plantation crops or other systems. In this system, an inter-related set of enterprises is used so that the "waste" from one component becomes an input for another part of the system. This reduces costs and improves production and/or income. Since it utilizes waste as a resource, farmers not only eliminate waste but they also ensure an overall increase in productivity for the whole farming system. Integrated farming focuses on increasing farm productivity by increasing diversification, resource integration and creating market linkages.

Integrated farming tries to imitate nature's principle, where not only crops but also varied types of plants, animals, birds, fish, and other aquatic flora and fauna are utilized for production. The basic principle is to enhance the ecological diversity by: a) choosing the appropriate cropping methodology with mixed cropping, crop rotation, crop combination and inter-cropping so that there is less competition for water, nutrition and space and by adopting eco-friendly practices; b) utilizing a multi-story arrangement so that the total available area is used effectively and there is a high level of interaction between biotic and abiotic components; and c) integrating subsystems by which the various components interact positively, so that the overall farm productivity is increased.

Diversified and Integrated Farming:

A rooftop farm provides food security

Renelyn Gamaya

Mr. Manuel R. Oliva of Infanta Quezon grows crops and raises livestock, harvests rainwater and makes his own organic fertilizer – at the rooftop of his house.

The 64-year-old farmer was a nurse who worked abroad to support his family. While there, he always dreamt of returning to the Philippines and be with his wife and their four children. When he finally came back home, he decided to take up farming although he knew very little about it.

He started farming in 2018 because he wanted to have a safe, secure and readily-available source of food for his family. It was difficult at first but through continuous learning and perseverance he was able to convert his rooftop into an integrated farm with diversified crops. Aside from his rooftop farm, he has a two-hectare rice field located in a different area which is twenty minutes away from his house.

Agroecological Farming Practices

Noli cultivates vegetables (pak choi, okra, mustard, bottle gourd, and bitter gourd among others), rice for household consumption and some herbs (lemongrass, citronella) which he uses as insect repellents. He also grows forage crops (water spinach and Tricanthera) as food for his livestock.

In addition, he raises pigs and chickens for home consumption and for selling. The pigs are fed two to three times a day with food scraps gathered from his farm. He harvests water spinach and Tricanthea and mixes these with table food scraps and, when available, some shredded coconut. The chickens are likewise fed with water spinach and Tricanthera and rice bran.

Collection of rainwater is also among Noli's agroecological practices. He collects rainwater and uses it to clean the pig pens. The wastewater from the pen cleaning is used to make foliar spray for the vegetable garden.

He makes his own organic fertilizer from farm wastes with the aid of a bio-decomposer known as *Trichoderma harzianum* - a fungal bio-decomposer that helps decompose organic materials faster to produce a nutrient-rich compost to fertilize his vegetable garden and rice fields.

Except for the Trichoderma and piglets which he buys, most of the inputs that Noli uses in maintaining the farm such as food scraps, seeds, or vegetative propagules come from either his household or from his fellow farmers with whom he shares and exchanges farm resources. During harvest time, he lets some crops grow to maturity so that they can produce seeds for the next planting season.

Challenges and Lessons Learned

The practice of integrated farming is not easy during the initial stages. It takes a lot of time and experience to understand the techniques. Managing rainwater catchments during the wet season is also a challenge because of heavy and frequent rains, with the farm being located in an area within the typhoon belt. However, he still collects the rainwater, uses it and saves the excess for the dry season.

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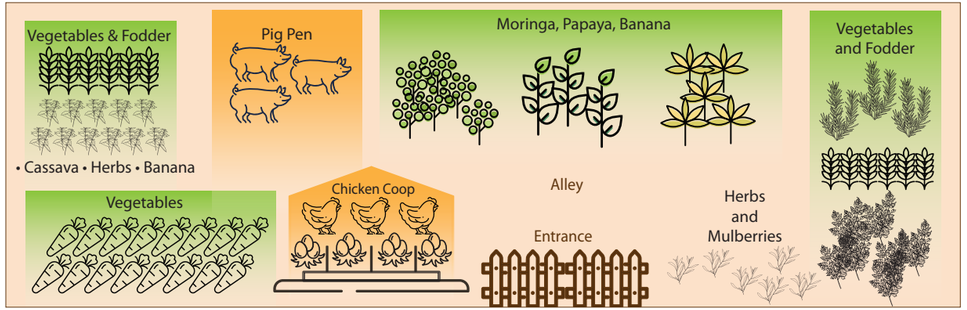
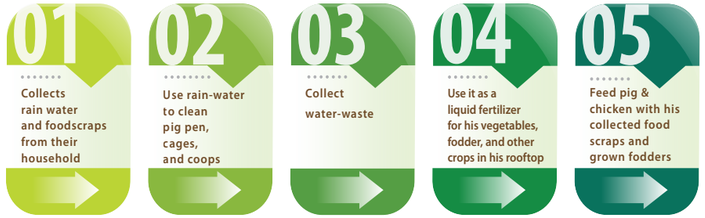
Farm Layout



Resource Flow



Integrated farming allows him to recycle wastes leaving less wastes in their household. It also reduces the cost of raising pigs and producing vegetables while at the same time giving his household food to eat with minimal expenses.

Farmers' Practices • Diversified and Integrated Farming



There was also a time when the soil became too wet as it exceeded its water holding capacity. This caused the soil to become more anaerobic. His solution was simply to add some absorbing or low-moisture bulking agents such as rice hulls rice straw, sawdust, peat and peanut shells to create more pore spaces and improve soil aeration.

Integrated farming allows him to recycle most of the wastes in their household. It also reduces the costs of raising pigs and growing vegetables while at the same time provides his household with food thereby lessening expenses. And despite the difficulties, Noli says that diversified and integrated farming really helps in securing food for the family even with a limited space.

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Diversified and Integrated Farming:

Optimizing use of the land for sustainable livelihood

Jonna Mae Ducala, Renelyn Gamaya and Guiller Domingo

Mr. Eddie Sasi knew that he could do more with his three-hectare lowland farm. Using the right farming system, the 60-year-old farmer believed that it could be more sustainable thus he started practicing diversified and integrated farming in 2016. His farm, which is located in Barangay Poblacion, President Roxas, North Cotabato, Philippines, is divided into two hectares for rice production, and 1.5 hectares for fruit trees, livestock, fish pond and vegetables. To make the most of the land, he plants different crops and integrates livestock, poultry and fish to have additional sources of income.

Integrated Farming Practices

Most of the crops that Ed cultivates are those that his family prefers. Fruits include banana, rambutan, coconut, papaya, lanzones and durian while vegetables consist of bottle gourd, bitter gourd, string beans, okra, tomato and eggplant. He grows vegetables all year round with zero chemical application and sells them within his community.

His farm also houses cows, pigs, ducks, and chickens. He does not spend on feeds for the animals. Every morning, he simply lets the cattle graze on available forages around the farm. He collects kangkong (water spinach) which he mixes with rice bran to serve as feed for the pigs. The poultry animals, on the other hand, are raised in a free-range setup. The chickens are fed with mixed rice bran and cracked rice twice a day (morning and afternoon). The ducks are fed twice a day during the off-season and three times during planting season. The ducks serve as pest control agents by eating golden apple snails present in the fields. The eggs and meat produced from the poultry provide the household with additional sources of income.

Ed's farm has a total of 500 square meters allocated for fish culture. The area consists of four separate growing ponds for tilapia and catfish. Feeding is done three times a day. He grows azolla and duck weed, and collects golden apple snails from the field to serve as feed for the tilapia. The catfish, on the other hand, are fed with bananas.

Integrated farming has provided Ed with diversified farm produce for family consumption and for selling in the market. And in difficult times, the harvests are shared with his neighbors who are most in need. During the lockdown caused by the pandemic, his family shared fresh produce with their neighbors, particularly with the senior citizens who could not go to the market.

Challenges and Lessons Learned

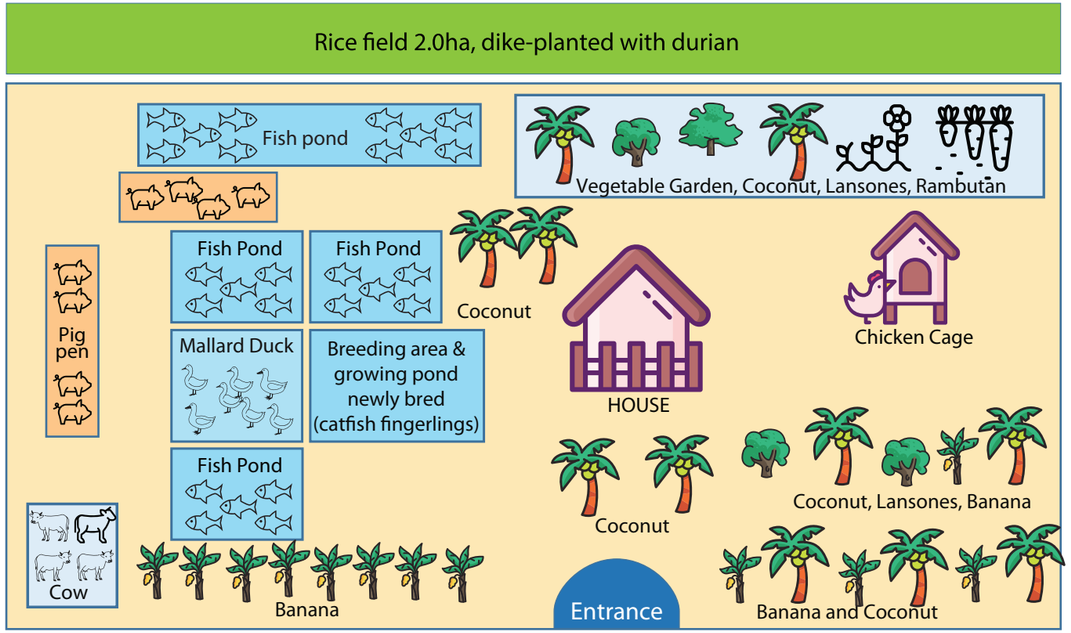
One of the challenges Ed encountered in managing the farm was in relation to its poultry component. During one rainy season, his neighbors vaccinated their chickens but did not properly dispose the vaccine vials. This created a health hazard for his own flock. His unvaccinated chickens were infected and eventually died, totally eradicating the flock.

He also has a minor problem managing his ducks during rice planting season. When left in the field, they would eat all the planted seeds. He shares that it is necessary to know the interaction of every farm component to determine which are compatible or could only cause damages in the farm.

He has learned that monocropping does not assure adequate farm income. Integrated farming is more sustainable with different farm enterprises and commodities available to ensure support for household needs. However, adequate financial resources are also needed in order to establish fish ponds, fruit tree plantations and raise livestock and poultry.

AGROECOLOGY:
Farmers' Practices in Southeast Asia

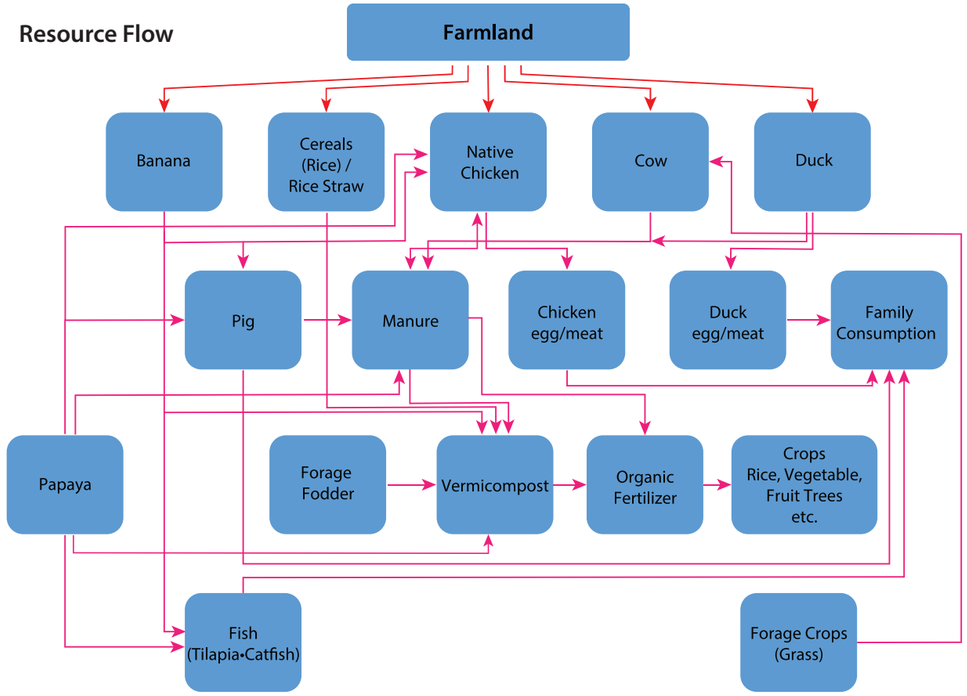
Farm Layout



Farmers' Practices • Agroecology and Family Farming

Southeast Asia Regional Initiatives for Community Empowerment

Resource Flow



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Farmers' Practices in Southeast Asia

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Farmers' Practices • Agroecology and Family Farming

Southeast Asia Regional Initiatives for Community Empowerment

Diversified and Integrated Farming:

Sharing access to food and resources with neighbors

Jonna Mae Ducala and Guiller Domingo

Mr. Diego Delfin has been an advocate of organic diversified and integrated farming since he started practicing the system in 2009. The 60-year-old farmer from New Pangasinan, Isulan, Sultan Kudarat, Philippines manages a 1.5 hectare farm with integrated crop production and livestock management with the help of his daughter.

Diego grows organic rice in 25% of his farmland and raises livestock, fish, poultry, fruit trees and vegetables in the remaining 75%. He maximized the use

Southeast Asia Regional Initiatives for Community Empowerment

of the area by planting different crops and integrating them with poultry and fish as he wanted to produce healthy and safe food for his family of five and have a good source of income.

Agroecological Farming Practices

Diego is one of the few people in his community who practice organic diversified and integrated farming. He grows fruits like soursop, lanzones and rambutan, and different kinds of vegetables such as eggplant, bottle gourd, water spinach, okra, tomatoes, squash, beans and root crops like taro. He always makes sure to grow his vegetables organically and sustainably. Instead of buying vegetable seeds, he uses the ones that he saves from previous harvests. Instead of applying chemical fertilizers, he applies vermicast to his farm. The farm's produce is both for home consumption and retailing.

Livestock and poultry are likewise raised organically. The chickens freely roam around the farm (free- range) and fed with rice bran—a farm by-product – instead of commercial feeds. He also adds salt in the drinking water to provide the chickens with electrolytes.

Aside from poultry, Diego also raises several goats. Every morning, he cuts and carries forages specifically napier grass to their sheds. He lays shrubs or rice straw underneath the goat sheds to catch their waste. He then collects the waste and adds it on his vermicompost and lets it decompose into organic fertilizer. With this practice, he is recycling and converting the waste into another useful farm resource.

He is focused on improving his 200 square meter pond of catfish and tilapia which he feeds with rice bran. His tilapia pond can hold 5,000 fingerlings while the

AGROECOLOGY:
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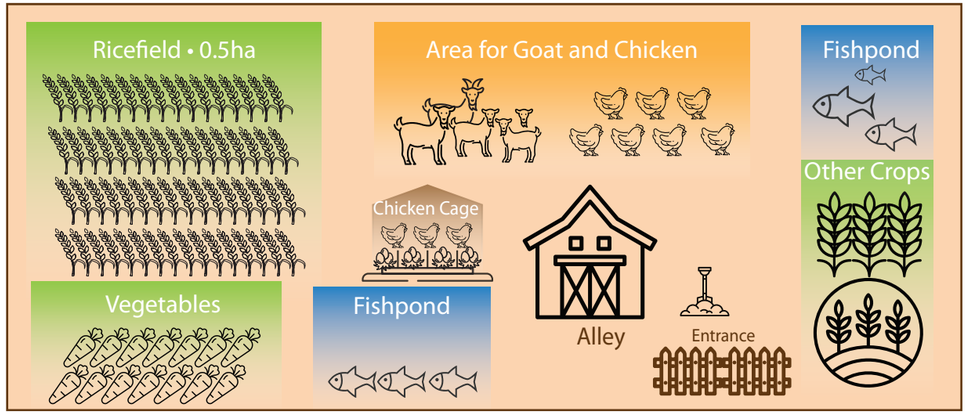
Farm Layout



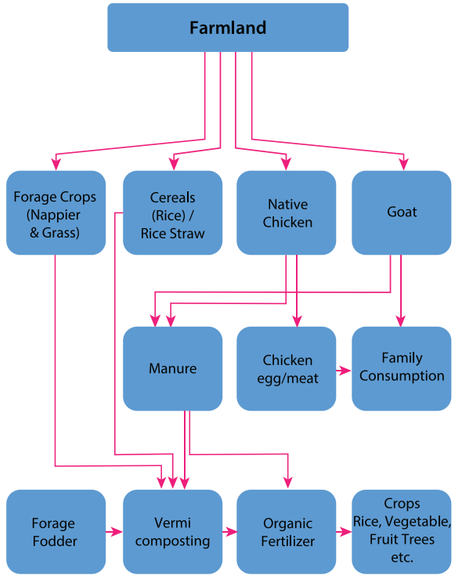
catfish pond can hold 1,000 fingerlings. Diego does not sell the tilapia and catfish since these are mainly intended for household consumption. The catfish are also intended for breeding. He wishes to learn more about breeding techniques of catfish since it is expensive to buy fingerlings every season (usually every four months).

His farming venture shows strong promise as he sees his farm becoming more productive, profitable, sustainable and environmentally sound. Organic diversified and integrated farming provides not only healthy, safe and diverse food on the table for his family but also additional income, which can be used for the family's other needs. His farm also provides his neighbors with access to planting materials and organic produce.

Today he is one of SEARICE's farmer-mentors. With his vast experience, he has opportunities to share his knowledge on organic diversified and integrated farming to other farmers within and outside his community.

Farmers' Practices • Diversied and Integrated Farming

Resource Flow



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Family Farming Helps in Achieving Sustainable Productivity

Jonna Mae Ducala, Norminda Naluz and Renelyn Gamaya

The many problems confronting farming have resulted in many farmers opting to find employment in non-agriculture related jobs. Those who choose to continue farming often have to work alone or have to hire workers to be able to maintain their farms.

The Tamonon family is among those who still practice family farming. Andres, Amalia and their three children - two daughters and a son - work together to sustain the farm that has provided for their needs through the years.

Although only the son is directly involved in their farm today, the daughters are also knowledgeable about and skilled on farm activities having been taught by their parents while growing up. Andres manages the entire farm. Mrs. Tamonan is responsible for the financial management in the household and helps supervise the farm particularly when the husband is unavailable. The son is tasked to feed and take care of the animals, and is in-charge of the cacao and coconut crops. The daughters help in managing a small store which they put up to augment their income. Decision-making regarding the farm is participatory, with the members consulted in choosing the seeds to buy, produce and animals to sell and where to sell, among others.

The family owns a two-hectare upland farm located in Sitio Sabang, Arakan, North Cotabato, Philippines. One hectare of the land is devoted to cacao while the remaining one hectare is planted with corn, coconut, rubber, coffee and fruit trees such as mangosteen, durian, lansones, rambutan, soursop (guyabano), pomelo, star apple, cotton fruit (santol), siniguelas, mangoes, avocado, jackfruit, marang, and others. Also present are vegetables such as squash and eggplant and perennial shrubs *Gliricidia sp.* and tricantera. The integration of livestock such as cattle, goats, pigs, chickens, ducks, geese, and turkey completes the farm.

Prior to practicing agroecology, the income from the total yield of their farm was insufficient to meet their financial needs, and they had to rely on their small food store and Andres' earnings as a public transport driver (motorcycle). Although they owned a relatively large tract of land, it was not used to its maximum capacity. Moreover, their farming system was heavily dependent on the use of chemical fertilizers in the hope of getting better yield particularly from their corn farming. During the time when rats and other pests infested their farm and diseases infected their crops, they resorted to using chemical pesticides and other inputs, endangering their and the soils' health. This put them heavily in debt as they had to borrow money to buy chemicals and pay workers to help in the farm. During a good cropping season, they could pay their debts including interests and still had enough left for their needs. However, occurrence of pest infestation or disease outbreak made it very difficult to pay debts and find capital.

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Farmers' Practices • Family Farming Helps in Achiving Sustainable Productivity

In the mid-90s, both husband and wife attended trainings on sustainable agriculture and organic farming sponsored by the Office of the Municipal Agriculture (OMA) of Arakan. Thereafter, they started adding different components in their farm to maximize the capacity of their land. They planted various crops in order to augment their income and to ensure that they have alternative sources of income when there is crop failure or prices of harvested crops are too low.

They attended other trainings, including on rubber production, cacao, participatory plant breeding (PPB) and participatory varietal selection (PVS) on rice under the farmer field school (FFS), and vegetable gardening. All these trainings have enabled them to shift to agroecological farming system.

Agroecological Farming Practices

The family transformed their farm such that the components are functioning in synergy. Fruit trees, crops, and livestock all contribute to each other's health and the soil. The poultry animals like chickens, duck, goose, and turkey are raised in a free-range setup around a parameter fenced with *Gliricidia sp.* Trees like cacao and coconut provide shade for the poultries to protect them from the heat, as well as serve as a good dwelling place for the cattle especially after they are done with the plowing. Perennial trees offer shelter, both shade and material for sheds and cages for the mature and young animals. They are also sources of food for the cattle and goats. Goats, being browsers, consume leaves, branches, and even weeds which help clean the farm.

The animals are also fed with corn which is planted for two cropping seasons. Cracked corn is mixed with shredded coconut meat and served to poultry animals. Hammered corn is mixed with rice bran and fed to the swine. All the corn by-products like cobs and straws are deposited in the vermicompost pit together with other farm wastes like *Gliricida sp.* leaves, decomposed rice hull/straw, vegetable wastes, grass and banana trunks, as well as wastes from the poultry and livestock. The wastes from the animals provide nitrogen which adds nutrients to the vermicompost.

Income is derived from selling of harvests and products from the crops such as copra, sap from rubber trees, fruits and vegetables. The family produces vermicast and compost which are harvested every 3-4 months, depending on the kind of raw materials used in the process, and sold to the Office of the Municipal Agriculture. On the average, they harvest 35 sacks and sell each sack of 50 kilos at PhP250 (USD5.13). They harvest cacao seeds every three months and when they harvest at least 50 kilos, they sell these for PhP85 (USD1.75) per kilo. Supplemental income comes from a small store they own where they sell cooked food, and produce from their farm – fruits, vegetables, chicken eggs and even live chickens and ducks, and hammered and cracked corn as animal feeds.

AGROECOLOGY:
Farmers' Practices in Southeast Asia

Challenges and Lessons Learned

Not being able to use the land to its full capacity and lack of capital were major problems for the family. But gaining knowledge and skills through trainings and applying these have greatly contributed to their farm's improvement. Knowing how to deal with common problems such as pests and diseases and using all the resources within the farm have helped in reducing expenses and generating income.

Amalia acknowledges that agroecological farming has made their lives comfortable. The make-over of their farm, shifting to more sustainable practices, and working together has afforded her family with the means to provide for their needs. All her children have completed their education – the eldest is a doctor, the second, a vocational course graduate and a farmer, and the youngest is a teacher.

Today, they no longer have to worry much when it comes to their financial needs as they have enough for capital for their small business and budget for their other daily expenses. Most of all, she says, they now have food security.

Implementing Institution

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Arakan Sabang Farmers Association Inc. (ASFAI)
Municipality of Arakan
North Cotabato

Farmers' Practices • Family Farming Helps in Achiving Sustainable Productivity

Farmer plant breeders are farmers who have developed knowledge and skills on plant breeding and apply their learnings on their farm. These farmers set the breeding goals, decide which varieties to use as parents in new crosses, cross-breed, grow and select the breeding populations, and release new varieties. Farmers have been involved in plant breeding since farming began. They carefully test and select varieties that suit the local climate, soils and tastes. Often, farmers are the best people to select and breed plants because of their extensive experience in the field. They have developed good crop selection skills because their livelihoods depend on choosing the best crop varieties for their farms. Farmer plant breeding is a way to find crop cultivars that grow well in local environments, to meet the needs of farmers, and to maintain important crop varieties.

Farmer Plant Breeding:

If scientists can do it, farmers can, too

Jonna Mae Ducala, Guiller Domingo and Norminda Naluz

Farmers are plant breeders. During harvest time, they would reserve a portion of their farm yield and save seeds for the next planting season. They understand the importance of plant breeding as it allows them to develop varieties that fit their specific farm environments and contain traits that they value most.

Mr. Diego Delfin is a 60-year-old farmer plant breeder from New Pangasinan, Isulan, Sultan Kudarat, the Philippines. He began working on his family's farmland along with his father when he graduated from high school at 17 years old. In 2007, he joined a season-long training on participatory plant breeding (PPB) sponsored by SEARICE and its partner organizations, hoping to learn even just a fraction of what college graduates would in four years.

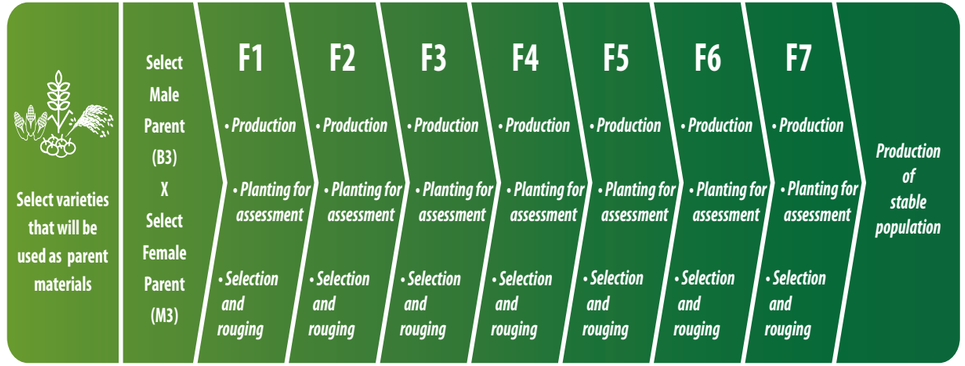
Since then, Diego has been conducting breeding experiments on his own because he wanted to develop a rice variety that is resistant to pests and diseases, high yielding, aromatic and adapted to local conditions. He also wanted to share and exchange seeds with other farmer plant breeders.

Farming Practices

To achieve his breeding objectives, Diego selected M3, a farmer variety and B3, a traditional variety as parent materials. With the aid of a rice breeding kit, he crossed the two varieties and established a trial farm. After producing the first filial generation, he conducted advanced F2 to F7 trials for selection towards variety development. He then selected the best lines for mass production.

He is satisfied with the rice variety that he developed which is aromatic and good tasting.

The farmer plant breeder named his developed variety as M3B3. M3B3 has provided him with additional income. Significantly, it has been shared with many farmers including those from Calasiao, Pangasinan, who used it in their farmer field school (FFS) and later in their own farms. Once stable, they lauded it as having good qualities.



The Calasiao farmers then requested makers of their town's famous Puto Calasiao (Calasiao rice cake) to try the variety as the base ingredient. M3B3 was pronounced as very suitable in making the rice cake as the variety bore consistency, texture and taste ideal for the product.

Challenges and Lessons Learned

According to Diego, rice breeding is a fulfilling job but the long selection process for variety development makes it hard for other farmers to do. It takes seven to eight generations before a selection becomes a stable variety. Recording of segregating lines selected per generation/planting season is also an enormous task. Farmer plant breeding is a continual process of crop improvement. But the work continues as long as there are farmers interested and willing to do it.

For Diego rice breeding has become an integral part of his life. He continues to conduct experiments and he is proud that his breeding efforts are comparable with those of formally trained agricultural scientists. "If scientists can do it, farmers can do it too," says the witty farmer.

Implementing Institution

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Supporting Institution

New Pangasinan Samahan ng Napalayang Magsasaka
New Pangasinan, Sultan Kudarat

Participatory Plant Breeding:[2]

A farmer's innovation gets a well-deserved recognition

October 30, 2018 is an important date for Mr. Chankith, a rice farmer from Nasome Village, Meuong Phieng District in Xayabouly Province, Laos. It was on this day that Meang Phieng 1 (MP1), a variety of sticky rice which he developed, was officially released. The recognition that he received for this achievement was worth the long time it took him to select this variety from segregating lines in on-farm trials that are part of participatory plant breeding (PPB) conducted in farmer field schools (FFS).

[2] Siviengkhek Hpommalath, van Oudenhoven, F., Salazar, R., Visser, B., Dohar, A., Manicad, G. 2018. First Provincial Release of Rice Varieties Developed under Participatory Plant Breeding in Laos. Unpublished report. SD=HS programme phase 1 (2013-2018), Oxfam Novib. The Netherlands.

Mr. Chankith was a member of an FFS on a participatory varietal selection (PVS) conducted with the Rice Research Center (RRC) of Laos. RRC provided the varieties, breeding lines as well as segregating lines for farmers to grow, observe, and select. When the field school ended, most of the farmers took breeding lines that they preferred and multiplied these for themselves. Mr. Chankith's selected plants from the segregating lines that had long grains, panicles and good grain filling characteristics. He thought that his choices may become better if he grew them in his own field. He made his selections for several seasons until the plants became uniform.

Of the total 70 segregating lines which were initially distributed to farmer field schools, 27 were selected as promising and 11 were chosen to be advanced as stable lines. Two of these which were planted during an earlier project phase finally became MP1 and SLV1 (TK17).

In 2015, the Provincial Agriculture Field Office (PAFO), the provincial extension service, distributed Mr. Chankith's variety to farmer field schools being conducted in other communities in the province for evaluation.

Meuong Phieng 1 is a variety of sticky rice that combines the yield, eating quality and non-photosensitivity of RRC variety TDK 1 with the resistance to gall midge and with a milling percentage (over 60%) of the traditional Meang Nga variety. It is a medium-duration variety (130-150 days) which needs to be planted early (in November) if grown during the dry season. The variety is adapted to and yields well in relatively poor, sandy soils and its quick growth and large height make it suitable for direct seeding (broadcasting), as it outgrows and quickly covers competing weeds. The variety is highly responsive to nutrient addition and will lodge under heavy fertilizer application. The cooking quality of this variety is peculiar in that it requires relatively little soaking time the first few months after harvesting (only one to two hours against overnight for other glutinous varieties). It becomes too sticky when soaked for too long.

Agroecological Farming Practice

Pre-breeding and early generation selection were done at the Rice Research Centre (RRC) in the capital Vientiane and the resulting segregating lines were given to farmer field schools in the different provinces. Farmers in the FFS applied pedigree selection to the segregating lines that they considered promising, generally for two generations, after which the lines were advanced through bulking, still with a degree of selection pressure applied.

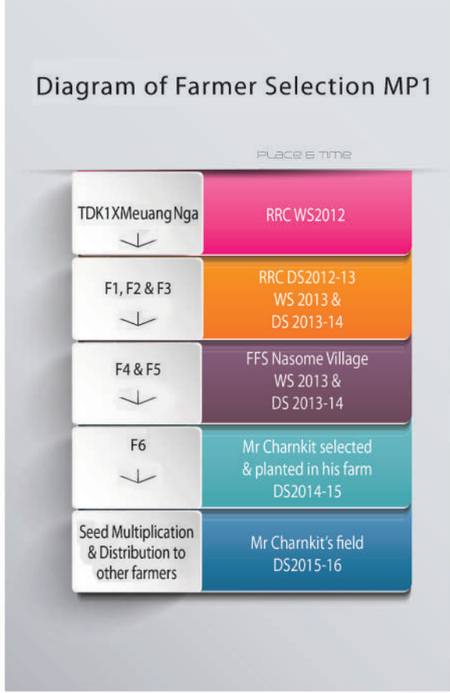
MP1 is the result of a cross between RRC variety TDK 1 and a traditional variety done in Luangprabang under the Biodiversity Use and Conservation in Asia Program (BUCAP), a collaboration between SEARICE and RRC. In the succeeding project, Sowing Diversity=Harvesting Security (SD=HS), the farmers in Xayabouly province received the segregating lines from the RRC in 2014 at 4th filial generation and the farmers participating in the field school developed the segregating lines until F6. The final selection and propagation work was done by individual farmers in their own fields. Once the lines had become sufficiently stable, the provincial extension service (PAFO) distributed the lines to other farmer field schools participating in the SD=HS project. These were evaluated against other lines.

Characteristics of *Meung Phieng*1

Varieties	*MP1*	*TDK1*	*Meang Nga*
Seed Color	Light red	Dark Red	White
Maturity (Days)	140-145	135-140	Flower (~end of October)
Crop Season	Wet and Dry	Wet and Dry	Wet
Plant Height (cm)	130-150	90-100	>130
Milling (%)	>60	50-55%	60%
Grain Yield (t/ha)	4.5-6	4-6	2-2.5
Rice gall midge	Resistant	Susceptible	Resistant

Farmers' Adaptation

More farmers started growing the MP1 variety in the past years though it was intermittently shared because it was not officially approved and thus, the authorities did not promote it further. However, leaders from several villages approached Mr. Chankith and offered to help promote the variety. They believed that if people liked it, thereby making it popular, there would be bigger demand for it in the market and the price may increase when sold to millers.



Challenges and Lessons Learned

Years ago, farmers would produce improved varieties and sell these to millers as seeds (for sowing) and not just as grains (for eating). The millers would sell the seeds to other communities who would reproduce them. The miller would then buy back the grains from them. But problems arose when some middlemen would go to Thailand to buy very cheaply priced seeds, smuggle these to Laos, and sell at a very low price. Farmers did not even know whether what they were buying were seeds or grains. The millers which were small and did not have much capital could not compete with the middlemen and were forced to stop buying from farmers.

Most plant breeding institutions do not give segregating materials to farmers as they do not believe that farmers can handle such materials. But when the plant breeders involved in the program implementation discovered for themselves that farmers could do breeding even better than some of them could, they realized that PPB is efficient in bringing locally adapted varieties in the field and addressing the various needs of farmers across different agro-ecosystems.

AGROECOLOGY:
Farmers' Practices in Southeast Asia

Variety	Spread in 2018	Growing Environment	Weather*	Input use
MP1	• 10 sites with a total of 15-20 ha in Xayabouly province • in 1 district (out of 10 in the province) • by FFS and other farmers	Similar for all varieties: lowland plains, both irrigated and rain-fed. Generally rice-rice systems, with no crop rotation.	• average temperature (25 3C) • rainfall (1,643 mm) • relative humidity (83%)	Similar for all varieties: low to medium application of organic fertilizer with small amounts of chemical fertilizers; no herbicides or pesticides

Implementing Institution

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Farmers' Practices • Farmer plant breeding

Fermented Plant Juice (FPJ) is used in solutions for seed and soil treatments and plant nutrition. It consists of the young shoots of vigorously growing plants that are allowed to ferment for approximately seven days with the aid of brown sugar. The brown sugar draws the juices out of the plant material via osmosis and also serves as a food source for the microbes carrying out the fermentation process. The weak alcohol produced during fermentation extracts chlorophyll (soluble in ethanol) and other plant components. It is non-toxic and edible. This solution is rich in enzymes full of lactic acid and microorganisms like yeast. Through drenching the soil with the solution or by directly spraying it onto fruits and flowers, this fertilizer allows plants to improve their health and helps them grow vigorously.

Fermented Plant Juice (FPJ) Production:

Restoring the health of crops

Renelyn Gamaya

Mr. Sofronio A. Sullano, a farmer from General Nakar, Quezon Province, was determined to learn natural farming so he could produce cheaper and safer food for his family of five. Thus he attended several trainings and seminars to develop his knowledge and skills on natural farming.

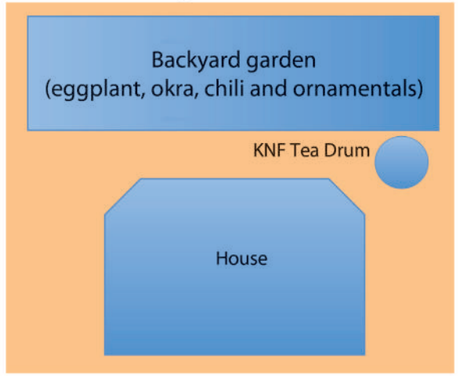
The 65-year-old Sofronio grows rice in a field located about twenty minutes away from his house, and vegetables in his backyard. He initially applied the farming practices learned from trainings when the rice in his 300 square meter field was infested with bacterial leaf blight (BLB) caused by *Xanthomonas oryzae pv. Oryzae*. This disease, locally known as "tasik", usually attacks after planting and when the rice seedlings are already fully established. The farmer recalls being gone from his farm for a couple of weeks and when he returned, his rice crops have withered with seemingly no chance of surviving. The adjacent farms were also infested with BLB, but the farmers opted to replant.

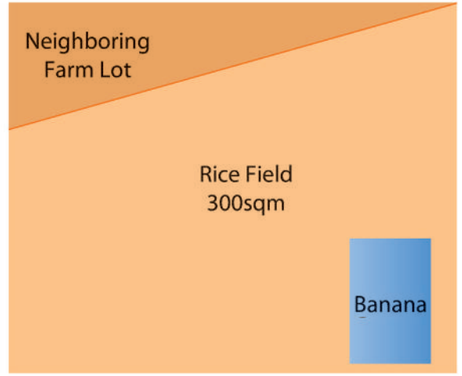
He chose to try to save his withering crop and thus, he treated the rice field with fermented plant juice (FPJ), one of the elements of natural farming.

Agroecological Farming Practices

Sofronio prepared the FPJ by mixing banana suckers with molasses. He mixed one kilogram of molasses with three kilograms of chopped suckers. He then sprayed this in his field every week. After several weeks of application, the rice recovered and flourished. The juice restored the health of his crops. He did not mind that instead of the usual four months, it took five months before he could harvest. The one month delay spared him from spending and replanting. And he was still able to save a lot on production costs and time by using FPJ.

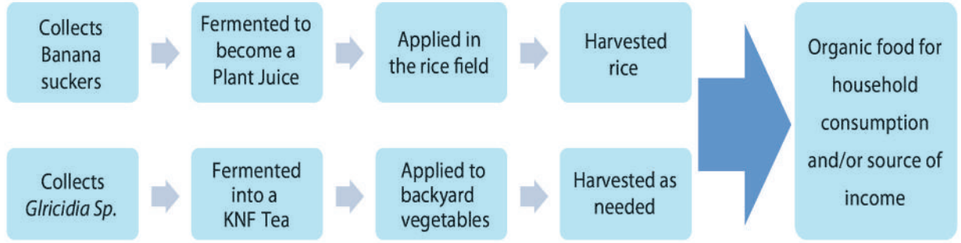
Household Farm Layout





Farmers' Practices • Fermented Plant Juice Production

Resource Flow



Aside from FPJ, he also prepares foliar spray for his vegetables (eggplant and okra). He uses a barrel to soak and ferment some nitrogen-rich plants (e.g. *Gliricidia sepium* or madre de cacao) for seven days. Depending on the weather, foliar spraying is done once a week when it rains frequently, or twice a week during fairer weather. The fermented tea for the foliar sprays does not have to be of a particular species, it could be any legume or cover crop.

When it comes to controlling weed population, the best way is to remove them before they reach maturity because when weeds mature, the pods dehisce or split open and the seeds are dispersed in the field.

Challenges and Lessons Learned

It is essential to have patience, persistence and strong principles to practice agroecological farming. Only a few farmers use organic fertilizers and pesticides because production takes much of their time and requires a lot of effort. But this is not a problem for some farmers as long as it gives them safer food for the family and inexpensive inputs are used in the farm.

Sofronio believes that for a practice to be considered best, it should be effective and economical. Since it helped him to recover from an infestation and manage the weed population without sacrificing the yield, he considers natural farming as among the best practices worth sharing with other farmers.

AGROECOLOGY:
Farmers' Practices in Southeast Asia

Farmers' Practices • Fermented Plant Juice Production

Implementing Institution

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Goat and Duck Raising:

Securing extra help in getting rid of pests

Jonna Mae Ducala, Renelyn Gamaya and Guiller Domingo

Mr. Eddie Ybot is a 67-year-old farmer from Magpet, North Cotabato, Philippines. His family has a 2.5-hectare upland farm which is planted to cacao, banana, coconut and rice. With a family of five, he needed to have extra income thus, he decided to raise goats, ducks and a few native chickens. Goats are not expensive to raise and ducks can be fed with some food scraps or rice from his farm. He has been raising ducks for more than eight years while goats were added in 2015.

Managing the farm animals

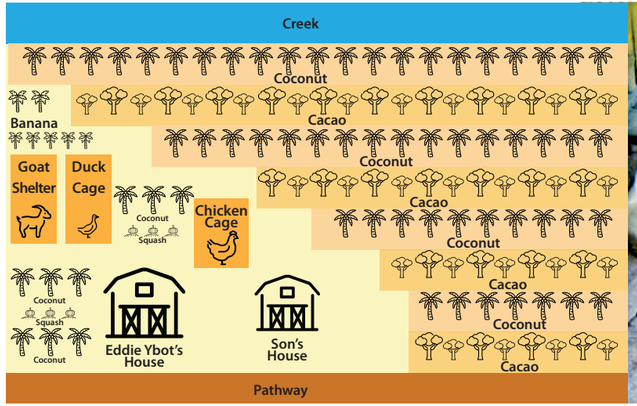
Goats are natural browsers and usually eat leaves, twigs, vines and shrubs. But if left unwatched in the field, they will eat all the growing crops that they can find. As a prevention measure, Eddie sets a schedule, such that the goats are allowed to browse in the field from 11:00 am until 3:00 pm. This helps him get rid of some unwanted banana suckers in his farm and, at the same time, feed the goats with fodder. However, during rainy season, instead of letting them browse, he feeds them through the cut-and-carry system, where he brings *Gliricidia sp.*, banana and other leguminous shrubs to their cages. He also gives them saline water instead of a salt block to help

them eat more. He mixes a handful of salt (about two to three tablespoons) into a gallon of water and gives the solution to his goats every afternoon, after browsing.

To increase the number of goats in his farm, the farmer reserves a buck for mating. He controls the feed intake of a gestating doe every farrowing season. He increases the feed intake only prior to and during the lactating period. With the help of his sons, they supervise the goats while giving birth and assist only when needed.

The ducks are let out to roam around the farm every morning. Eddie feeds them twice a day, usually with rice bran or surplus fruits from his farm like banana and papaya, as well as some food scraps from their house. Since ducks do not easily get sick, the cost of raising them with the goats is not expensive and both can be easily sold.

Farm Layout



Challenges and Lessons Learned

The innate nature of goats as browsers is one of the challenges in managing them. Eddie recalls that when he was still in his early years of raising goats, they became a problem since they kept on eating the leaves of his cacao trees, one of his major cash crops. Thus, a farmer should always be vigilant when feeding or leaving the goats in the field. Furthermore, goats can get sick easily during the wet season thus it is best to provide them with a dry and clean shelter.

He believes that a farmer can raise a healthy and productive livestock without using any synthetic input. It is just a matter of learning their behavior and being resourceful. He added that his livestock are not costly to raise and he can still manage them without sacrificing the other farm work. Furthermore, the market for both goats and ducks is not hard to find since he can sell them in the community.

Implementing Institution

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Collaborating institutions

Payapa at Masaganang Pamayanan Farmers Association or Peaceful and Prosperous Community Farmers Association PAMANA
Magpet, North Cotabato

Green manuring is the practice of turning undecomposed green plant tissue into the soil. The function of a green manure crop is to add organic matter to the soil resulting in the increase in nitrogen supply of the soil and certain nutrients made more readily available, thereby increasing the productivity of the soil.

Green manures are plants, preferably leguminous, sown fairly thickly to produce a dense mat of green growth that is dug in (or cut down) before the plant flowers to increase soil fertility. They add organic matter and nitrogen, conserve nutrients and protect the soil surface during erosion. Green manures should be inexpensive to plant, be easily established, produce succulent tops and roots rapidly, generate good ground cover quickly and be capable of growing on poor soils (sands and clays benefit most).

Since green manure crops are often sown after a primary crop, the green manure cover or catch crop utilizes excess fertilizer not taken up by the main crop. When these catch crops are incorporated into the soil, rather than harvested, they not only protect the soil from erosion and runoff, they also conserve nutrients which might have leached away or contributed to the contamination of streams and lakes.

Source: CTHAR, 2020

Green Manuring:
Low cost fertilizer for better harvests

SWISSAID Staff

U Win Naing Htun is a green tea farmer from Kyae Twin Kone village in Pindaya Township, Shan State in Myanmar. He is 35 years old, married and with three young children.

He has been farming for more than 21 years and manages the family farm along with his wife. They cultivate a 2.15 hectare rain fed land with 1.2 hectares dedicated to tea and 0.40 hectare to avocado. The rest is planted with vegetables such as kale, broccoli, leek, and golden pea. Rice bean is grown as green manure crop. They earn a living by selling green and pickled or fermented tea in the market.

Agroecological Farming Practice

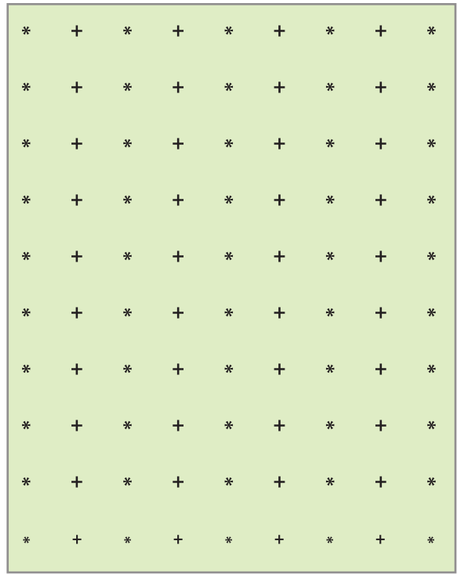
For over four years now, U Win has been using green manure in their tea plantation to improve soil structure. Rice bean serves as green manure and grown between rows of green tea plants at the start of the rainy season in June. U Win noted that intercropping these two crops improves yield and quality of the tea plants.

Using green manure combined with unburnt crop residues is a cheap alternative to fertilize the farm. For farmers like U Win who cannot afford to buy chemical fertilizers, green manure serves as an accessible form of low-cost fertilizer to improve soil fertility. It also helps the green tea plants to have better resistance to extreme weather conditions including tolerance to direct sunlight.

Facilitating Farmers' Adaptation

U Win is one of the recipients of the training courses on natural pesticide production sponsored by Shwe Danu Self Help Group, a local NGO in Southern Shan State, and SWISSAID Myanmar. Based in Pindaya Township, Shwe Danu implements projects in 23 villages in nine village tracts in the Township and includes poor men and women farmers. Shwe Danu develops the capacities of local communities to improve their livelihoods and make them self-reliant. Among the capacity development trainings they provide are on agroecology, livelihood, financial management, value addition with market linkages and land rights awareness. They also provide farming inputs, farm machineries and

Farm layout



*Legend: *Tea crop +Rice bean*

stroge facilities, and capital to encourage farmers to have practical experiences for their livelihood and apply agroecological farming. Social responsibility, gender equality and the empowerment of women are central elements of their work.

U Win is grateful for his training and for the assistance that CSOs and NGOs have provided in his transition to ecological agriculture. He may not have finished formal schooling but this did not deter him from learning more about green tea production and in improving his skills in tea pruning. He is an active leader cum member of several groups and committees in his village. Currently, he is the leader of his farmers' group and also serves as its farmer to farmer extension officer.

Implementing Institution

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The System of Rice Intensification (SRI) is a climate resilient, agro-ecological methodology for increasing the productivity of rice by changing the management of plants, soil, water and nutrients. The central principles of SRI are:

- Reduced and controlled water application. Rice field soils should be kept moist rather than continuously saturated, minimizing anaerobic conditions, as this improves root growth and supports the growth and diversity of aerobic soil organisms.
- Reduced plant density. Rice plants should be planted singly and widely spaced to permit root and canopy growth to keep all leaves photosynthetically active.
- Early quick and healthy plant establishment. Rice seedlings should be transplanted when young, less than 15 days old with just two leaves, quickly, shallowly, and carefully, to avoid trauma to roots and minimize transplant shock.
- Improved soil conditions through enrichment with organic matter

SRI was reported to increase yield, save water, reduce production costs, and increase income. SRI, on average, increased yields by 20 to 200%, improved resistance to environmental stresses, and increased carbon sink activity while reducing emissions.

Source: http://sri.ciifad.cornell.edu/aboutsri/methods/index.html

Integrated Rice-Fish Farming:

Improving sustainable livelihoods and restoring community health

Ngo Tien Dung

Agroecological Farming Practices

Rice-fish culture is a system that can help farmers increase the yield of both rice and fish. The fish grow very well in the rice field where there is an abundance of food to feed on - worms, insects and grass seeds. Fish play a role in weed and pest control thereby reducing herbicide and pesticide use and labor costs. Aside from helping farmers get rid of the pests which destroy the crops, the fish also help in improving oxygenation of the soil.

Farmers create their rice-fish farm by digging ditches in the rice field. A deep canal and several small ditches connecting the canal to the inside of the field are

Farmers' Practices • Integrated Rice-Fish Farming

laid out to allow the fish to easily move from the canal to the field. At the beginning of a cropping season, the fish are moved to the surrounding canal as the field needs to be drained for transplanting. During the tillering stage, the water level is raised and the fish are moved back into the rice field to catch and feed on pests.

When the rice is in the ripening stage, it is time to start harvesting the fish. The rice fields need to be drained first after which fish can be harvested from inside the fields or under the canals around the fields.

Burning of rice straw is no longer practiced in order to reduce environmental pollution and to have recyclable organic materials for the soils. In no-till rice-fish fields, compost and rice straw are important inputs used to improve the trophic relationships between insects and fish. Organic materials stimulate the growth of insect communities which, along with weeds, are basic elements of fish diet. Fish droppings provide additional nutrients for rice and stimulate the phytoplankton growth which complements the fish diet. Rice-fish farming does not only improve the sustainability of local rice production but also provides a diversified food source and significantly increases gross margin from rice production.

In 2016, the Ao Luong Village Women's Club conducted a survey to find out the economic gains from rice-fish farming. The results showed that the average gross margin from integrated rice-fish production was 6.8 times higher than that from just rice cultivation. The gross margin for rice-fish farming was US$2,700 while rice farming earned only US$396.

Farmers' Adaptation

Supported by the Center for Initiatives on Community Empowerment and Rural Development (ICERD) and building on the experiences from farmer field schools (FFS), local communities designed more efficient, productive and sustainable farming systems including adoption of the System of Rice Intensification or SRI. Over 70% of the rice farm area is now cultivated under Integrated Pest Management (IPM) and SRI while rice-fish cultivation has been adopted by 27 households in Ao Luong. Nutrient cycling was enhanced through the recycling of residues and organic wastes into compost which is then applied to rice fields. This practice has reduced the use of chemical fertilizer by as much as 75%. The amount of rice seeds used has also reduced by 60% through improved sowing and transplanting techniques.

Overuse of chemical pesticides led to outbreaks of brown plant hopper. To control the pests, chemical pesticides were replaced with the bio-agent Metharizume anisopliae (entomo-pathogen). Between 2014 and 2018, pesticide use in rice fields was reduced to about 90% and in rice-fish plots, 100%. Fields where SRI was being practiced also showed increase in numbers of natural enemies (35%) and aquatic animal species (55.5%). Table 2 presents figures compiled in 2016 by the farmer' group applying integrated farming rice-fish and SRI in Yen Bai Province.

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Farmers' Practices • Integrated Rice-Fish Farming

Table 1. Yield and Economic data of Rice-Fish system in 2016 in Ao Luong village, Son A commune, Nghia Lo district - Yen Bai province compared to rice only cultivation.

	Parameters	Integrated "Rice-Fish" Cultivation	"Rice Only Cultivation"
A	Rice Yields (kg ha)	5,391	5,859
B	Revenues of Rice (US$ ha)	1,910	1,853
C	Yields of Fish/Aquatics (kg ha)	1,309	0
D	Revenues of Fish/Aquatic (US$ ha)	2,956	0
E	Total Revenues of Rice, Fish/Aquatics (b + d)	4,866	0
F	Production Costs (US$ ha)	2,166	1,456
	Gross Margin (US$ ha) (e – f)	2,700	396

Exchange Rate: **US$1:VND21,405**

Table 2. Impact data of integrated farming rice-fish fields in which System of Rice Intensification (SRI) was applied

Impact	*Percentage*
Increased natural enemies	34%
Increased aquatic animals	55.5%
Increased yield	22.5%
Increased economic efficiency	24%
Reduced pesticide	90%
Reduced seed requirement	60%
Reduced water requirement	40%
Reduced chemical fertilizer	75%

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Youth participation is also a pillar of the programs of ICERD. Secondary school students are engaged in training courses and therefore play an important role. They also present to commune authorities, Women's Club, Farmer's Union their survey results on current issues related to agricultural biodiversity and risks related to pesticide use. They share with their family members and community in general the need to transition from external-based agriculture to a more sustainable system of integrated farming.

The members of Ao Luong Woman Club of Sơn A commune believe that the three key factors for success are "cooperation, sharing and learning". They consider these as the primary driving forces for improving sustainable livelihoods and, at the same time, restoring their community's health.

Farmers' Practices • Integrated Rice-Fish Farming

Southeast Asia Regional Initiatives for Community Empowerment

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AGROECOLOGY:
Farmers' Practices in Southeast Asia

Farmers' Practices • Integrated Poultry/Livestock Raising & Vegetables Production

Bio-mats

Bio-mats are formed by combining fermented biological agents with biomass and mulch from the floor of the chicken coops or livestock stables. This accelerates manure decomposition, and deodorizes foul-smelling and poisonous gases from the shed. The residues of bio-mats are ultimately used to make compost as alternative to chemical fertilizer.[3]

How to make bio-mats

- Use organic material such as woodchips, sawdust, crushed corncob, husks, rice straw, dry leaves or sandy soil to compose the bed, ideal range of C:N ratio being 4-10 (do not use pressure treated wood, or any wood that have been treated with anti-microbial chemicals).
- Create a floor low enough or build a structure high enough to contain absorbent organic materials.
- Activate soil microbes of EMUNIV into the organic bed at a ratio of around 200 grams of powder to 10 square meter bed, feed EMUNIV microbes with rice bran powder or sugar water. Spray water and make sure the bed is not too wet or damp.
- Wait for about 24-48 hours to have high quality bed before using.
- Monitor temperature and maintain at 28°C-35°C.
- After around 10-30 days, when the smell of manure returns, make additional spraying of soil microbes EMUNIV to keep beneficial microbes population strong and active. Add more organic materials, if the moisture level of the bed goes high.
- Harvest 100% of the organic bed after 12-24 months for composting.

[3] ICERD. Support to SRI-LMB FPAR Women's Group to enhance efficient application and appreciation of SRI for the improvement of livelihoods and the environment. https://icerd.vn/support-to-sri-lmb-fpar-womens-groups-to-enhance-efficient-application-and-appreciation-of-sri-for-the-improvement-of-livelihoods-and-the-environment/

Integrated Poultry/Livestock Raising and Vegetables Production:

Improving health and increasing income
through bio-mats technology and composting
Ngo Tien Dung

Poultry Raising and Vegetables Production

Ms. Ha Thi Vinh is a 54-year old farmer from Ao Luong, a mountain village within Son A commune of Nghia Lo district, Yen Bai province, Vietnam. She has a rice field with an area of more than 1,000 square meters and a vegetable garden measuring more than 300 square meters, both of which are free from chemical inputs. The household's main source of income is chicken farming. Every year, Ms. Vinh raises between 700 to nearly 1,000 chickens, from which she earns about USD 1,500 per year. Ms. Vinh raises the chickens using the biological mats or bio-mats technology.

Ms. Vinh is a pioneer in the use of bio-mats and compost making. She promotes the use of this technology in livestock/poultry raising, and compost in fertilizing vegetable gardens among the members of the Ao Luong Women's Club, of which she is the Chairperson. Through her guidance, the members increased their knowledge on agroecological farming practices, and on related environmental and health concerns. Ms. Vinh encourages the members to produce organic vegetables and supply these to the village kindergarten and different agencies in neighboring areas. Their efforts help in boosting access to more and safer food in the communities.

Livestock Raising and Vegetables Production

Women belonging to ethnic minorities in Vietnam perform multiple tasks in their households. Aside from taking care of children and doing housework, they are mainly responsible for livestock raising and vegetables production.

Many households raise pigs and chickens to add to nutritional food sources and generate income for the family. But the pigs were usually kept near their houses, which caused foul-smelling air. The manure was simply thrown away and not used as natural fertilizer for the vegetable gardens. Chemical pesticides and fertilizers were commonly used to save on time and labor.

These practices were among those that the Center for Initiatives on Community Empowerment and Rural Development or ICERD wanted to address through its agroecological program. ICERD began the implementation of this program with a training conducted by the Vietnam National University of Agriculture (VNUA) on how to create and use bio-mats. The technology then was tested by the Women's Club and was adopted by the local community. As part of their learning, 27 households in Ao Luong relocated their livestock to their home gardens.

ICERD and its partners further trained 66 farmers (47 female and 19 male) in Ao Luong village on different agroecological farming systems and practices. They have also included 316 students (204 female and 112 male) in their trainings. The series of trainings stimulated the participants' interests in growing vegetables in their home gardens as a strategy to diversify their diets and increase their income.

In Ao Luong, the Women's Club played a crucial role in capacity building as the club itself went on to organize additional trainings on sustainable vegetable production. Armed with knowledge and skills in integrated farming systems, the members now boast of highly diversified vegetable gardens. They have been selecting local varieties and exchanging seeds among themselves. They do not use chemical fertilizers and pesticides thus attracting buyers who are interested in local organic produce. Their holistic approach to farming helps ensure that their families and the whole community have sustainable supply of safe and healthy food.

Agroecological Farming Practices

Poultry raising has been a source of income in Ao Luong province even before ICERD introduced its agroecology program. But due to the amount of labor involved in cleaning chicken coops, farmers raised only a small number of chickens. The application of the bio-mats technology has reduced the labor required to clean the chicken coops and lowered vaccination expenses as the chickens became healthier. This enabled the farmers to significantly increase the number of chickens they raised.

In the past, Ms. Vinh, could only raise about 500 chickens per year but with the use of bio-mats she now raises nearly 1,000 chickens per year. Similarly, Ms. Hoang Thi Lien, Vice Chairman of the Commune People's

Committee, used to raise less than 200 chickens per year. She has more than doubled the number and is now able to raise 500 chickens per year. In the case of Mr. Dinh Van Tuy, who used to grow less than 200 chickens per year, the number has increased to nearly 2,000 chickens each year in the last three years.

Bio-mats are formed by combining fermented biological agents with biomass and mulch from the floor of the chicken coops or livestock stables. This mixture accelerates manure decomposition, and deodorizes foul-smelling and poisonous gases from the shed. The residues of bio-mats are ultimately used to make compost as replacement for chemical fertilizers in vegetable production. The bio-mats technology has been registered for use with a "Certificate of Circulation of Probiotics (EMUNIV) in Waste Treatment in Vietnam - number 95/LH-CPSHMT" of the General Department of Environment - Ministry of Natural Resources and Environment.

The women are now using bio-mats because they want to reduce the work on cleaning poultry coops and livestock stables, and deodorize foul-smelling and poisonous gases that come from these. They also want to eliminate the use of agrochemicals (pesticides and fertilizers) in their gardens to produce vegetables that are safe-to-eat.

Table 1 compares the expenses incurred from poultry raising with and without the use of bio-mats. It shows that coop cleaning work with bio-mats compared to without bio-mats significantly decreased. The care and labor and drug injection costs also reduced by 100% because the chickens did not get infected with diseases when raised in coops with bio-mats. These figures were compiled in 2018 by members of the Ao Luong Women's Club.

The practice incorporated nutrient cycling within the farm with the recycling of residues and organic wastes into compost. The compost replaced chemical fertilizers applied in the home gardens. The use of bio-mats made the conversion from chemical-based practices to organic farming easy. Among those who benefited from the organic farming practices were kindergartens and boarding schools and the rest of the community as they have gained access to safe food.

Farmers' Adaptation

In 2014, ICERD partnered with the Center for Application of Advanced Environmental Technology -

Table 1

Items	Without Bio-mats (Vietnam Dong)	With Bio-mats (Vietnam Dong)
1- Bio agent: 1 pack x 50,000 VND	**0**	**50,000**
2- Materials (biomass) for making bio-mats:	**0**	**196,000**
Rice husks: 17 bags x 10,000 VND / bag		*170,000*
Rice bran: 4 kg x 6,500 VND / kg		*26,000*
3- Labor for making bio-mats	**0**	**100,000**
4- Labor for cleaning the chicken coops for 6 months:	**2,400,000**	**300,000**
Without Bio-mats (8 times a month for 6 months x 50,000 VND/cleaning)	2,400,000	
Apply Bio-mats (1 time a month for 6 months x 50,000 VND/cleaning)		300,000
5- Labor for vaccination and care for chickens (2 x 100 chickens)	**200,000**	**0**
6- Medicines for chickens	**50,000**	**0**
GRAND TOTAL	**2,650,000**	**646,000**

Note: 1 USD = 22,765

Vietnam National University of Agriculture to develop bio-mats technology for the organization's agroecology program. ICERD then worked with the Centre for Organic Agriculture - Vietnam National University for Agriculture Research for pilot testing of the technology by the Village Women's Union, which eventually adapted the use of bio-mats in chicken raising.

In 2015, ICERD together with the Sub-Department of Crop Production and Plant Protection of Yen Bai Province and the People's Committee of Son A Commune implemented the agroecology program in Son A commune. Ao Luong village was selected as a model because of the women who were the pioneers in the development of the agroecology program. The program has received enthusiastic support from The Field Alliance (TFA), FAO Asia Regional IPM/Pesticide Risk Reduction Program, Department of Plant Protection (PPD) - Ministry of Agriculture and Rural Development (MARD) and the Ministry of Education and Training (MoET).

Sustainable Agriculture through Participatory Learning and Action

ICERD supported the implementation of an agroecology program aimed at improving the livelihoods of the rural communities. This was made possible through the conduct of the following activities:

- Conduct of Survey on the status of agrobiodiversity, impacts of pesticides on public health and environment conducted jointly by students and farmers;
- Elaboration of data on pesticide risk reduction (PRR) collected in the communities and information dissemination to raise awareness and solicit support at the local, national, and regional levels;
- Conduct of trainings on integrated pest management (IPM), pesticide risk reduction (PRR), agro-biodiversity conservation and use, System of Rice Intensification (SRI), biological control, composting, bio-bedding/bio-mats, integrated rice-fish cultivation, vegetable production and crop-livestock integration to strengthen nutrient cycling within farms; and
- Conduct of trainings for secondary school students on biodiversity conservation and use, including of indigenous plants such as vegetables and medicinal plants, together with the processing and understanding of their effects.

AGROECOLOGY:
Farmers' Practices in Southeast Asia

Farmers' Practices • Integrated Poultry/Livestock Raising & Vegetables Production

Challenges and Lessons Learned

Rice serves as the main staple crop in Ao Luong village and its production extends along 25 hectares of land, with about 0.2 hectare per household. The farmers also grow vegetables, mainly brassica[4] species, tomatoes, herbs and corn while fruit trees are found in the house gardens. Small scale livestock production systems are also part of the local agriculture and involve almost all of the families, which raise pigs, chickens and ducks in their backyards.

Before the introduction of the agroecology program, households were doing conventional crop and livestock production. Local rice and vegetable production strongly relied on synthetic inputs, specifically nitrogen fertilizers and pesticides. This practice incurred high production costs and raised concerns on the impact of farming on the environment and human health.

Local agricultural production did not guarantee sufficient livelihoods for the communities because of the limited land available per household and the high costs of inputs. Men and youth were forced to look for off-farm jobs outside the villages resulting in women, with ages ranging from 40-65 years old, taking over their work and making up the major workforce (70%) in the farms.

Over the past ten years, the land area for vegetable production decreased by over 65% due to lack of family workforce, high production costs (fertilizers, pesticides, labor), and crop pests and diseases. Farmers were forced to buy vegetables from the market which were potentially unsafe due to pesticide residues.

Pesticide abuse and limited use of personal protective equipment (PPE) posed health and ecological risks. Storage and pesticide disposal were not safely carried out. Children were always at risk since schools are surrounded by crop fields where insecticides and pesticides were sprayed and carried by the wind, reaching even residential areas. Shortage of rural workers, continuous promotion of herbicide use and lack of measures to ensure food safety posed additional challenges to the project. Pollution from livestock by-products and manure mismanagement also affected the local environment and human health due to gas emissions and odors coming from backyards.

To facilitate a more effective and efficient dissemination and adaptation of the bio-mats technology in integrated livestock/poultry and crops production, there is a need to establish a database of farmers/producers and their chemical-free produce. The farmers also need market platforms to make their produce easily and readily available to customers. They need further knowledge and access to new technology, i.e., mobile phone application and/or social media platforms. Local production systems should be re-designed in order to make agriculture more profitable and sustainable. Farmers' participatory training and direct

[4] A member of the family of vegetables that includes broccoli, Brussels sprouts, cabbage, cauliflower, collard greens, kale, and turnips.

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involvement in community planning processes are very crucial in the adaptation process.

ICERD is also considering further raising awareness about the risks associated with unsafe foods, good nutrition regimen and improving skills in food production, processing and preservation. They intend to conduct field trials, evaluation and information dissemination and create community resources and nuclei to promote community eco-agricultural application. With years of experience from the field, ICERD knows that community planning skills are the foundation of a successful sustainable development program with policy support from local authorities and mass organizations and community participation.

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Multiple cropping techniques such as intercropping and crop rotations make effective use of resources like air, water, light, space and nutrients. Crops grown together in both temporal and spatial dimensions are more resource efficient due to their differential growth habits and requirements.

With multiple cropping, incidence of crop failure due to biotic agents (insects and pathogens) is minimized. One crop may provide cover to the other against such agents through biological control. Multiple cropping also narrows the space available for weeds to grow and hamper their growth through exudation of allelochemicals.

Crop rotation increased the diversity and composition of soil microbial communities and thus the enhancement of nutrient acquisition attributed to niche differentiation. Intercropping enhanced water use by separating in time the maximum water requirements for the different species and by separating spatially their hydraulic lift.

Multiple cropping increases not only the productivity but also the biodiversity and stability of agroecosystems. Aside from enhancing the provisioning services of an agroecosystem by increasing yield and biomass, it also helps regulate pests, conserve pollinators, recycle nutrients and retain soil water.

Multiple Cropping:

Making the most from limited spaces

SWISSAID Staff

Daw Pri Dim used to plant seasonal vegetables in her small farm and sell the harvests to earn a living. To augment her income, she also worked as a wage worker in the village from time to time. However, the money from both sources of livelihood would yield only about 248 Euro[5] in a year which was barely enough for her family's needs. Thus, she resorted to borrowing money from other people but paying back high interests every year.

[5] 1Euro = MMK1,379

Her regular participation in village activities sponsored by SWISSAID and the Kachin Baptist Convention (KBC) led her to discovering ecological farming. Through the projects of the two organizations, she learned about different agroecological methods such as intercropping, crop rotation, composting, and making botanical pesticides. Daw Pri Dim also acquired knowledge on seed selection and System of Rice Intensification (SRI). During the 2016-2017 cropping season, she started growing rice in her 0.40 hectare farm using the SRI method. The rice that she produced from this was about 70 baskets during the rainy season. After harvesting the rice, she intercropped soya bean, tomato, mustard, and cabbage in the same field. She did the same thing during the crop year 2017-2018 and achieved the same yield of 70 baskets. Daw Pri Dim generated much more income during the two years (510.05 Euro and 428.12 Euro as shown in Table 1) when she put into practice what she learned. From her farm income, she was able to buy a motorbike.

Table 1. Income derived from practicing agroecological farming

Crop	2016-2017			2017-2018		
	Quantity (Kg)	Amount (Euro)	Total (Euro)	Quantity (Kg)	Amount (Euro)	Total (Euro)
Rice (Paddy)	1460.20	3.72	260.40	1460 20	3.72	260.40
Soybean	20.41	1.86	18.60	16.33	1.24	20.25
Tomato	130.63	0.25	32.65	106.14	0.31	32.90
Mustard	Lumpsum	12.40	12.40	Lumpsum	9.30	9.30
Cabbage	1500	0.12	186.00	800	0.12	99.20
Potato				32.66 kg	0.19	6.07
Total			510.05			428.12

Daw Pri Dim is active in various activities in her community. Aside from being the Secretary of the Ecological Farming Group which was formed in 2016 in her village with the support of SWISSAID and KBC, she is also a member of a micro-credit union in her village. She has learned how to efficiently manage her income. She now has enough to buy food for her family of five members, support her children's education, and donate to church and other social activities.

Daw Lu Awng

Fifty-year-old Daw Lu Awng is a widow and a mother with two children who are both attending school. They live in Namya village, about 161 kilometers from Myitkyina, Kachin State. Her main source of livelihood is her upland rice field measuring 1.2 hectares and pig raising. In the past, when harvest period was over, she would earn money by doing daily wage work, working eight hours a day for 5,000 MMK (2.33 Euro). Work was not available every day so in many instances, she did not have income.

Through SWISSAID and the KBC, Daw Lu Awng learned that she could make the most out of her small plot of land measuring 33.5m x 36.6m by practicing multiple cropping and intercropping. Thus she planted perennial trees and interspersed various plant crops in her garden. During the first season, she intercropped mustard and tomato as well as potato and spring onion, while during the second season, she replaced tomato with lady finger, and the potato and spring onion with beans. She used natural insecticide made from tobacco plants and prepared composts as fertilizer. Crop residues were used to feed her pigs.

In time, she realized the benefits of which the most evident was the increase in crop yield which also meant increase in income. In one year alone, she was able to earn 750,000 MMK (349 Euro) from an initial capital of 80,000 MMK (37.23 Euro).

Today, aside from providing sufficient income, her home garden has become a stable source of nutritious vegetables for her family.

Agroecological Farming Practices

Most farmers in Kachin State are now practicing ecological farming. In the past, they were caught in the trap of conventional farming practices where excessive and expensive inputs of chemical-based fertilizers, pesticides and herbicides were required. Though there were times when their yields improved, overall their profits were greatly diminished due to increased costs of inputs. Over time, farmers saw deterioration in soil fertility which resulted in drop in yield no matter how much fertilizer they added.

Since August 2016, the farmers have been practicing various farming methods such as intercropping, crop rotation, mulching, and application of cover crop, green manure, indigenous micro-organism or

IMO-based compost, fermented plant and fruit juice, carbonized rice hull, and fish amino acid to improve soil fertility and crop yield. They make soil amendments, natural pesticides, and foliar sprays for their rice farms and home gardens.

Building soil nutrient and enhancing soil microbial activities are important features in an ecological farming system. Green manures such as niger *(Guizotia abyssinica)*, an oilseed crop, and leguminous crops are used to regenerate soil fertility. These are planted after harvesting the rice and other cash crops. They are cut before the flowering stage, ploughed and mixed into the soil to decompose and release soil nutrients for the benefit of the next crops to be planted.

Kachin farmers also make composts from rice straw, cow-dung and urine, green plant part and IMO solutions. The farmers prepare the IMO solution themselves and use this in composting, according to the recommended ratio. They also prepare fish amino acid and fermented fruit juice and plant juice to be used in spraying crops and for soil fertility. They produce carbonized rice hulls for the purpose of soil fertility improvement.

The farmers understand all the benefits of ground cover and mulching to the soil. They use rice straws and dried weeds to cover and mulch the soil especially between plant rows. After harvesting the crops, most farmers leave the weeds and crop residues on the ground to rehabilitate the soil.

AGROECOLOGY:
Farmers' Practices in Southeast Asia

Most farmers also earn extra income from raising animals by integrating them with crop production. They produce animal feeds in their farms by intercropping fodder crops with the main crops. They then make silage[6] which is fed to the animals by using these fodder crops and other crop residues available in their farms and villages.

The farmers have realized that ecological farming is a good way to get healthy and produce safe food with less farming costs when compared to the conventional farming system.

Facilitating Farmers' Adaptation

The Kachin Baptist Convention (KBC) is a faith-based organization promoting ecological farming in Kachin State, Myanmar. To facilitate the transition from conventional to ecological farming, KBC staff help farmers in developing their farm conversion plans starting with collection of baseline data. Year-end assessments are conducted to collect updated data on farmers' learnings and progress in adaptation of ecological farming practices.

KBC taught farmers how to prepare natural farm inputs using resources that can be found in their own farms and how to efficiently use these. The organization shared its learnings in helping farmers transition to ecological farming: selection of farm site should be carefully considered, farm history must be thoroughly checked, and most appropriate farming practices must be determined. Farmers need to be patient since the results of ecological farming will take longer than expected to be seen. Also, there may be lower yields in the first season as the soil takes time to recover from years of using chemicals. This loss is a challenge for poor farmers in the short term, but they understand the long–term benefits: higher yield, better product quality, balanced biodiversity, better health, among others. Small grant support during the transition period from conventional to ecological farming is one way to compensate farmers for possible early losses.

Challenges and Lessons Learned

Farmers in the townships understand well that agroecology is the only way for a sustainable farming system. However, they are constrained by the status of their land tenure. Some poor farmers need to rent farmlands every year or even every season. Sometimes, they have difficulty in renting or they need to rent different plots. This makes it difficult for them to learn and see the long–term results of ecological farming.

[6] Silage is a type of fodder made from green foliage crops which have been preserved by fermentation to the point of acidification.

Farmers' Practices • Multiple Cropping: Enhancing Productivity and Making the Most of Limited Space

AGROECOLOGY:
Farmers' Practices in Southeast Asia

Another challenge is the lack of awareness and appreciation by other farmers and consumers regarding the benefits derived from ecologically-produced farm products. Some of the neighbouring farmers still use too much fertilizers, insecticides, and weedicides. This puts the ecological farms at risk with the chemicals reaching their soils and crops.

Practitioners of ecological farming are also unable to get higher price for their produce than conventional products in the market. In this case, campaigns to raise consumer awareness need to be strengthened to help farmers.

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Native Chicken Raising:

Minimal care yet strong resilience to changing climate

Jonna Mae Ducala and Renelyn Gamaya

Mrs. Fe Fernando is a 57-year-old farmer from Arakan, North Cotabato in the Philippines. Her family owns a one-hectare farm which is filled with diverse fruit trees such as cacao, coffee, rubber, jackfruit, avocado, mangosteen, rambutan and coconut. She also has a small plantation of a native banana variety, Bongolan. Her five children help her and her husband in managing their farm.

Aside from practicing sustainable and organic farming (which she started in 1999), she also turned to raising native chicken to provide supplemental food for her family and to have an additional source of income.

Native Chicken Farming Practices

Fe opted to raise native chickens because they are more resilient to the changing climate and they are the predominant breed in her community. They require minimal care compared with commercial breeds. Native chickens are a prolific breed as a hen can lay 18-20 eggs per clutch.

The chickens are raised in a semi free-range setup. A 20x20 meter area in her farm is allocated for them. This netted lot has shelters for hatching and cages for brooding. After hatching, the chicks are immediately separated from the hen, transferring them to the brooding cage since they need more intensive care. Caring for newly hatched chicks is a very critical period in native chicken raising since many chicks can get sick and die between the time they are hatched until they are one month old.

Fe feeds the chicks with corn bran and continuously provides them with water. When the chicks turn 15 days old, she separates them again from the newly-hatched chicks to avoid instances of crushing and competition for feeds. When the chicks turn into pullets or grow a month older, they are transferred to a bigger cage on the ground for the hardening stage. This allows them to adapt and become stronger. When the chicks turn into pullets or a month older they are released into the open.

To make her chicken farming more sustainable, Fe planted some *Trichanthera* and *Gliricidia sp.* inside and around the lot for food supply. She broadcasts some food scraps like cooked rice, cooked banana (Saba variety) and sometimes, fresh papaya, twice a day - in the early morning and late afternoon. The chicks, however, are fed three times a day (morning, noon and late afternoon). By doing this, she minimizes household wastes and maximizes their feed resources.

Challenges and Lessons Learned

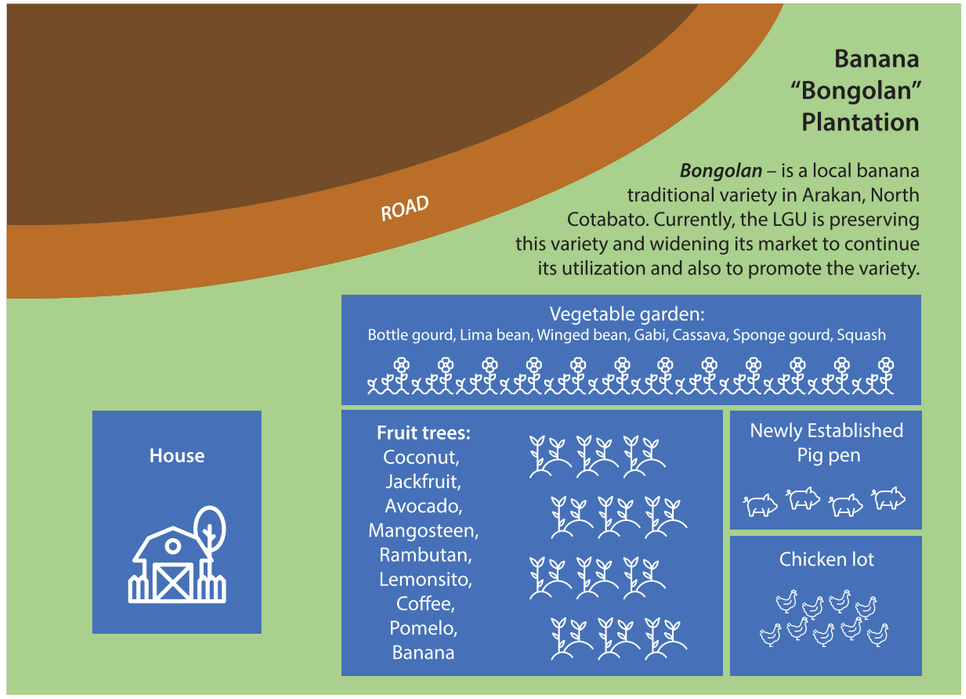
Fe says that the main problem in raising native chicken is infestation with Newcastle Disease (NCD). This disease usually occurs during the wet season since high humidity and moisture create a favorable environment for the virus. There is still no effective treatment for NCD thus she ensures that the cages and the lot are kept clean.

It takes much patience when raising native chickens and those who want to go into this enterprise must be prepared. Native chickens take six months before they can weigh one kilo and can be sold in the market. Diversifying and optimizing available resources in the farm is a good practice as these allow farmers to have available food and a source of income the whole year round.

AGROECOLOGY:
Farmers' Practices in Southeast Asia

Farmers' Practices • Native Chicken Raising is a Good Farming Business

Southeast Asia Regional Initiatives for Community Empowerment



AGROECOLOGY:
Farmers' Practices in Southeast Asia

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Farmers' Practices • Native Chicken Raising is a Good Farming Business

Natural Farming uses methods that observe the laws of nature and utilizes natural materials and products. It is based on the principle of interdependence among all living things and have a nurturing impact on the environment. Natural farming uses natural materials instead of chemicals to make its agricultural inputs. Materials are locally available and inexpensive, and the farming inputs are made by the farmers instead of being purchased from the market, thus lowering cost for the farmers and converting waste as resource.

Natural farming system is based on the Nutritive Cycle Theory. The system is associated with the use of "indigenous" microorganisms (IMOs), use of nature's tillers (aerobic and anaerobic bacteria, fungi, mole crickets, earthworms and moles etc.), grass mulching as remedy for weeds (using brown rice vinegar), planting with proper distance in crops and plants and the use of natural inputs to "distract" the pests from the fruits/crops (e.g. Fermented Fruit Juice). The theory guides the farmer on what inputs to apply, how much and how often.

Source: Reddy, 2011

Natural Farming:

Making use of nature's gifts

Slamet Nurhadi and Maritsa Zuchrufa

Usrek is a female farmer who is the driving force behind natural farming in Sido Makmur Community in Plambang Hamlet, Pasrujambe Village, Pasrujambe District, Lumajang Regency, East Java.

Usrek learned about natural farming in 2009 from two farmer educators from Kudus (Central Java), Yasfin and Bandi, who were brought to Pasrujambe by Bina Desa. Thinking that this farming system was ideal, Usrek and some of her friends decided to visit Kudus to observe how the farmers practiced natural farming. There they learned how to make plant nutrients, microbes, and natural medicines to control plant pests.

Farmers' Practices • Natural Farming: Making use of nature's gifts

The interaction with farmers and natural farming practitioners left a lasting impression on Usrek. She became determined to improve her natural farming skills in order to gradually apply the farming model on her land until she could farm without using chemical inputs.

However, Usrek's efforts were not without challenges. During the first harvest, she suffered losses due to reduced crop yield. Her husband then opposed her practicing natural farming but Usrek did not give up. Her faith guided her to keep trying until things got better. On the third harvest season, her farm yielded higher volume. Her husband eventually became enthusiastic about natural farming after seeing the good results of her harvests.

Since then, Usrek has been an unwavering advocate of natural farming. She saw that aside from improved yield, natural farming also improved crop quality because the harvests are free from chemical inputs. Usrek also feels a sense of independence because she no longer has to rely on production means from sources outside her farm.

"We had been like dead chickens in a rice barn as we depended on others for our farming needs. Natural farming opened our eyes. Nature provides us many things. We can be independent and do not have to rely on products from others. This is an opportunity for us to critically examine everything around us and make use of nature's gifts for farming. As a result, nature will be preserved, nature will not be harmed," said Usrek.

Agroecological Farming Practices

One of the key components of natural farming that they practice is the preparation of fermented plant juices (FPJ). With goat manure, FPJs are prepared with plant nutrients coming from banana heart, spinach, and bamboo shoot which are all abundant in the area. Some seeds are obtained by exchanging with friends and neighbors. Then, they purchase other plant nutrient ingredients such garlic, shallots, brown sugar, and vinegar.

Farmers in the community grow bananas, coffee, taro, cassava, corn, eggplants, beans, long beans, leeks and herbal plants such as ginger, cardamom and curcuma (turmeric). Water from the mountain directly flows to the residents' houses and farmlands. Some have catfish ponds where they feed the catfish with shredded papaya leaves. Goats are fed with grasses gathered from nearby and are also provided with water and salt. Usrek also produces and sells herbal medicine. The pulp from the plants used for the medicines is fed to the goats.

Another crop that is cultivated through natural farming is coffee, one of the high-value commodities in the area. Pasrujambe Village is known for its coffee crop production, as its sloping and rolling topography is suitable in growing various types of coffee and banana. Usrek and other Sido Makmur members grow coffee. Their harvested coffee beans are processed and sold but a portion is reserved for home consumption. They used to sell freshly harvested coffee beans to middlemen but later decided to dry these first then sell them for a higher price. The coffee beans cultivated and produced by Usrek and other Sido Makmur members are among the flagship products in the area.

Usrek and her friends, Nah and Sumarni, professed that participating in Sido Makmur's activities can help farmers increase their income. Natural farming reduces production expenses particularly on plant nutrients, fertilizers, and seeds, as these can be easily obtained from their households. In addition to improved economic conditions, practicing natural farming yields health benefits derived from safe and nutritious harvests.

Farmers' Adaptation

At first, only Usrek was into natural farming but eventually her friends from Sido Makmur community followed in her footsteps. From six, there are now 25 natural farming practitioners in the Sido Makmur community. Most of them are women, aged over 30 years old, and all relying on farming for their livelihood.

They have formed an *arisan*[7], a mechanism that provides labor support for each community member's

[7] Generally the arisan is a social gathering of a group of people (usually females) that takes place at a fixed interval, at each member's home in turn with a purpose of togetherness.

farm. It is through the arisan where the person who will help is decided.

According to Usrek, natural farming became an ideal choice for them because it helps them save on farm production costs. Sido Makmur community members produce plant nutrients together and share these with other members.

Natural farming does not only give higher yield, but also improves soil fertility. It promotes multiple-cropping system and ensures the protection of biodiversity in the agricultural ecosystem. Natural farming practices preserve indigenous wisdom in agricultural practices and encourage the practice of *"gotong-royong"* (mutual cooperation) by peasant communities.

Post-harvest handling is carried out collectively. The process of preserving crops is done using natural ingredients. Harvests are designated for the provision of seeds, family food needs, social needs, and demand of the local market. Distribution channels ensure a fair profit for the farming family.

NGO Support

Bina Desa supports the development and practice of natural farming in the village. They help develop plans that are based on the geographical condition of farmlands. One of their requirements is for the farming family to have a control of a piece of land and manage it in sustainable manner. There should be sufficient supply of water that comes from non-polluted sources. It could come from both irrigation network and natural sources (springs, rivers, reservoirs, rainwater). The family also has to use appropriate farming tools, indigenous or local seeds, and natural fertilizers, pesticides and herbicides.

Challenges and Lessons Learned

In the past, the most prevalent problem of farmers was the *ijon* system which was widely practiced in the region. *Ijon* is an informal credit system in which farmers borrow money from middlemen by mortgaging their future harvests. Farmers pay their loans with crops at harvest time based on the lowest selling price. Farmers had no choice but to accept the terms of the middlemen who buy their produce every harvest season. They even get all of their farming and household needs from the middlemen. But problems arose when yields went below expectations and were not even enough to cover the farmers' basic needs.

Usrek and many other farmers availed of this system even though they knew that they would not benefit from it. At one point, she aired her concern to Bina Desa. "If this situation continues, I worry that farmers will leave the village to seek a better life because of worsening economic problems," she said.

Usrek was able to overcome the difficulties in shifting to natural farming. The decline in harvest during the first season sparked considerable doubt, people's skepticism arose, and no one wanted to support the practice. But her persistence paid o and she continues to encourage members in her community not to give up easily in starting natural farming. According to Usrek, "if we take care of the lands and plants, there will be rewards. *'Istiqomah*' (steadfastness) is the way to get through it."

AGROECOLOGY:
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Farmers' Practices • Natural Farming: Making use of nature's gifts

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Natural Farming:

Putting a stop to environmental damages

Dameria Rosalin Situmorang and Abella Diandra Clarissa

Irwan, a 33-year-old farmer from Galeso Village, Polewali Mandar Regency, South Sulawesi, Indonesia, comes from a family that had been practicing chemical-dependent farming even before he was born.

It was during his younger years as a farmer when he became aware that the farming system that he was used to was contributing to environmental and economic damages in agriculture in Indonesia. Years passed, he became restless owing to the conflict and consequently became vocal about his concerns regarding the prevailing farming system.

The Salassae Rural People Organization (RPO) heard his voice and welcomed his views. Soon his journey towards natural farming began. In 2014, a field officer from Bina Desa, who was based in Sulawesi, encouraged Irwan to learn natural farming.

Since then, he has been on the path of learning, understanding, practicing and promoting natural farming. He has found the answer he was looking for to ease his restlessness. He realized that the environment will suffer more damages if the farmers in his village continued practicing chemical farming.

Agroecological Farming Practices

The natural farming cultivation system does not need external inputs (such as chemical fertilizers, pesticides, factory seeds) because it prioritizes and uses what is locally available. Farm resources come from nature and return to nature. The key objective of natural farming cultivation, as Irwan realized, is to produce maximum results. Therefore, if one of the components like seeds, soil management, and the use of nutrients is not contributing or functioning well, the results will be unsatisfactory.

Choosing the right seed is important in natural farming. "Using local seeds for natural farming is much better since they are more resistant to pests and diseases," said Irwan. He and other farmers in his community practice seed exchange through the RPO network, namely RPO Ngudi Makmur in Karanganyar, Central Java. This exchange of local seeds improves natural farming cultivation, production, and processes.

The soil is also important. Irwan compares it to a house, as solid soil is needed for plants to grow. Therefore, the soil has to be managed well so that it can support plant growth.

Likewise, plant nutrition plays an important role in maximizing the results of natural farming. Irwan identifies microbes with 14 materials, which include fish, bones, eggshells, bamboo shoots, banana humps, raw bananas, ripe papaya, ginger, garlic, raw and ripe pineapples, seawater, and brown sugar as the most basic nutrients needed by plants. These ingredients are provided by a farmers' group in the community which is composed of 17 natural farming practitioners who work together to produce plant nutrients. They also collectively carry out activities on soil management, crop management, and treatment (spraying, providing nutrition, and weeding).

Irwan's family has learned to embrace natural farming. Labor is divided among the members with his mother in charge of making plant nutrients. She helps in planting both in their field and in the backyard. She regularly waters and cleans the yard. Irwan's father and siblings, on the other hand, maintain the rice fields and care for the rice crops, and help clean the dikes and soak seeds. Irwan focuses more on farm maintenance but his family takes over the duty when he has to attend to activities with other farmers outside their village.

After six years of practicing natural farming, Irwan and his group have finally reaped benefits from it. The farmers' families and their community witnessed the many changes in the environment, economy, food resilience, and family welfare. The soil has become more friable, and plants have become resistant to pests.

Benefits

In conventional farming, the high cost of pesticides poses financial problems for the farmers. They usually incur Rp1,500,000-2,500,000 (USD105 – 175/Euro 89-149) per hectare to deal with problems on pests. In contrast, farmers practicing natural farming need to spend only Rp20,000-50,000 (USD1.40-3.50/Euro 1 20-2.99) per hectare per planting season. With natural farming, farmers can simply search for medicinal plants in their fields to fight pests. Production costs much lower thus overall farmers gain more economic benefits.

Irwan and his family used to borrow money to buy fertilizers and other cultivation inputs. Today the low production and plant maintenance costs, and high sales of agricultural produce, have improved his family's economic conditions as they make Rp4,000,000-5,000,000 (USD280-340/Euro329-299) per month.

Better quality and safety of food are also benefits that convinced Irwan and his family to practice natural farming. For their daily consumption, they have naturally-farmed rice. For their other nutritional needs, they have vegetable crops planted on their 10x12 meters home garden. The family attests that the produce from natural farming are better and healthier. Irwan's mother used to have knee pain and often experienced fatigue but after consuming natural farming products, she never experienced them again.

Farmers' Practices • Natural Farming: Putting a stop to environmental damages

Farmers' Adaptation

The impacts of natural farming are experienced not only by Irwan's family but also the surrounding communities, and his group, the Polewali Mandar Farmers' Union or SPPM. Farmers no longer have to worry when planting season starts, as they are assured that their production costs will not lead them to indebtedness.

Irwan also motivates a women's group that is focused on yard crops such as chili, tomato, and other vegetables as part of his advocacy to encourage women's participation in natural farming.

Irwan's role in facilitating natural farming education has extended to villages outside of his own and to date, he has reached 43 villages in 12 districts, in Kabupaten Polewali Mandar.

Challenges and Lessons Learned

Convincing farmers to practice natural farming is a challenge for Irwan and the SPPM because farmers are skeptical of programs that are not sponsored by the government. The presence of chemical input producers in the communities is also an additional challenge. The companies approach farmers and convince them to use chemicals, causing several farmers to resort to conventional farming methods.

Despite these challenges, the encouragement they get from other farmer-practitioners keeps Irwan and the SPPM community motivated to continue practicing and promoting natural farming. They have taken the opportunity to promote natural farming in this time of the COVID-19 pandemic since there is scarcity of chemical fertilizers while materials for natural farming are accessible and always available in their communities.

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Natural Farming:
Regenerating a damaged land

Ika N. Krishnahanti

Mrs. Mubayyinah Djauhari, a 66-year-old widow with three children and five grandchildren, manages her ancestral home as well as her family's farmland. She oversees the 3.5 hectares of rice field that belongs to her and her siblings. At the same time, she oversees her own fields planted with rice (0.50 hectare), fruits such as orange, avocado, and papaya (0.30 hectare), and ground nuts (0.25 hectare). She practices intercropping peanuts with banana and papaya.

She grows local varieties, a tradition handed down from her grandmother, both for her family consumption and for retail

Mrs. Mubayyinah was living in Jakarta as a successful businesswoman when she was summoned by her mother to return to her hometown village to continue the family farming business. She heeded her mother's call, and believes that it was one of the best decisions she has ever made.

Back in Merden Village Purwanegara Sub-District, in Banjarnegara Regency, Central Java, Mrs. Mubayyinah saw the severe degradation of their farm caused by the overuse of agricultural chemicals. With a strong determination, Mrs. Mubayyinah decided to abandon the use of chemical inputs that kept her mother in debt until the end of her life. Together with her eight siblings, she started the journey towards a farming system to regenerate their damaged land. They founded a group of farmers and tillers and named it "Istiqomah Integrated Natural Livestock-Farming Group".

Istiqomah[8] is a group of 18 farmers, a mix of landowners and tenants, and is a member of the Indonesian Peasant Alliance (Aliansi Petani Indonesia or API). Mrs. Mubayyinah works with her tenants in managing the rice fields under a yield-share system with 1/3 share for the tenants and 2/3 for the landowners. All agricultural inputs, including local seeds and other materials (fertilizers, local or indigenous microbes, botanical pesticides, growing stimulants, and nutrients), are provided by the landowners. All the inputs are organic as the landowners want to ensure that their products are completely natural. Mrs. Mubayyinah says that healthy soils will produce healthy food and healthy food will make both the body and mind healthy.

To build her skills on natural farming, she looked for several learning opportunities. In the early 2000s, she began studying natural farming in various discussion

[8] Means to go straight into the proper route, performing rightly, permitting no deviation. It's from the identical root that the phrase mustaqeem is derived (i.e. sirat al-mustaqeem - the straight path). It may be translated as 'steadfastness' from https://medium.com/@SyahidElhawk/what-is-the-meaning-of-istiqomah-steadfastness-here-comes-the-explanation-55856a56980c

circles. She would have in-depth discussions with professors at universities in Bandung where her sons studied. She also engaged in conversations with farmers who had previously worked on natural farming. She even met the famous Dr. Cho Han Kyu, one of the pioneers in natural farming in South Korea, when he visited Indonesia.

She never expected that the initial goal of practicing natural farming would lead to the rewards experienced by her group today.

Agroecological Farming Practices

Natural farming is a cultivation system that relies only on natural ingredients. Food is produced from local non-genetically modified seeds, using compost as organic fertilizers and natural ingredients such as fermented leaves or fruits as ingredients to get rid of pests. Post-harvest handling techniques do not use polishes, preservatives, bleach, or fragrances. Foods produced through natural farming method contain less contaminants making them safe and healthy for consumption. Since agricultural chemicals are not used, water and air are also guaranteed to be free from unwanted and dangerous substances.

Farmers practice natural farming because they want to bring life back to the soils that had been degraded by the use of chemical fertilizers. The high cost of chemical inputs also puts them into debt traps. They yearn for more sustainable, economically feasible, socially dignified, culturally appropriate, and environmentally friendly ways of farming. They want to become self-sufficient and independent, and have sovereignty in their own farms.

The farmers themselves produce the inputs either individually or collectively. Instead of purchasing from the market, they make their own organic fertilizers, indigenous microorganisms (IMOs), bio-pesticides, fermented plants, and animal juices. All are natural ingredients sourced from their surroundings. Rice straw, local fruits and vegetables, herbs and spices are converted into useful resources. They produce bio-pesticides from herbs/plants and spices through the fermentation process. Animal manure, rabbits' urine, and internal organs of cows are also used as fertilizers.

Farmers consider natural farming as a good practice because it is less expensive, easy to learn and uses farming technologies appropriate to their biophysical and socioeconomic conditions. Food and food products generated are likewise healthy and environment-friendly which command prices higher than commercial ones. It also makes the farmers more independent and self-sufficient as they no longer need to depend on manufactured inputs.

Farmers' Adaptation

Through the support of API, farmers from Central Java Province are actively practicing natural farming. Since 2007, API has organized and supported ten Indonesian farmer organizations with 8,878 members. Among these members, 2,666 are certified organic farmers managing 864.69 hectares of land. Most of the farmers grow organic rice while the others produce cinnamon (84 hectares), cacao (37 hectares), and coffee (28 hectares).

API considers awareness and the strong will of farmers to convert from conventional method to natural farming as among the key factors that contribute to successful program implementation. Building more knowledge includes teaching farmers to use natural ingredients in producing inputs for managing pests and maintaining soil fertility. API's presence in guiding farmers, accompanying them until natural farm products are produced and distributed to consumers, are also major factors why they are now reaping the benefits of natural farming.

Challenges and Lessons Learned

Among the biggest challenges in practicing natural farming is the farmers' need to put more efforts to produce all the inputs by themselves. This is not easy especially because they have been very dependent on easily available chemical inputs provided by agricultural industries in the past. Thus, farmers need to be convinced that they benefit more from natural farming and that they should have a strong will to overcome their dependence on chemical inputs.

Natural farming practices also entail more intensive labor in the farm. For instance, farmers should be able to prevent pest outbreaks by having early warning capacity to identify them and apply preventive natural farming techniques before pests attack the crops.

Farming adheres to "seeing is believing". Thus there is a need for champions who practice natural farming and consistently apply the principles so that others will follow. It is also important to organize farmers, develop networks (farmers to farmers, farmers to consumers, farmers to government) and continuously promote natural farming practices among them.

Natural farming methods can attract the youth to engage in agriculture; they only have to apply the appropriate technology to produce inputs and manage their farms. More young people practicing natural farming means more people who can make meaningful contributions to sustainable agriculture.

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Farmers' Practices in Southeast Asia

Farmers' Practices • Natural Farming: Regenerating a damaged land

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Southeast Asia Regional Initiatives for Community Empowerment

Natural Farming:

Proving a better way of farming

Alvin John Quitel and Renelyn Gamaya

Mr. Rosito Tudoc from Brgy. Calabgan, Casiguran, Aurora, Philippines, has been a farmer-trainer on organic farming since 2008. He promotes appropriate management of wastes from farm animals and produces organic fertilizer for his own use. His family of five has been enjoying consuming organic and safe food since 2012.

Agroecological Farming Practice/s

Rosito grows various crops in his farm. Other than rice and corn, he cultivates vegetables (bottle gourd, string beans, eggplant, and squash), fruit trees and perennials (coconut, banana, sesame, and jackfruit). He also grows forages (Tricanthera, water spinach, and *Gliricidia*) for his livestock and poultry consisting of goats and native pigs and chickens.

Organic Fertilizer Production

In Rosito's farm, the cages and pens are carefully set up to have a more effective nutrient-recycling system. The wastes from the pig pen at the lower area and wastes from the goat shed and chicken cages located at the higher part of the farm are directly deposited to the composting bed or vermibed where they are decomposed. To hasten the decomposition process and to prevent the odor from permeating the air, he sprays the wastes with a concoction made from indigenous microorganisms (IMOs) which he produces once a week.

To produce IMO, he collects left-over rice and places it in a bamboo internode. He then mixes it with molasses or muscovado[9] (whichever is available), and seals it with paper or plastic. It is necessary to keep it under an anaerobic condition to optimize microbial activity and lessen contamination. After seven days (duration of fermentation), the resulting mud-like product is ready for use. He prepares a solution by mixing one millilitre (mL) of IMO with one liter of water, which he sprays on the vermibed. The final product is vermicast or vermicompost. He uses the vermicompost as fertilizer mainly for his coconut trees especially during the transplanting stage. He also applies it in his backyard vegetables and ornamentals.

Organic Livestock Production

In 2014, Rosito decided to include livestock and poultry raising in his farming system. He raises native pigs that are fed with forages such as water spinach, Tricanthera, and *Gliricidia*, all of which are abundant in his farm. He collects and chops these forages and mixes them with rice bran. He feeds the pigs twice a day, usually in the morning and in the afternoon, with food waste and vegetables scraps from his household.

Native pigs are not difficult to raise. They are more resilient to pests and diseases as compared with commercial breeds. He does not have much problem in his pigs getting ill but when they do, like having respiratory problems, he turns to herbal remedies by giving them boiled sambong (Blumea balsamifera) leaves.

[9] Unrefined or partially refined sugar which contains molasses

Challenges and Lessons Learned

One challenge he has encountered in raising native pigs is finding a better mixture of organic feeds that would help increase their girth and weight. Since native pigs are smaller compared with commercial pigs, they cannot compete in the market very well. However, raising native pigs is not expensive and does not incur high maintenance costs. Organic method of raising ensures that the pigs are safe for consumption.

Rosito also faces challenges in goat management. During rainy season, goats are more vulnerable to hoof rotting, a condition which makes them tender-footed and lame. This makes it difficult for the animals to move around or even eat well. Thus he practices the cut-and-carry method, in which he cuts the forages and carries these to feed the goats in their sheds. He also does this during the rainy season and lets the goats browse around the farm during the dry season.

In general, he finds it a challenge to prove to other farmers that organic farming is way better than agrochemical-dependent farming. But he believes that perseverance and passion are the keys to convincing them that going organic is beneficial for all.

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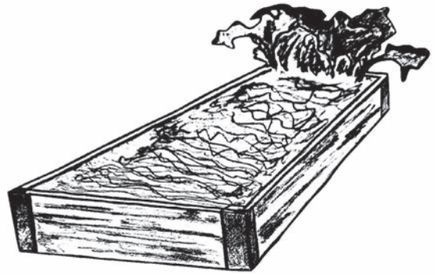
Raised bed gardening is the growing of crops on a bed above the ground. Raised beds are constructed using containers out of any materials with sides to allow the soil to be built up higher than the natural soil level. The material does not matter, as long as it is sturdy enough to keep the soil from being washed away. A raised bed garden provides more control over the soil and also the wetness of the soil both of which are important in getting the best results from gardening. Raised bed soil never needs to be tilled because the soil remains loose, the few weeds that do sprout are easily removed, and roots of plants are able to grow better in the loose soil because oxygen can reach the plants easier. Raise beds once set up are much easier to maintain.

Raised Bed Gardening:
A way to natural farming

Prof. Anthony Wong



Situated in the Malaysian island of Langkawi is an integrated organic farm where plants and livestock thrive without the use of synthetic pesticides or antibiotics. Known as the Frangipani Natural Farm, it strongly advocates for environmental conservation and organic farming. As such, it educates the local community including farmers and other people by offering farm courses about organic farming and ecological balance; provides them with agriculture science skills; and creates awareness about healthy eating. Much emphasis is given on waste management that can be used for making compost and raised bed gardening.

Raised Bed Gardening

A raised garden is simply a contained bed of soil whose level is higher than the surrounding soil. Raised garden beds are constructed for several good reasons. They provide a convenient and easy way to produce plants or vegetables. Gardening in a raised bed is all about maximizing productivity. It helps farmers in getting the most out of a limited garden space, or out of a garden with poor soil quality (rocky soil or with inadequate soil drainage).

Raised bed gardening can be done using recycled containers such as old bathtubs, broken rain gutters, and aluminum containers, among others. These materials can be easily found in homes and in communities.

Farmers and other gardening enthusiasts and practitioners find the raised bed system easy to implement. It can be adapted by most people without spending much as there is no need to invest in an expensive drainage system. Likewise, the farmers agree that the farming practice is good as crops are produced in an environment-friendly manner resulting in safer food.

Constructing Raised Beds

Since Langkawi Island has a sandy soil type, creating a raised bed garden is considered the best option to grow crops. It has the ability to amend the soil or to create new soil for the bed. Raised beds can be filled with loose soil rich with nutrients and organic matter will allow the roots of the plants to grow freely, and ensure that they have access to the water and nutrients they need to sustain healthy growth.

The raised bed gardening system (also known as Lazy Man's Way) is made by constructing garden beds inside a 3 ½ feet tall x 3 feet wide container. Cardboard is placed on the first layer to retain water. This is followed by dried leaves, mulch, twigs and barks. The purpose of this layer is to provide good air flow at the bottom so the raised bed does not emit foul odor. The third layer consists of food wastes that contain nutrients for the soil. Steps two and three are then repeated one more time. Lastly, all the layers are closed with topsoil, including materials that could start to generate compost.

When all the steps are done, JADAM[10] solution is prepared with a ratio of 1:20. The solution is then used to water the bed's soil, two to three times before planting. This is a quick and inexpensive way of bringing microbes back into the soil. Farmers find the solution is more effective if used together with natural fertilizer and insecticide.

[10] JADAM is a group of farmers practicing organic farming, which was established by in 1991 by a chemist and horticulturist named Youngsang Cho from South Korea. The objective of JADAM is to bring back farming to the farmers; to restore the farmers' sovereignty in technology; spread an ultra-low cost method of farming; and ultimately open a new world where farmers, consumers, and mother nature are in harmony. Available at https://en.jadam.kr/com/com-1.html

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Farmers' Practices • Raised Bed Gardening: A way to natural farming

Facilitating the Transition to Natural Farming

In spite of the many advantages that agriculture can provide, especially in helping the country attain food sufficiency and sustainability, the education system does not give more focus to farming. Because of this, there is not much interest in its development. Not a lot of people are interested in farming because farmers are not given the respect that they deserve.

Frangipani Natural Farm School is a local organization that aims to help advocates, practitioners and others who are interested in transforming their farming system in lowland and coastal areas into organic and sustainable farming. Since 2005, the school has been conducting trainings for local farmers and beginners who are interested in organic farming. Each training session consists of 20 to 40 participants. Since the practices are specific to each location, in this case sandy and saline soil conditions, it is essential to define the best farming practices for each specific land type.

The Frangipani Farm also aims to improve consumer awareness on organic produce and encourage farmers to transition to natural farming.

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Farmers' Practices • Raised Bed Gardening: A way to natural farming

Seed conservation is undertaken to prevent loss of diversity and species extinction. This is done by collecting and testing seeds of different varieties, crossing them to produce new varieties and multiplying them so that other farmers from within and outside the village can test them under their own local conditions. By conserving the seeds, more systematic actions can be taken to prevent the extinction of the species.

Seed Conservation:

Securing food for generations to come

Metta Development Foundation Team
Pathein Office (Ayeyarwady Region)

Farmers supported by the Metta Development Foundation in Myanmar have been collecting seeds for testing, hybridization and conservation. Some collect seeds while visiting other farmers, and during field visits and exposure trips. Sample seeds of each variety are systematically stored in glass bottles. Vegetable seeds are derived from the good produce and are set aside for later use. Medicinal plants are also collected and cultivated.

Part of capacity enhancement on seed conservation provided by Metta Foundation are Variety Adaptation Trials (VATs) which farmers conduct to identify the strengths and weaknesses of rice varieties. In particular, farmers experiment to identify varieties with reduced fertilizer requirements, locally adapted, pest-resistant, climate-tolerant, etc. Varieties are selected in stages and selected by plant height, number of tillers, number of panicles, yield, and other desired characteristics. VATs have given farmers a better and deeper understanding of the strengths and weaknesses of rice varieties and seeds. Selected varieties are systematically harvested by hand, dried at a specified percentage and stored in plastic bottles and other airtight containers. Seeds of Locally Adapted Varieties (LAVs) are shared with other farmers for testing in their own farms while others are distributed to other farmers in need of planting materials. Results of VATs are also imparted by conducting field demonstrations and sharing with visiting farmers.

There are also efforts to obtain new varieties of paddy by self-hybridization. Farmers try to further conserve and improve the use of traditional varieties by creating new population or varieties with their preferred characteristics. They produce new rice varieties by crossing parents with desired characteristics.

Seed Production

Seed production is done using Registered Seeds (RS) of rice purchased from the Department of Agriculture. Seeds of LAVs that are selected from VATs are also multiplied and distributed to other farmers. The rice varieties are grown using a six-row, single-row system in a 0.40 hectare of land or bigger. Harvesting involves manual harvesting, machine cleaning and packaging. The seeds are systematically dried, stored and packaged.

Seed production is carried out using the Participatory Guarantee System (PGS) with a number of farmers participating and managing its implementation. PGS is the practice of collective seed production using a collective insurance system, which allows farmers to connect with each other, set prices, and sell. They work together in the field, completing the necessary paperwork, and selling based on collective insurance. The seeds are sold individually or in collaboration with other groups within and outside their villages.

Farmer Practitioners

Daw Moe Moe Ko lives in Myo Thit Village, Hygein Gyi Kyun Sub-township, Ngaputaw Township. Though only 30 years old, she has been farming for 12 years. In her two hectares of land she grows mainly rice in the rainy season and peanuts and vegetables in the summer.

She buys rice seeds (Kauk Gyi and Kauk Ka Lay varieties) from local seed producers and multiplies these

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in an area of her farm (0.40 hectare). The harvested seeds are stored in bags and are distributed to eight farmers annually. Daw Moe Moe has been doing this for the past ten years. She notes that it would be better if ways can be found to store local seeds for many years as the seeds they have in storage need to be continuously maintained and redistributed. She and some of her fellow farmers have formed seed committees to distribute seeds and share responsibilities to mobilize young people to get them and the women actively involved in their group activities.

Kyaw Swa Win, 45 years old, is from Yae Twin Kone Gyi Village in Kangyi Daunt Township. He grows rice and perennial crops such as betel nut, coconut, banana and guava in his 9.71-hectare farm. He has been farming for 25 years.

He has experimented with ten rice varieties, of which four have been selected as locally adapted varieties and maintained annually. He produces seeds together with 15 other farmers who are members a group practicing PGS. Kyaw Swa has shared his experiences on seed conservation and soil management with 30 farmers in his village and with another 30 from other villages. He also promotes sustainable agriculture by talking to young farmers and helping them to produce their own good seeds and sharing his experiences in farming.

Man Aung Mya Thein is 43 years old and is living in Mae Due Chaung Village. He has been farming for 25 years. He grows rice, betel, banana and malaka (guava) in his 2.67-hectare irrigated farm.

He does seed production annually on 0.40 hectare of his land and sells them only to farmers in his village. Man Aung Mya has conducted varietal adaptation trials of nine rice varieties which he collected from a study tour he participated in. He is also maintaining the seeds of two locally adapted varieties (Yadanar Kyi and Takun hwe). The resulting seeds are dried and stored in plastic bags.

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Farmers' Practices • Seed Conservation: Securing food for generations to come




Man Kyi Win lives in Kayaung Kwin Village, KaMan Daunt Township. The 47-year-old farmer has been into farming for 32 years. He grows rice in his 0.80-hectare land in the summer and black gram, chili, flowers, watermelon, and other crops in the winter.

He has experimented with 20 rice varieties and was able to select and retain five of them. He is among the 15 members of the Golden Plains Seed Production Group.

U Ai Khant Khalin, 36 years old, from Aye Ywar Village, Myaungmya Township owns six acres of land which he has been cultivating for 15 years. He produces the paddy varieties and grows other vegetable crops in both summer and rainy seasons by himself thus his family does not have to buy from outside.

Seed multiplication used to be very limited but this has been accelerated with one acre devoted to production during summer and rainy seasons. For storage, U Ai Khant keeps the seeds in a plastic bag to keep out moisture. He has shared seeds with six farmers from four villages.

U Aung Kyi Win is from Mi Chaung Theik Village, Kangyi Daunt Township. He is 45 years old and he has been into farming since he was 10 years old. He grows mainly rice and vegetable crops in his 2.63-hectare farm.

He was able to test ten varieties from seeds collected during a study visit he went to in 2011. Four of the varieties have been found to be locally adapted. The seeds have been shared with 20 other farmers. He is among the 19 members of a PGS group carrying out seed production since 2011 in a 2.43-hectare farm.

U Aung Win lives in Ywa Thit Kone Village, Payachaung Village Tract, Pathein Township. He is 63 years old and has been farming for 45 years. He grows rice in

summer and fall while other crops are grown only in summer. He also cultivates chilli, roselle, sweet potato, beans, cucumber, gourd, golden pumpkin, white pumpkin, sponge gourd, winged bean, and velvet bean every year.

U Aung Win tested 25 rice varieties and identified two that are suitable for his area. He also does hybridization of favorite varieties obtained from the Variety Adaptation Trials (VATs) that he has participated in. He crossed the Shwe Yin Aye and Pakhan Shwe War varieties as well as Thee Hta Yin and Shwe Yin Aye varieties. He also maintains 45 varieties of vegetable crops annually. The seeds are stored in cans and bottles, and distributes some to other farmers every year. He has been collecting seeds for four years now, most of which came from seed exhibitions and field trips. He cultivate one acre of Ayar Min and one acre of Paw San Yin rice varieties under an 18-member PGS group.

U Bo Kyaw of U Kyun Village, Wakhaema Township is 35 years old and owns 4.86 hectares of land. The farm is cultivated with rice, peas, green peas, buckwheat, pineapple and turmeric. U Bo has been practicing seed conservation since 2017 and has maintained four LAVs. Seed production is carried out on two hectares of his land under a PGS group.

U Hla Phone Thint lives in Mantakundaing Village, Ein Mae Township. The 55-year-old farmer cultivates a six hectare farm in which he grows rice during the rainy season and peanuts, green peas, peanuts, taro, turmeric, lady finger and roselle during summer. He has been farming for about 30 years.

He grows 50 rice varieties annually, initially on only 0.20 hectare but later increased the area to four hectares. From the 50 varieties, U Hla Phone was able to identify three LAVs which have been redistributed to 30 farmers.

He has been into seed production since 2017 with a six-member PGS team.

U Htay Myint from Taikgyi Kone Village, Kangyi Daunt Township farms on a 1.74-hectare land. He grows rice in the summer and the rainy season and some annual crops in the winter. He also cultivates guava, citrus, lemon, banana and other perennial crops. He is 56 years old and has been farming since he was 16.

He has been collecting and cultivating seeds of rice and other crops, including some medicinal plants since 2015. Harvested seeds are systematically dried and stored in a safe place. He produces pure seeds in a 0.40-hectare of land together with the other 15 farmer members of a PGS group.

U Myint Aung is living in Mi Chaung Theik Village, Kangyi Daunt Township. He has been growing rice and other annual crops in his 2.02-hectare farm since 1988.

The 55-year-old farmer has conducted VATs using 60 rice varieties. He was able to select ten and is maintaining them. The resulting varieties are harvested by hand, stored in plastic bottles and shared with other farmers in need. Since 2014, he has been collecting seeds for competitive testing and hybridization to develop new varieties that are suitable in his community. Seed production of selected LAVs is being carried out in 1.62 hectares of land annually.

U Soe Naing from Kant Balar village, Nga Pu Taw Township started farming his 1.62-hectare land 15 years ago. He grows rice in the rainy season and peanuts, pulses, eggplant and okra and other vegetable crops in the summer.

The 38-year-old farmer conducts varietal evaluation trials and selects varieties that are locally adapted, climate-tolerant, pest-resistant, drought-tolerant, and high-yielding. He has selected a local variety - Paw San Yin, of which the harvested seeds are dried and stored in bags. Annually, he performs seed production with his PGS group consisting of nine members on a 0.80 -hectare land.

U Tun Win, 41 years old, lives in Anyar Su Village, Kangyi Daunt Township. He grows rice every year as well as other annual crops in the summer and perennial crops like mangoes. He has been cultivating his 5.87-hectare of land since 2008.

In addition to the Registered Seeds he purchased for pure seed production, he was also multiplying the ten LAVs he selected under a PGS group with 19 members. He also cultivates and produces his own varieties of rice and other annual crops by hybridization. He has crossed varieties such as Thukha Aung and Sin Thwe Latt, Khomani and the Japanese variety Hnan car, Thukha Aung and Sin Thwe Latt, Malar Mwe and Lake Ma Lay.

Farmers' Adaptation

Metta Development Foundation was able to help farmers increase production of rice and vegetables production without using chemical fertilizers or pesticides. Farmers were trained on the principles and techniques of the System of Rice Intensification (SRI) to demonstrate how rice yields can be sustainably increased under local conditions. Among other agroecological practices, they promote and facilitate farmers' adaptation of appropriate technologies to improve soil fertility including the cultivation of green manures, preparation of compost and other organic inputs; and cropping systems and farming practices adapted to local environmental and socio-economic conditions.

Metta Foundation also promotes and facilitates farmers' sharing of their experiences and practices with the new generation of farmers through farmers' forums, field demonstrations, seed exhibitions, field visits, etc. They give emphasis on mobilization of women and youth to participate in social activities in their villages.

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Terracing

Terraces are made from a piece of sloped land cut into a series of graduated flat surfaces, creating 'steps' or terraces in the slope. The method is used to farm hilly or mountainous land, maximizing arable farming land and reducing erosion and surface runoff.

The objective of terracing is to maximize the land available for farming in difficult sloping conditions. It also acts as protection or safeguard against farming challenges related to sloping land, including poor soil health, increased rates of erosion and surface runoff, and poor water retention. Terraces form low, flat beds of earth suitable for planting crops, graded against the slope of the land with excess water directed towards a small channel. In essence, the purpose of terracing is to reduce soil erosion and conserve water. Terrace beds usually support crops requiring irrigation such as rice but they may also be used to transform previously infertile land into arable land for planting a variety of crops.

Terracing:

Building stairways towards sustainable livelihood

Xisto Martins

At 69 years old, Bento Da Cunha still works in his family's farm, applying the techniques he learned from RAEBIA (Resilient Agriculture and Economy through Biodiversity in Action) more than a decade ago. RAEBIA is a non-government organization which works alongside communities in rural and remote areas of Timor-Leste to promote food and livelihood security and ensure sustainable natural resource management.

Belonging to a very small indigenous community called Ilimanuk, Bento lives in the Ilimanuk Mountain in Manatuto District, Timor-Leste. Most of the people from his community did not have any access to formal

education. He and his family manage a half hectare (0.5 ha) farm inherited from his parents. The land used to have soils that had very poor quality, was rocky and had little vegetation to produce organic materials for farming.

In 2009, Bento received technical assistance from RAEBIA. He learned Sloping Agriculture Land Technology (SALT), terrace construction, seedling production, composting and organic pesticide production. He gradually applied the techniques he learned, constructing terraces in the sloping land before planting the crops. He then proceeded with production of composts and organic pesticides for his crops. In time, he was able to improve the quality of the soil and was able to transform his farm into an arable land.

Today, he grows various crops, which include maize, cassava, taro, yam, papaya, banana, Leucaena, Gliricidia, Mucuna, beans, as well as fruit trees such as mango and orange.

Building a Terrace

In Timor-Leste, farmers use a local innovation called an *ai matenek*, "clever tree" or A-frame to identify where the land naturally slopes and what path the terrace should consequently take. With a weighted string hanging from its center, the ai matenek indicates the area of flat land. Farmers push sticks or poles into the ground at the base of the ai matenek, at the point at which the weighted line hangs true vertically. The ai matenek ensures that the new terrace follows the existing gradient of the land evenly and does not cause water to pool unevenly in the new terrace bed.

To create terraces, farmers use their hands and tools such as shovels, axes and sticks to dig up the rocky ground. They use rocks and stones to construct walls along the contour line. They also use wire cages packed with rocks to create retaining walls. Rocks are used in

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terrace construction to ensure the strength and stability of new terraces.

Terrace beds usually support crops requiring irrigation, such as rice, but they may also be used to transform previously infertile land into arable land for planting a variety of crops. Farmers who have been practicing terracing observed reduced crop vulnerability to pests, increased crop yields, improved soil quality, and more nutrient-dense and better-tasting produce.

RAEBIA has been training farmers in constructing and maintaining high-quality terraces since 2004. Terracing is a long-term land use solution for communities working on sloping land but requires hands-on management and maintenance for optimum performance. RAEBIA has also facilitated exposure visits for new farming communities seeking to learn more about terracing, and has helped many communities build more terraces in their areas. This technique of terrace construction is currently being used by hundreds of farmers in Aileu and Manatuto districts in mountainous central Timor-Leste.

RAEBIA hopes that through sustainable techniques and centuries-old knowledge, they can support rural communities across Timor-Leste to farm better and break free from poverty.

Challenges and Lessons Learned

Farmers in Timor-Leste have been constructing terraces in their lands for generations, but they lacked knowledge and training on construction of sound terraces. Because of poor construction, the terraces were flooded with upstream water, especially during heavy rainfall, causing depletion of fertile topsoil. As a result, crops were destroyed and farmers simply gave up and left

their lands unplanted for fear of experiencing the same ruin. There are farmers who are interested in learning but there are also some who adopt a wait-and-see attitude on the benefits of terracing before applying the practice in their own farms.

But communities which have received training in terrace construction have improved their knowledge on terrace farming and have built strong, stable and resilient terraces. They now have opportunities to use more land with fertile soil protected from floodwaters. Today, farmers are more confident in their farming and abilities in strengthening their source of livelihood.

More training sessions on terrace construction are needed to cover more communities. Terrace construction and maintenance is a labor-intensive practice and current construction techniques limit capacity to support its growth or to scale out. One way of making the process more effective and efficient is by involving trained farmers to conduct training on terraces construction.

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Vermicomposting:

Harnessing the power of worms to produce fertilizer

Renelyn Gamaya

Vermicomposting is a process of using earthworms and microorganisms to decompose and detoxify organic wastes and convert them into composts. It involves culturing of earthworms outdoors in beds or in confined chambers in the presence of organic materials. The earthworm's metabolic activity and cooperation with microorganisms lead to a 40–60% reduction of volume, an increase of bioavailability of nutrients to plants, a reduction in the C/N ratio, and a decrease of the availability of some dangerous contaminants such as metals. Vermicomposting produces a rich organic soil amendment containing a diversity of plant nutrients and beneficial microorganisms.

In Real, Quezon, the Philippines, a 58-year-old farmer named Orlando Cordial practices vermicomposting for many reasons. He uses worms on his 100-square meter backyard farm to help reduce farm wastes, have a free and secure source of fertilizer, and minimize the use of chemical fertilizers.

Agroecological Farming Practices

Orlando first learned about vermicomposting from his fellow farmers and vermiculture practitioners. Having acquired knowledge and appreciating the benefits, he decided to venture into vermicomposting. He started by preparing the area for composting. He shared that the size of the space depends on the volume of the worms that will be used in making vermicompost or a vermibed. He divided the vermibed into two - one for initial composting, and the other for transferring the composted residues after harvesting them. Other farmers prepare three separate beds for the purpose of selling the vermicompost later on.

Organic materials to be used in vermicomposting should be high in macronutrients because the kind of nutrients present in the decomposing materials determine the kind of nutrients that will be deposited in the vermicompost. Orlando usually uses Trichanthera, Leucaena, banana suckers, rice straw or other plant residues, and chicken dung, all sourced from his farm.

The farmer further explained that vermicompost production and storage areas should be far from where trees are since these can take up all the nutrients and their roots may invade the vermicompost below ground. The vermicompost should be kept moist but not soggy. During the dry season, the vermibed should be watered every morning to keep it cool and it should be kept covered if it is not located under a shed. Orlando applies the vermicompost as a basal fertilizer prior to planting as this results in better plant growth.

Vermicomposting has helped in managing his farm's wastes and turning these into useful resources. Equally important is that it provides him and his family of five with organically grown vegetables. Many farmers in his community have witnessed the usefulness of organic and farmer-friendly practice of vermicomposting.

Challenges and Lessons Learned

Farm wastes or by-products can be made useful through vermicomposting technology. It is very beneficial in supplying year-round fertilizer for the farm, thus minimizing expenses on production costs and helping manage farm wastes and by-products.

Farmers have noted that mixing manure from swine fed with commercial feeds in the vermicompost took longer to decompose. The mixture resulted in increase in temperature in the vermicompost, a condition that is not favorable to vermiworms, thus decelerating the decomposition process. Orlando suggests that if a farmer wants to add swine manure in the vermicompost, it should come from swine fed organically or with green fodder.

He recommends that a study on the performance of vermicomposts under submerged conditions or in wetland rice farms be conducted to help farmers with such farms.

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Agriculture, Ecology and Society

Pressures on agriculture to increase food supply while minimizing environmental damage and social disruption are likely to continue to intensify in the coming decades (CNS-FAO, 2019). With continuing growth in human population, these pressures would require agricultural systems that facilitate the convergence of agricultural practices and ecological principles, systems that increase farm productivity while protecting and enhancing the natural resource base, that conserve biodiversity and reduce the effects of climate change, that ensure food and nutrition security and help alleviate poverty.

Agroecology as a farm management practice improves the well-being of farming households, strengthens agrobiodiversity, builds fertile soils, reduces natural resource exploitation, and helps mitigate and adapt to climate change. Agroecological principles help identify management practices that can lead to the improvement of ecosystem services capacities and flows, stimulating the shift from conventional agricultural systems to agroecological systems that make smart use of the natural functionalities that ecosystems offer.

Unfortunately, though many of the agroecological farming practices are both more environmentally sustainable and could result in beneficial economic returns, adaptation of practices is not guaranteed. Farmers' adaptation of agroecological farming practices is severely affected by limited access to information, appropriate technologies or finance, inclusion in or exclusion from social networks, land tenure, and other sociocultural determinants (Jarvis, et al., 2013).

Agroecological farming also needs to help build resilience to market fluctuations through reduced production costs, better access to markets, and building of decentralized markets. Effective demand in the market and the value chains beyond production are important in ensuring that farmers can receive an attractive return for their efforts to produce safe and nutritious food and other ecosystem products. Farmers must also address stresses on agricultural systems from powerful drivers outside of agriculture. As a social movement, agroecology should also look at agricultural and food systems in a holistic and transformative way and ask not only how to produce, but also what to produce and for whom it needs to be produced.

Facilitating Farmers' Adaptation

Agroecology requires innovative approaches and strategies to motivate farmers to adapt farming systems and practices that are knowledge-intensive, highly context-specific, and provide benefits mostly in the long term. Technical support should be oriented towards solving farmers' problems, enhancing understanding of new concepts and principles, enabling a change in mind-set, cultivating willingness to test and adapt new practices, and committing to a longer-term process of change in their farming systems.

Agroecology also requires farmers, researchers, extension workers and other agricultural professionals to have a holistic understanding of farming systems and agricultural practices and to ensure increasing adaptive capacity and resilience in agriculture and the food systems. They need to be skilled not only in knowledge, education and learning services provision but they should also have the capacity to work across traditional science disciplines and work closely with farming communities. This is essential especially for agricultural systems that consider local contexts and build upon traditional knowledge as well as innovation (FAO, 2017).

Farmers' participation in technology development and extension approaches provides the necessary platforms for joint learning and co-creation of knowledge. Participatory development of agricultural innovations allows farmers to participate in innovative processes where their creativity and skills are encouraged to jump-start knowledge creation and use. The same is true for farmer-led research and grassroots extension approaches as well as other participatory learning and action approaches such as Participatory Plant Breeding (PPB), Participatory Varietal Selection (PVS) and seed rehabilitation.

Farmer Field Schools (FFS) and other experiential, discovery-based and participatory learning approaches are also key in developing and sustaining agroecological systems and practices. Farmers who have participated in FFS have shown improvement in their knowledge, confidence with problem solving, and demonstrated better decision-making skills. The key to local livelihoods is the capability of local communities to innovate, evaluate, and adapt as they involve themselves in agricultural development process based on local knowledge and organization (Altieri and Nicholls, 2005).

Besides, agroecological farming needs reliable local individual and institutional champions whose own examples will encourage adaptation of verified agro-technologies. These champions are then supported by research and development groups, non-governmental organizations, private sector service providers, government agencies, and donors. Mentoring programmes, where experienced farmers assist newcomers during the early years of technology adaptation, are indispensable if yield increases and higher profitability are to be expected. Further scaling up of agroecological practices to achieve sub-national and national impact requires enabling policies and institutional support (including training, access to knowledge and research).

Nurturing Local Food Systems

As an integrative and holistic approach to study agricultural systems, agroecology is being considered as the ecology of food systems. Agroecology contributes to sustainable and resilient food systems that help regenerate ecosystems and progressively improve farm productivity to promote food security and sovereignty. Food systems are not only critical in ensuring food security and improved nutrition. They are important in achieving social, economic, and environmental goals as well.

Agroecology has the explicit goal of strengthening the sustainability of all parts of the food system, from the seed and the soil, to the table, including ecological knowledge, economic viability and social justice. A local food system is a collaborative network that integrates sustainable food production, processing, distribution, consumption and waste management in order to enhance the environmental, economic and social health of a particular area.

Local food systems use ecologically sound production and distribution practices, are economically viable for farmers and consumers and enhance social equity and democracy for the whole of the community. They are rooted in a particular place and adapt local food production and markets based on the community's priorities and needs. Local food systems include a focus on home gardens, farmers' markets, community supported agriculture (CSA) schemes and other forms of direct sales, local public procurement, as well as steps to source inputs within the farming communities (IPES-Food, 2018).

Creating an Enabling Environment

Social capital is an important pre-requisite to the adoption of sustainable behaviors and technologies over large areas. It is as important as the regenerative agricultural technologies involved in agroecological farming. It describes the importance of social relationships in cultural and economic life and includes the trust and solidarity that exist between people who work in groups and networks, and the use of reciprocity and exchange to build relationships in order to achieve collective and mutually beneficial outcomes (Kassam, et al., 2017).

Farmers tend to believe other farmers when discussing agricultural innovations. Trust makes it easy for them to exchange ideas and experiences that help strengthen their own linkages and reinforce technology adaptations. They usually coalesce into informal groups with common interests and form the basis for learning and innovation groups. These small informal groups evolve into associations, clubs, co-operatives, or other organizational arrangements. They derive confidence from mutual support and exchange, accelerating innovation and adoption. They also develop bargaining power with buyers and sellers, traders, and service providers. If sufficiently well-organized, they may be able to effectively pressure local and national governments and institutions for necessary reforms and services. The development of such groups can then become a powerful means of encouraging others to join and sustain the agroecology movement.

Much of the successful diffusion of agroecology has occurred because of support from the private sector, farmers' groups, or other non-government organizations. An important determinant of whether agroecological farming systems and practices are adopted, scaled up, and sustained is the presence of an enabling policy environment. Governments need to recognize the public good value of the environmental benefits generated by widespread adoption of agroecological farming practices. Appropriate policies and incentives need to be put in place to encourage knowledge-sharing amongst stakeholders at all levels and to enable the integration and verification of agroecological systems and practices into practical programmes.

Enhancing Social Transformation

Agroecology is not only based on the management of ecological processes in order to produce environmental services, but also often involves a social and political dimension in the transformation of production methods and, more generally, of food systems in their entirety. Broader social issues present deeper challenges to agroecology as a "transformative approach" to agricultural sustainability. The questions of social structure and agency, and the interplay of the state, private enterprise and civil society, are central to understanding prospects for agricultural sustainability. Thus, fundamental values regarding human dignity, social justice, equity, economic opportunity and environmental stewardship, as well as the principles and processes governing society's choices, are important subjects and practical challenges for agroecology. There is a need to link knowledge with action for improved ecosystem management, with governance, accountability and participation. The related questions of social justice and power within society - that is, who makes decisions on important issues like environmental valuation and social trade-offs and by what rules, and who decides on the rules - are central to the question of agricultural sustainability.

A transformative agroecology comprises transdisciplinary science, sustainable agricultural practices and social movements. Within this larger scope, society and its various aspects play fundamental roles, shaping agriculture within a complex food system. In order to facilitate transformations, the ecosystem services perspective is considered as one way of integrating social and environmental perspectives and considering ecosystem trade-offs from the perspective of human well-being. The concept of ecosystem services bundles, on the other hand, combines sets of services that appear together repeatedly and have close interactions. Finally, considering agroecology as a coupled system shows how agricultural, environmental and social sciences play complementary roles in understanding contemporary challenges to food system sustainability, environmental integrity, and resilience. A more radical transformation of agriculture is needed, one guided by the notion that ecological change in agriculture cannot be promoted without comparable changes in the social, political, cultural and economic arenas that also conform agriculture (Altieri and Nicholls, 2005).

Case Studies
Farmers' Practices in Southeast Asia

Agroecology and Market Opportunities for Women in Development Project in Myanmar

Metta Development Foundation Team - Taunggyi Office (Shan State

Women play an often unrecognized role as producers, traders and buyers in agriculture. If supported with the right skills, market access and a thriving agricultural market system, women can help lead the country toward sustainable development, peace and poverty reduction.

In 2016, Metta implemented the "Market Opportunities Development for Women Project"[11] in Shan State. The project involved women producer groups who put up income generating enterprises using agroecological farming systems and practices. The enterprises include agroforestry, garlic production, chili seeds production, chili post-harvest handling, and alternative farm inputs production.

[11] The project was supported by the Mennonite Economic Development Associates (MEDA). MEDA is an international economic development organization that creates business solutions to poverty that are sustainable, scalable, measurable and replicable. https://www.meda.org/

Agroforestry

The Women Producers' Group and Village Cultivators of War Kha Yar Village, Hopong Township in Southern Shan State are practicing agroforestry and seasonal crop cultivation in their upland farms to improve soil quality and prevent environmental degradation. They grow a variety of crops to generate extra income for basic family essentials and to have alternative sources of income if one crop has no market.

Among the crops they grow throughout the year are avocado, maize, Thanat Phet (the leaves of these are used in making cheroots), rice, turmeric, peas, and beans. They intercrop coffee, avocado, peas, beans, and Thanat Phet. Niger and rice are cultivated in rotation in most avocado orchards season after season. Some seasons, rice and maize are also cultivated between avocado lines. Farmers practice this before the avocado plants grow too tall and shade the entire field, so they can do the ploughing, weeding and harvesting.

Almost all families in War Kha Yar Village raise buffaloes on a small scale and self-sufficient way. They use buffaloes and cows for weeding between crop lines. Weeding at the plants' base is done manually. Cattle manure is composted and used as fertilizer for the turmeric plants.

Farmers preserve local varieties of beans and pulses, turmeric, vegetables and rice. They also link with one another to be able to access good avocado species from nearby villages. During planting season, they exchange and share materials when needed. They also help each other out when farm labor is needed.

Garlic Production

Farmers in the villages of Line Kin, Lae byin Aut and Hti Eun in Taunggyi Township, Southern Shan State cultivate garlic, rice and vegetable crops in lowland/irrigated farms and upland/rainfed farms. Women's groups in these villages were organized to strengthen their capacities and broaden their knowledge through various trainings and other activities on agroecological farming practices. Among the practices they apply are mulching, green manuring, compost making, and crop rotation.

The women have learned how to use all the resources within the farms. For example, after ploughing the corn fields they would set aside the corn stalks. In the past, the stalks were simply burned but today they use these together with the rice straw as mulch for growing garlic. They use local seeds and sow them in line to allow passing of mechanical weeders. They also make composts and add them to the soil to enrich its organic composition. Pest management practices include the use of herbal insect repellent and fermented fruit juice/plant juice. Garlic takes about four to five months before harvesting. The women farmers sell the produce together as a group.

The villagers observed that agroecological farming practices were less damaging to the environment. They found that beneficial insects were no longer dying and the soil remained fertile and productive. The practices also reduced farming expenses since local resources were used although they required more time and labor. In addition, the crops became resistant against diseases and the garlic cloves produced were bigger (which middlemen prefer) thus commanding a much higher price. The practice also promoted better health of household members and consumers.

Twenty (20) of the farmers involved in the project have stopped using chemical pesticides when they learned the negative effects of these. Other farmers shifted to natural farming when they finally saw the increase in yield achieved from adopting agroecological practices.

Chili Seeds Production

Chili crop is cultivated on slopes and rainfed farms in Mee Yet, Kho Hpoon, Hti Hsone, Hti Ta Khyaw, Pan Tha Khwa Villages in Hsi Hseng Township, Southern Shan State. Growing of local chili seeds dates back to the time of the farmers' ancestors. These seeds are farmer-saved and shared, long lasting, resistant to diseases, easy to store, dependable and adapted to local growing conditions.

Farmers systematically preserve, exchange and use only local seeds that are of good quality and free from fungus and other pests. In order to achieve this, farmers pick only beautiful, colored, large fruits that are free from disease at maturity. They dry them properly, remove the debris and store the seeds in dried gourd, boxes and bottles. They put basil leaves in the storage containers to protect the seeds from fungus and pests.

These practices provide farmers with seeds that are free from pests, have good seed germination and achieve uniform growth resulting in healthy crops. They have steady access to good seeds that are locally adapted. Because they practice seed exchange, they also get to save some money as they no longer have to buy seeds.

Farmers who are adapting seed production practices do not need to depend on external inputs as they only use locally adapted and farmer-saved seeds. However, farmers have learned that it takes time to acquire good quality seeds. They have also realized that not all farmers can adapt the practices due to their lack of skills in the selection process.

Chili Post-Harvest Handling

In the past, farmers dried the chilis either on roofs or on the ground. The resulting color was dull and pale or whitish because of dust and frost, or because of fungus. And when it rained, a large number of workers was needed to bring the chili to a covered place.

In order to fetch a higher price in the market, the chili must be of good quality - free from fungus, with better color, no moldy smell while being cooked, with

good taste, and safe to eat. In 2018, farmers started chili post-harvest management practices that included proper drying and systematic packaging.

Proper drying required facilities thus they constructed a podium or platform using bamboo poles (which are locally available) and covered this with plastic sheet for roofing. The harvested chilis were placed on the bamboo platforms and once dried, they were stored in airtight plastic bags.

The result was chilis with better color, less damaged/ruined produce, protected from dust, frost and rain and free from fungus. The chilis produced were not only healthier but also safer for consumers, which were much more preferred in the market and commanded higher prices. The farmers were also able to save on labor and thus had more time to do other activities that could help generate additional income. Using plastic sheets as roofing also solved the need for more labor to keep the chilis from being wet when it rained.

Among the successes of the project was the adaptation of the chili production and post-harvest handling practices by five groups of women chili producers and other chili farmers. The farmers realized the value of using and preserving local wisdom/knowledge and local resources. However, they are worried that resources like bamboo may become scarce and they will be forced to use plastic for as they have to change plastic roof of the chili drying platform every two years.

Group Production of Alternative Farm Inputs

The villagers of Kyaung Chel, Hsi Hseng Township in Southern Shan State are reaping the benefits of participating in the project. With the knowledge and skills they received, 60 members of the Women Producers Group and other farmers in the village are jointly producing composts, fermented plant juices and insect repellent which they use in their own farms.

These inputs can be prepared with less expenses since the farmers can make these by themselves. The ingredients are locally sourced and there is no need to buy production equipment. These farm inputs can be used not only for seasonal crops but also for perennial crops like pineapple.

Currently, they are producing compost through vermiculture using earthworms, breeding tins/bins and piles of organic materials gathered from around their farms. Fermented plant juices and herbal insect repellents are also being prepared in bulk from inputs collected by members of the group. The farm inputs are processed, appropriately stored, and shared among members. The group shares the techniques with other farmers who are willing to try them.

Farmers have realized that they have the ability to use and preserve local knowledge and local resources, which is beneficial in the long term although some farmers still hesitate because they want to have immediate gains. As the group members noted, improvements in farm productivity and environmental quality are gradual and slow.

Natural Farming Bzrings Sustainable New Life in Indonesia

"Nature gives us much better things than what we give to it."

Dameria Rosalin Situmorang, Slamet Nurhadi, Maritsa Zuchrufa and Abella Diandra Clarissa

During the New Order Era in the 1970s, the Indonesian government introduced the Green Revolution to modernize farming. However, it only damaged the environment and farming ecosystem. The intensification of farming system depended heavily on the use of chemicals, which resulted in degradation of soil quality. The Green Revolution transformed the farming culture of farmers and affected their economy and welfare.

Though there was no open resistance against the Green Revolution, farmers in several regions attempted to reintroduce and redevelop natural farming in their communities. But the efforts were extremely limited because of the strong policy influence and oppressive approach by the government. Green Revolution remodeled authentic farming into a sociopolitical farming system that is integrated with the State and market, which asserts dominant control over all instruments from the local to the national level, and even connecting it with the global farming system.

Various efforts were carried out in post-1998 to raise awareness about the destruction of the ecosystem caused by the intensive use of chemical inputs. For its

part, the government opened itself to various suggestions from the public to push for the development of a national farming system that is "pro-nature" and sustainable. As such, it issued several policies and national agriculture programs that could be seen as efforts to mitigate the political impact of the Green Revolution and as response to the growing signs of climate crisis which the program contributed to.

Among the policies and programs formulated were the Go-Organic 2010, One Thousand Organic Farming Villages, organic fertilizer subsidy, and the establishment of an authoritative body on organic farming under the Ministry of Agriculture. There were also several regulations related to farming, including: 1) Law No. 41/2009 concerning the Protection of Sustainable Food Agricultural Land; 2) Law No. 18/2012 about Food; 3) Law No. 22/2019 focusing on Sustainable Farming Cultivation System; and 4) Law No. 11/2020 about Job Creation.

Law No. 22/2019 was intended to mend the current farming system so that productive farming activities can be in harmony with nature and the environment. However, many of the articles are contrary to the principles of harmony. One of these articles openly supports the use of seeds resulting from genetic engineering, which is certainly against the principles of pro-nature farming.

Moreover, the law is weak in its support for farmers' independence to secure the means necessary for agricultural production, such as seeds, fertilizers and pesticides. But it includes penalties for farmers should they develop their own seeds and fertilizers for their farms.

Law No. 11/2020 about Job Creation was reported to be among the government's efforts to accelerate economic growth through creation of jobs. However, despite the good intentions, others believe that this law will only further diminish opportunities for businesses to create a sustainable farming system.

However, the government's policies that supported a pro-sustainable agriculture model turned out to be artificial as the Green Revolution was still being practiced at the time. The various policies and programs that used the term 'organic' ended up causing confusion among Indonesian farmers regarding the goals of the supposed better alternative movements to the Green Revolution.

Efforts towards environment-friendly farming system

The dependence on external agricultural inputs caused higher production costs for farming families. Eventually, farmers lost control and sovereignty in determining the price of their agricultural products which resulted in economic losses for their families. Worse, the losses affected the development of a younger generation of farmers in Indonesia. According to the Central Statistics Agency (BPS), the number of farmers aged 19-39 years has been constantly declining. From 2017 to 2018, there was a decrease of about 415,000 farmers. This crisis is

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experienced in several regions in Indonesia. One of the reasons for the disinterest of youth in the agricultural sector is the view that it is not a profitable source of income, and that it fits only those belonging to a low social status. Thus, they prefer and shift to occupations not related to agriculture.

But two organizations are exerting efforts and showing the way towards agriculture that is friendly to the environment: the Komunitas Swabina Pedesaan Salassae (KSPS) and the Serikat Petani Polewali Mandar (SPPM). And the youth have taken notice and are taking active part in the movements.

Komunitas Swabina Pedesaan Salassae (KSPS)

The Komunitas Swabina Pedesaan Salassae (KSPS) or Swabina Salassae Rural Community is a farmers' organization in Salassae Village, Bulukumba, South Sulawesi. Founded in 2011, it was organized in response to the negative impacts caused by the use of chemical inputs in the village. Through its Natural Farming Training, KSPS is committed to continue carrying out and promoting natural farming practices and "gotong royong" (mutual cooperation), thereby improving the farmers' welfare and their environment.

Efforts made by KSPS in promoting natural farming did not go unnoticed among the youth as they have witnessed the negative consequences of using chemicals in their farms. Aside from soil degradation and unhealthy harvests, they saw how the high costs of production burdened farming families. KSPS helped them gain knowledge and awakened their interest in natural farming. As a result, the two have collaborated to promote environment-friendly agriculture that do not put the finances of their families at risk.

The youth's involvement in natural farming training in Salassae proved to be very productive. From being training participants, they eventually became facilitators. They used social media as a platform in their campaigns. In 2016, the youth carried out nutrition practicum in the village of Bonto Tangga. In 2017, they were actively involved in organizing a meeting on natural farming and food sovereignty. Majority of the youth support and practice natural farming activities. Currently, there are 129 youth in Salassae who have agreed to help villages and continue adopting this farming system.

KSPS has earned the trust of the village government and other rural communities to continue their Natural Farming Training Program to build quality agriculture and foster the spirit of "gotong royong" among the villagers of Salassae. This community is now famous for its natural farming practices and villages. To date, there are approximately 300 villages that have reaped the benefits of natural farming in Salassae.

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Serikat Petani Polewali Mandar (SPPM)

Another youth-led movement actively engaged in sustainable agriculture is the Serikat Petani Polewali Mandar (SPPM) or the Polewali Mandar Farmers Union based in Polewali Mandar, West Sulawesi. Some of its members are still in high school, others in college and the rest are young farmers in the village. This movement was borne out of the concerns of the village youth regarding the worsening condition of agriculture in their communities which causes massive damage to the environment and increases the burden on farmers due to high production costs.

SPPM believed that farmers' sovereignty will not be realized when farm inputs are all sourced from outside suppliers. Thus they organized themselves to help farmers learn natural farming to remove their dependence on expensive chemical supplies and thereby lowering production costs.

To date, SPPM has promoted natural farming by conducting village-to-village trainings in 26 villages. In addition, SPPM produces natural farming products such as rice and cocoa, an endeavor which they jointly manage with the villagers. The profits from the enterprise is used for the maintenance of the organization.

With the spirit of youth very much alive in embracing and practicing sustainable agriculture, SPPM is now building a natural farming center which will serve as a venue for their training activities.

Challenges

Farmers' adaptation of natural farming practices is constrained by the length of time it takes to rehabilitate the land and improve farm productivity. The transition period for natural farming takes at least two years until the quality of soil is able to support better plant growth.

Majority of farming families in Indonesia either control a small piece of farm land measuring under 2,500 square meters, or landless. As smallholders, the farmers are vulnerable to quick-fix farm intensification agenda of the government and the agriculture industry.

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Lessons learned in promoting natural farming in Indonesia:

- Farming families can independently produce farming inputs by developing learning networks between peasant communities, including strengthening local seed exchange practices between communities.
- Farming families strengthen their farming methods by gradually removing the dependence on synthetic external inputs.
- Natural farming strengthens the preservation of agricultural practices that reflect the local culture of Indonesia. Mutual cooperation should be practiced continuously and discussion forums must be expanded in peasant or farming communities,
- Natural farming community networks grew from the initiatives of peasant organizations and were able to strengthen relationships with the local level government (district and village).
- Farming families are able to improve the consumption pattern at the household level into healthy food consumption.
- Women farmers' organizations that campaign for natural farming practices have gained recognition for being equally involved in decision-making at the village level.
- Peasants who practice natural farming are able to change their mindset to be more critical of the conditions and issues that affect them.
- To create a positive image for farming and make it an attractive occupation, there is a need to establish organizations that include the youth in tackling agroecological issues. The youth inclusion strategy will hopefully encourage them to take proactive role in building a better future for Indonesian agriculture.

Peoples' Biodiversity Management for Food Security in Vietnam

SEARICE

SEARICE implemented the project "Putting Lessons into Practice: Scaling up Peoples' Biodiversity Management for Food Security"[12] from 2012-2015 in collaboration with partners from government, non-government and research institutions.

[12] The project was supported by the International Fund for Agricultural Development (IFAD) and implemented jointly with Oxfam Novib.

The objectives of the project were to:

1) develop adaptation strategies for food security by bridging traditional knowledge and science on plant genetic resources (PGR);

2) influence policies on food and agriculture from local to international level toward realizing the right to food of indigenous and smallholder farmers; and

3) strengthen their adaptive capacities in PGR conservation, including access to and sustainable use of plant genetic resources for food and agriculture (PGRFA), by scaling up successful and/or innovative models.

The components included capacity-building through collaborative strategies - Participatory Plant Breeding (PPB) and Community Seed Management (CSM), and policy support by providing venue for the farmers to articulate their concerns and issues to government leaders. The Farmer Field School (FFS) approach was used as a learning and empowering methodology while the System of Rice Intensification (SRI) and PPB were introduced to farmers as climate change mitigation measures. It targeted 75,000 low-income farming households from several provinces of Vietnam.

The project recognized that the knowledge and experiences of the farming communities of indigenous peoples and smallholder farmers (IPSHF) are integral elements and actors in the 'global responses' to climate change. For one, the participants' prior knowledge of ecosystems and their resilience are keys in identifying the challenges posed by climate change and in building appropriate responses. The initiative thus anchored and capitalized on these knowledge and experiences by building on them and, at the same time, enhancing them by introducing new adaptation mechanisms whose adoption or not was decided by the participants themselves based on their contexts.

The project built on past similar SEARICE projects in Vietnam, i.e. the Community Biodiversity Development and Conservation (CBDC) implemented in 1994 to 2005, Biodiversity Use and Conservation in Asia Program (BUCAP) implemented in 2000 to 2005 and the merged program (CBDC-BUCAP) implemented from 2006 to 2011.

Implementing Approaches and Strategies

FFS was used as a learning and empowering methodology. Through FFS, farmers were organized, supported each other, and were able to sustain the efforts beyond project implementation. Technical skills and topics discussed and subsequently applied on-farm included PPB and CSM. The principles of SRI, a known ecological farming method that is also touted as a climate change adaptation and mitigation measure for agricultural systems, were also implemented. The inclusion of SRI was important as it was new to the participants and it made them re-think their already established farming practices such as continuous standing water, dense transplanting of seedlings, overuse of nitrogen fertilizer, and spraying of pesticides, among others.

Policy support was in the form of provision of venue for farmers to air their concerns, issues and needs such as events like farmers' field day, end-of-season assessment and planning and farmers' technical and policy conferences which were attended by local government officials.

The project was implemented across five provinces in Vietnam: Son La, Hoa Binh, Thanh Hoa, Lao Cai and Yen Bai with counterpart implementation in 19 provinces in Mekong Delta. It was able to reach 75,000 poor farming households from the upland areas of the northwest (Hoa Binh, Son La, and Lao Cai), northeast (Yen Bai) and northern central (Thanh Hoa) consisting of at least 20% ethnic groups engaged in rice and maize production and the central Mekong regions of the country.

The project sites were in mountainous and coastal plains. The arable lands were small and crop productivity was highly constrained by soil salinity and low soil fertility, which were further aggravated by adverse weather conditions. Since the arable lands in this province were affected by salinity and acidity, and since they had not yet found the most adaptable variety for these adverse conditions, the farmers continued to experience crop failures.

At the start of the project, it was found that farmers were nowhere near to being able to even just withstand the effects of climate change. Results of baseline studies showed a notable dwindling of agrobiodiversity in the communities. There were also food security issues, with reported hunger periods of up to 17 weeks annually.

Key Results and Outcomes

It is a given that farming communities are highly at risk and vulnerable to impacts of climate change. But while they are vulnerable, farmers also hold a crucial key in mitigating and adapting to the impacts of such. It is thus critical that farmers' potentials to address their own vulnerabilities are strengthened by harnessing their traditional knowledge and skills and providing their capacity to adapt to climate change.

Ethnic communities tend to be disconnected from the larger society, missing on economic and developmental opportunities. The project connected them by involving government services and educating farmers to make use of science-based technologies and opportunities in the market. The culture of sharing is strong among ethnic groups, particularly women. Female FFS graduates, widely recognized for their knowledge and capability to supply quality seeds, reached out to wider number of farms in the communities. This had tremendous impact on their self-consciousness and pride.

With the capacity building, farmers had the opportunity to select and develop varieties that provide

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high yields, adapted to local conditions, including saline tolerant varieties and which had the characteristics preferred by indigenous people and smallholder farmers.

The initiative was able to help address genetic erosion and limited access to locally adapted varieties of rice and corn. The IPSHF communities learned concepts and skills to allow for the development and rehabilitation of local and traditional varieties. Subsequently, these were reintegrated and reintroduced into the farming systems. The initiative contributed in improving access to locally adapted seeds and lessened farmers' dependence on for-sale seed sources. The introduction and integration of new techniques likewise lessened the amount of seeds required for production, thus allowing for seeds to be saved.

Through the mobilization of the public sector, the project's participatory plant breeding took advantage of the rigor of science and technology while decision-making and final selection were devolved to farmers' groups. This resulted in locally adapted and commercially competitive varieties, diversity and farmers' empowerment. The merits and potentials of participatory methods that link farmers' groups to public sector institutions were solidly demonstrated.

Improvement in capacity translated to improvement of farm productivity: at least a 10% jump from harvests prior to program implementation and hunger periods reduced from as high as 17 weeks annually to a maximum average of seven weeks across the provinces with some areas even claiming zero hunger periods, attributed to the improved access to and availability of appropriate seeds.

Challenges and Lessons Learned

The project included indigenous peoples as partners and beneficiaries, but it lacked a clear development framework on IPs that would have allowed tailor-fitting of interventions, or for interventions to be IP-sensitive. Thus, interventions were geared more for farmers in general and the IP dimension was merely consequential as the farmers happened to also be IPs.

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Furthermore, the timeframe of the program was short in consideration of the time required for varietal crosses to become fully stable. A longer timeframe would have allowed for full development of new varieties within the project period. Likewise, a longer timeframe would have allowed a more extensive experiential learning for the farmers.

Creating venues and opportunities for women's participation was a plus point of the project. Future interventions, however, can contribute further to breaking the gender divide and social construct or viewpoints on men and women and the power relations that go along with them.

The involvement in and acceptance of local authorities of the project was crucial in the realization of project targets. This involvement also allowed the tapping of services and expertise of the various government agencies for the benefit of the IPSHF communities. The role of local institutions cannot be discounted. It cannot be denied that these institutions contributed to the realization and implementation of the project. Direct engagements with community formations like unions (e.g., women, youth, and farmers) and people's committees can be explored in the future for better chances of institutionalization of projects and programs.

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Supportive policies that allow farmers to continue their traditional practice of seed exchanges contribute to the diversity on-farm. Likewise, allowing farmers unrestricted access to plant genetic resources not only as planting materials but as raw materials for breeding enhances the capacities of farmers to adapt to the challenges brought about by climate change. Further, allowing farmers with the capacity to develop new varieties and produce good quality seeds, sell their seeds at least at the local level, not only contributes to their livelihood but also provides easy access to locally adapted seeds among the members of the community.

Sustainable Agriculture Code of the Municipality of Arakan

North Cotabato, Philippines

A Farmer Co-Developed Municipal Ordinance on Agriculture

Arakan used to have a rich and diverse agricultural biodiversity. However, at the height of the "Masagana 99" or the modernization of agriculture program of the country's Department of Agriculture and local government units (which involved the promotion of a package of technology of seeds, fertilizer, and pesticides), crop diversity was significantly eroded due to the introduction of new varieties that were, in many instances, not adaptable to the local environment.

The traditional practice of seed saving and exchange between and among farmers existed in the community. The introduction of new and package of technology particularly on seeds was one of the main reasons of ecological imbalance that resulted in the emergence of different and new strain of pests and diseases. Farmers became dependent on the different private companies and public research institutions for seed supply.

The development of the sustainable agriculture code started with a vision of then Municipal Agriculture Officer of Arakan, North Cotabato, to transform the destructive agricultural practices in the municipality into sustainable agriculture. This was just a part of his bigger dream which was to have sustainable livelihood and food security; empower the farmers; protect the natural resources; improve watershed and wildlife habitat; and improve the land tenure arrangement in Arakan. His vision was in harmony with the empowerment agenda of SEARICE hence the collaboration between the two institutions was sealed in 2011.

The objective of the collaboration was to develop an agriculture code for the Municipality of Arakan that embodies the aspirations of men and women farmers to have an agricultural system that protects and sustains the natural resources and promote farmers' welfare. The second objective was to ensure that the necessary government support was provided for the implementation of the agriculture code through a Municipal Ordinance.

Developing the Sustainable Agriculture Code

To develop the agriculture code, SEARICE and the Municipality of Arakan co-organized an ordinance-writing workshop for several stakeholders in the municipality. The draft code was then submitted for consideration and adoption of the Municipal Council. Farmer leaders (women and men) of Arakan, North Cotabato in partnership with the Municipal Agriculture Office (MAO) and the Agriculture Committee of the Municipal Council were directly involved in drafting the Ordinance.

The code compiled all existing local ordinances on agriculture and added new provisions that would reflect the desire of the communities for a sustainable agricultural system. It is one of the very few local legislations on agriculture in the Philippines that support farmers' rights to plant genetic resources (PGR) and most likely the only one that went through a participatory process involving smallholder farmers. The ordinance is seen by Arakan farmers as a huge support to their efforts to completely transition to sustainable food production systems.

The key outcome of the collaboration is the participatory development of the agriculture code by key stakeholders including the farmers, and its subsequent submission to the municipality for consideration and adoption. The farmers' active participation in the process is reflective of a key modality of SEARICE's engagement with the farmers - farmer empowerment - which enables them to speak out about their issues, make informed decisions and lobby for the adoption of supportive policies.

The salient points of the agriculture code include:

1) management, utilization, exchange and development of plant genetic resources for food, agriculture and health, including protection of local seed systems and institutionalization of community seed banks;
2) municipal guaranteed protection of farmer-bred varieties, including institutionalization of a seed registry and protection against appropriation;
3) free access to seed for all farmers;
4) a ban on genetically modified organisms (GMO);
5) facilitating and monitoring access and benefit-sharing, including through the Arakan Farmers' Trust Fund;
6) protection and promotion of Farmers' Rights;
7) provision of incentives for farmer-breeders of traditional and indigenous varieties;
8) development of a loan assistance program; and
9) commitment to make an annual Farmers' Day a permanent part of the Municipal Foundation Anniversary.

But law making processes in the country slowed down the adoption of the code. In 2012, the collaboration started to lobby for Arakan Municipality to adopt an Ordinance that would support the vision of the Municipal Agriculture Office. A workshop to draft the Ordinance was conducted in 2013 and the final Draft was completed in August of the same year. However, the Ordinance was approved and adopted only in 2017 due to political rivalries among the members of the Municipal Council.

The law has been adopted with the persistent lobbying of champions within the local government unit. With the lessons learned from the ordinance development, the development of Implementing rules and regulations (IRR) and subsequent approval went through an easier and faster process. The IRR was drafted in January 2019 and was approved immediately in March 2019.

Collaborative Multi-Stakeholder Policy Development

The development of the agriculture code is indicative of the deep commitment of the municipality to promote and protect farmers' rights. It puts to task the local government leaders to ensure the protection of farmers. The ordinance ensures that budget will be allocated by the government to implement the law. An initial funding of one-million pesos (USD19,684) was already allocated for the implementation of the ordinance. Its subsequent adoption serves as an example

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for other local government units to follow through with concrete ways to protect and support their farmers.

The adoption of the municipal ordinance is a monumental step, a legal measure that concretizes the centuries of work of smallholder farmers and a stepping stone for future generations of farmers. Arakan has since strengthened its campaign, and moved towards sustainable organic farming. Within the municipality they have established model farms that serve as an encouragement to other farmers, convincing them that sustainable farming is possible. It plans to influence its neighbouring communities and provinces to adopt the same measure. Collaborative multi-stakeholder policy development ensures that the voice of the most important stakeholder - the farmer - is duly heard. The draft ordinance contains provisions from the farmers' personal and collective experiences and learning from their years of managing their lands.

The farmer leaders who participated in the process realized that they have a right in advancing their welfare and that they can and should raise their voices. The agriculture code of Arakan, from its development to its subsequent adoption, empowers the farmer leaders on realizing their role, capacities and potential in affecting policies for their development. The code recognizes the critical role of small farmers in the conservation of plant genetic resources for food and agriculture (PGRFA) through the protection and promotion of traditional seed systems, farmer-bred varieties through the institutionalization of community seed banks, and benefit sharing among many others. Involving the farmers in the development of policies on agriculture was an empowering exercise. Not only did the exercise ensure that their voices were heard, it also informed the farmers that they do have the right to be heard and that they can and should use it to speak up and advance their issues and concerns.

The involvement of the Municipal Agriculture Office and openness of the local government to truly consider the voices of the farmers in their community are key in municipal agricultural policy advocacy and development. Identifying champions within the local government can greatly facilitate the process and ensure adoption. Representation of all relevant sectors, particularly women farmers and indigenous communities, in the whole process is crucial for the collective ownership and eventually, effective implementation of the law.

Sustaining Agroecological Farming through Champion Farmers in Timor Leste

Xisto Martins

Champion farmers play a very significant role in the sustainability of the agroecological farming program of RAEBIA. They and local community leaders act as point persons who connect with other farmers for program demonstration and replication.

Since 2002, RAEBIA has been developing champion farmers who work together with farming communities in order for other farmers to continue, replicate, and expand the farming systems and practices they learn to improve their livelihoods and sustain progress in the community without relying on external support.

Developing Champion Farmers

Developing the capacities of champion farmers takes time. The process of selection is thorough, and is conducted once RAEBIA begins working with selected communities. Everyone has a chance of becoming a champion farmer candidate, male or female, young or old. At the start of program implementation the staff of RAEBIA observe the farmers working together in the project communities. They take note of candidates who have basic skills and knowledge specific to the program. The candidates are also observed for their innovativeness, diligence, potential of becoming strong leaders, and willingness to learn and voluntarily work with and provide technical assistance to farmers. But the most important trait that RAEBIA considers is that the farming community must respect and follow the potential champion farmers' orientation.

The staff then works more closely with the candidates with the intention of building a stronger relationship. The candidates receive practical training to develop their capacity in terms of skills, knowledge and experience to become experts or volunteer staff in the future.

The candidates are gradually trained to be facilitators. They lead the activities and are tasked to present their group works during community events or when visitors arrive. They are provided with more training for new programs, activities and approaches so as to adapt to the program's requirements. This helps them become stronger, more capable, confident and resilient to assist the farming groups in the community where they are located.

The farmer-to-farmer training is a strategy anchored on the principle of volunteerism. RAEBIA makes sure that the champion farmers will provide voluntary service for all farmers in their villages, and not only for their families or any special group. The essence of the program is for the champions to continue the work of the project staff once the program is terminated as RAEBIA then ceases supporting community activities. As part of its implementation, RAEBIA does not support activities or processes that create dependency of the champion farmers and the community on the organization.

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Scaling Up/Out

A good example of the program's sustainability is found in the Uma Kaduak village, Laclo sub-district, Manatuto district. A group of champion farmers was identified in 2004 and remains to be well-organized until today. Farmers such as those from the KIKA Resource Centre[13] continue to manage their agriculture projects, practicing land, water and crops conservation in the resource center. Applying the techniques introduced by RAEBIA, they cultivate vegetables in homes and community gardens, stall feeding livestock, produce organic fertilizers and pesticides, and manage their seed banks. They have sustained the conduct of these activities even long after the project has been terminated.

The same is the case with the farming communities in Manelima and Tulataqeu and Fadabloco in the sub district of Remexio Municipality of Aileu. The role of selected champion farmers is almost the same as that of the field staff in charge of the project, as the formers' influence to engage other farmers is stronger and continues to this time.

From several years of experience developing champion farmers to be in charge of sustaining

[13] The Centre is a collaborative effort between RAEBIA and a farmers' co-operative, Ilimanuk. It has been running since 2012. The Centre serves 87 resettled indigenous families to increase their capacity in converting their livelihood from hunting-gathering and collecting fire wood to sustainable agriculture. Retrieved from https://www.socioeco.org/bdf_fiche-document-5181_en.html

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agroecological farming in communities, RAEBIA learned some considerations in scaling out/up the strategy:

1) Present champion farmers with special recognition for their great work;

2) Conduct or facilitate exchange visits between and among champion farmers especially in new locations or with new candidates for sharing of experiences, results, methodologies and techniques; and

3) Champion farmers should belong to and provide services to the community where they live.

Community Benefits

Champion farmers take their roles seriously and with moral responsibility. They offer their time and energy in providing technical assistance to the farming community in sustaining the work that has been implemented during the past projects and assist farming communities even without any external support.

The benefits of having champion farmers can be seen in communities where RAEBIA no longer operates. Farmers in these communities continue to practice the techniques they have learned, resulting in the demonstration, adoption, replication and expansion of recommended farming practices being replicated in other communities.

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Challenges and Key Learnings

The organization recognizes and acknowledges that most programs have been successful because of the proactive role of the champion farmers in the whole agricultural development process. Project implementation is quicker and successful with the help of champion farmers.

But there are several challenges in implementing the champion farmers as a strategy. Foremost of these is the short funding cycle which affects the maintenance of staff assistance in the communities. There is also the difficulty in determining the right persons for the role of champion farmers. Another is the voluntary nature of the assistance being provided by the champion farmers to program staff (without any promise of compensation or amenities). These challenges subject the program to uncertainties. Nevertheless, the program always tries to involve the champion farmers in every single program in the community and gives them due respect, special attention and treatment to be involved in the program and lead the community in program implementation.

The use of champion farmers is a sound strategy as it can respond to the issue of sustainability of activities and programs intended to uplift living conditions for better, secure and resilient environment, livelihoods, food and nutrition at the household and community levels.

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