

SUSTAINABLE AGRICULTURAL SYSTEMS FOR SMALL-SCALE FARMERS IN THAILAND: IMPLICATIONS FOR THE ENVIRONMENT

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ABSTRACT

Agriculture has been found to be a social safety net in Thailand, in terms of food security and as a source of employment, while the country is undergoing a recession as the result of the recent economic crisis. The agricultural sector therefore needs restructuring, in response to this need to increase the agricultural labor force and utilize farm resources more intensively. The approach to sustainable agriculture is being made mainly through five farming systems: integrated farming, organic farming, natural farming, agroforestry and New Theory farming. All these are being promoted as alternatives to Thai farmers, especially small-scale farmers. There is evidence that sustainable agriculture is not only financially viable, but also enhances environmental quality, for the benefit of farmers and Thai society in general. Development and assistance policies should be carried out to spur the growth of sustainable agriculture in Thailand.

INTRODUCTION

Given the high level of economic risk and uncertainty around the world, reflected in repeated economic crises, it is becoming accepted that economic development should be based on the concept of sustainability. Although there is no uniform definition, sustainable development generally refers to a development path such that the well-being of the present generation will not reduce the welfare level of future generations. Sustainability between generations can be viewed from the physical, economic, social and environmental aspects, depending on the issues to be considered. In brief, the world's resources and environment should be utilized today in such a way that they are transferred in good condition to tomorrow.

In all aspects, agriculture is well suited to the concept of sustainable development. On the one hand, agriculture deals with climate, soil, land, water, forests and biodiversity through the production of crops and animals. On the other hand, agriculture is related to farmers, rural communities, poverty and other social problems. Especially in developing countries, agriculture always plays more roles than just a way of earning income from farm production. Agriculture is a way of life for people

in rural society. The sustainability of agriculture, therefore, affects not only food production and the use of natural resources and environment. It also influences the social welfare of people in the agricultural sector, and in society as a whole.

The sustainability of Thai agriculture has been on the national agenda for a long time. Since 1997, when there was an economic crisis in Thailand, the agricultural sector has been absorbing labor from other failing economic sectors, as well as being a source of investment. Expansion of the free market economy under globalization has, however, resulted in a more competitive market for commercial agricultural production. This has led to the adoption of modern farm technologies, together with the more intensive use of agricultural chemicals, without sufficient control or effective production zoning.

Many Thai farmers are caught in a dilemma. On the one hand, they are under pressure to commercialize through contract farming and large-scale agribusiness. On the other hand, they are also searching for appropriate farming systems in harmony with the ecology and the rural way of life.

The issue of sustainability is even more crucial for small-scale farmers in Thailand, with farms of 3 - 4 ha (6 - 10 acres), located mainly in rain-fed areas. They are one of the poorest groups in the Thai

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population, because of scarce resources and limited opportunities. Promoting sustainable production systems for these small-scale farmers is now a major issue in Thai agricultural policy. Although they may not contribute very much in terms of market value and export earnings, small-scale farmers are a significant part of Thai rural society, in terms of food security, environmental conservation and the solidity and self-reliance of rural communities. Failure to find a sustainable solution for them may damage the whole country, causing food shortages and environmental degradation, weakening the rural social structure and creating many social problems.

This Bulletin discusses the promotion of sustainable agricultural production systems for small-scale farmers in Thailand. Both the economic and environmental aspects are considered.

AGRICULTURE AS A SOCIAL SAFETY NET

In Thailand and other developing Asian countries, most of which are located in the tropics, the agricultural sector is fundamental. It is not only a major source of goods and foreign exchange, but is a way of life for the majority of the population. Agriculture provides an occupation, culture, traditions and values for rural people, who have long existed in harmony with nature. Agriculture is also part of the natural capital of the country, in terms of natural resources, biodiversity and the environment. Whatever changes occur in the agricultural sector, in one way or another they are likely to affect the rest of the country.

It is a necessary condition for Asian countries in general that agricultural development is the basic requirement for their overall economic development.

In 1997, a serious economic crisis took place in Thailand, before spreading into other Asian countries. Industrialization based on imported technologies and borrowed capital had gradually led the country into a foreign debt problem (approximately US\$90,000 million). In addition, the liberalization of the financial sector, together with speculation in foreign exchange, led Thailand into an unavoidable currency devaluation. The exchange system of a fixed rate of 1US\$ = 26 Baht became a managed floating system, in which 1US\$ = 45 Baht. As a result, stagnation and then recession have been seen in the industrial and service sectors ever since.

This economic crisis has had, directly and indirectly, at least three significant impacts on the agricultural sector.

Movement of capital and labor into agriculture

First, a surplus of capital and unemployed workers, once engaged in the financial, industrial and service sectors, have moved into agriculture. Investment into agro-industry and export-oriented agricultural commodities such as food processing, contract farming for vegetables and shrimp aquaculture, are all increasing. Some people feel that Thailand should take advantage of this opportunity to concentrate more on food production and processing, so that the country can be regarded as the “food center” of the world.

More intensive use of agricultural resources

Second, as affected by the first issue, agricultural resources and the environment, especially farmland, forestland, the coastal zone and the water supply, have become more intensively utilized. Farm resources and the environment are expected to deteriorate as a result.

Need to restructure agriculture

Third, agriculture itself thus needs to be restructured, in terms of production planning and resource use, if it is to sustain itself into the future. If the country continues to promote commercial agriculture without proper resource planning and appropriate technologies, agriculture will not be sustainable for long.

On the one hand, it seems that the crisis the financial sector of Thailand has resulted in a crisis for the agricultural sector. Farm-based resources such as land, water and forest have been affected significantly, due to increasing demand.

On other hand, it seems that whenever Thailand has a crisis, agriculture has always played an important role as the county’s “social safety net”, protecting the country from a worse situation. Agriculture has again and again proved itself to be the source of comparative advantage to create self-sufficiency for Thailand. The fertile resource base of agriculture and the structure of rural society in Thailand, although they may have been ignored during the period of rapid industrial growth, remain solid assets for the country.

From agriculture come benefits such as food security, household employment, rural community support and various environmental benefits, which become even more important in critical periods.

Although the value of these assets cannot be expressed directly in monetary terms (in GDP), it is clear that the country would be in an even more uncertain situation without them. In addition to environmental resources, the age-old knowledge and wisdom of Thai farmers still remains in the agricultural sector as “social capital” which can be utilized. The term “social safety net”, therefore, implies the continued support given by the agricultural sector to the rest of the country.

A key question at the present time is how Thailand can make best use of its natural and social environment to sustain the agricultural sector into the future. Since the country has not yet fully recovered from its economic crisis, policy recommendations regarding agricultural development must be made more careful, more specific and much clearer than before. In fact, it seems that agriculture itself has come to its last frontier.

AGRICULTURAL SYSTEMS FOR SMALL-SCALE FARMERS IN THAILAND

An important fact about the agriculture of Thailand is that the sector, which involves about 30 million people or 50% of the Thai population, has a dual structure. Large-scale commercial farmers, who produce mainly for agro-industries and export markets, produce side-by-side with small-scale subsistence farmers, who struggle to produce for household consumption and domestic markets. These small-scale farmers each own about 15-20 rai (2.5 - 3 ha) of land. They are approximately 50% of the total farm population, but contribute only 25% of the total market value of agricultural production. The poorest group of small-scale farmers are those who reside in rainfed areas with scarce resources, limited opportunities, and poor access to markets. They are producing food for their own consumption, and selling the surplus to earn some income. If farm income is insufficient, off-farm employment is important for such farmers.

This group of small-scale farmers is estimated at 8 million households, using about 25 million rai (4 million ha) of land. Most of these small-scale subsistence farmers share some interesting common characteristics, including:

Failure from commercial farming

They were once farmers who produced in a commercial monoculture system. However, they suffered net losses from their production, due mainly

to increasing input prices and decreasing farm commodities. They left the commercial sector and became subsistence farmers.

Health effects

The intensive chemical use of commercial farming damaged their health and quality of life. This forced them to seek alternative farming methods that were considered safer.

Non-market values

Even though they are small-scale farmers who contribute only a tiny amount in terms of market value to national income and export earnings, their existence in rural areas is very important in terms of non-market values. They contribute to food security, and resource conservation and help build rural communities as well as conserve Thai culture and local wisdom.

Retreat from non-agricultural sectors

Some of these small-scale farmers have recently retreated from industrial and urban employment during the economic crisis. They considered the agricultural sector as their final safety net.

Production on marginal land

Most poor small-scale farmers live on marginal land, which is often associated with a crucial resource such as the boundary of a national forest, a watershed area or a coastal zone. Their methods of farm production have a direct impact on natural resources and the environment. Unsustainable farming practices may damage forests, biodiversity and fisheries, as well as polluting soil and water.

In view of these characteristics, the appropriate farming system for this group of farmers must be different from typical commercial production.

In general, the monoculture of economic crops in order to take advantage of economy of scale (decreasing unit cost from increasing production scale) is the pattern typical of commercial farm production. The types of crops or animals in the monoculture system will depend on the expected market demand and price. Thus, there is always the risk of excess supply and decreasing prices. At the same time, commercial farming will normally use external inputs such as chemical fertilizer, insecticides, pesticides and farm machinery. These

mean higher production costs, and lower or even negative profits.

Small-scale farmers, on the other hand, have limited capital and farmland, and suffer from a seasonal shortage of water. Monoculture designed mainly to serve market demand may bring net losses to small-scale farmers. Moreover, farm resources and the environment will deteriorate from the inappropriate farming system and technology.

Agricultural development, especially for small-scale farmers, should concentrate on farming systems that have at least four features.

Food security as the first priority

A farming system for poor, small-scale farmers should give priority to food security for the farm household. Self-sufficiency in staple foods such as rice, vegetables and fish is a basic need. Cash income comes second.

Minimizing costs as the main objective

Farming systems for low-income farmers should be based on the rationale that resources and inputs “inside” the farm area will be those most utilized, rather than acquiring inputs from “outside”. In this way, production costs are minimized. Profit maximization, as the normal objective of farm production, should be modified to take into account the concept of minimizing cost.

Diversification to avoid risk

Diversification of crops and animals on each farm is necessary, in order to reduce risk and uncertainty from a supply surplus and falling prices, as well as outbreaks of pests and diseases. An integrated farming system based on multiple types of production will potentially lead to increased benefits from economy of scope (i.e. different farm activities complement each other to reduce unit cost), since the residues and wastes from one type of production can be used for other types.

Agriculture as a way of life

Small-scale farm households, and the rural societies they belong to, usually consider agriculture as way of life rather than as an ordinary occupation. Maintaining resources and a good environment in farm production is therefore a necessary condition for their quality of life.

Since small-scale farmers are relatively poor,

they benefit very much from farmers’ groups and networks, by which they can help each other through the exchange of knowledge and experiences. Farmers’ groups can also increase the bargaining power of small-scale farmers in the purchase of inputs and marketing of outputs.

Especially during the economic crisis of Thailand, the “middle of the road” philosophy for economic development initiated by His Majesty the King has become the main development concept in Thailand. This was later developed into the philosophy of self-sufficiency based on moderation, reason and security in social development.

For the agricultural sector, self-sufficiency for small-scale farmers starts with a farming system which emphasizes the farm household. Farmers then should combine into groups or cooperatives, in order to exchange goods and services, as well as to increase efficiency in production, marketing and other social activities. Finally, strong farmers’ groups and solid rural communities can also expand their investment into outside sectors such as finance and energy, in order to increase the wealth of society.

This Royal initiative approach is currently adopted as part of the core concept for agricultural development as well as development in other economic sectors of Thailand, for the Eighth and Ninth Development Plans (1997 - 2001 and 2002 - 2006, respectively).

SUSTAINABLE AGRICULTURAL SYSTEMS IN THAILAND

Sustainable agriculture for small-scale farmers in Thailand simply implies an agricultural system that will lead farmers to self-sufficiency, and that will also maintain a favorable ecological balance and stable farm communities.

Sustainable agriculture can thus be seen as an alternative solution for small-scale farmers who wish to have a different method of farming than mainstream agriculture, which is based mainly on market forces. The difference between the two approaches can be seen in terms of these fundamental objectives. Commercial large-scale production has as its ultimate goal the maximization of **profits**. Sustainable agriculture, on the other hand, takes into account the maximization of **benefits** such as household food security, the quality of life, environmental conservation and rural development.

Agricultural resources in Thailand are diverse, and so are rural culture and traditional wisdom. Sustainable agriculture must be adjusted to suit different contexts. In Thailand, at least five main

patterns of sustainable agricultural system are being promoted. These are integrated farming system, organic farming, natural farming, agroforestry and New Theory farming.

Integrated farming system

The integrated farming system is a good example of sustainable agricultural production. It involves the wise use of limited farmland to increase the range and number of farm activities, thus reducing risk and making use of waste from one type of production in another type. Integrated farming implies at least two kinds of agricultural production operating simultaneously, and complementing each other in one way or another to reduce production costs.

In economic terms, the integration of complementary farm activities is considered economy of scope, because of cost sharing and recycling of farm inputs. Some types of successful integrated farming system include fish-rice production and pig-fish-vegetable production. The resources needed for integrated farming system are found throughout Thailand, but are especially suitable in the Central region.

Organic farming

Organic farming can be practiced in any farming system. It uses organic matter as the only fertilizer, while pests and weeds are controlled by cultural practices, including “organic chemicals” made from herbs. The aim is to increase food safety and restore soil fertility and water quality which have been damaged by chemical use. The improved environmental impact associated with organic farming can be expected to include improved quality of underground water, the conservation of natural enemies and biodiversity.

The production of organic rice, fruits and vegetables to supply niche markets in Bangkok and other major cities of Thailand is becoming increasingly common.

Natural farming

This farming system is probably the ultimate pattern of sustainable agriculture, in terms of conserving resources and the environment. Natural farming attempts as much as possible to avoid the use of inputs from outside the farm gate, and also to reduce all physical methods which disturb the ecological balance on farmland. Farm activities

which are **not** practiced under a natural farming system are key treatments such as ploughing, weeding, chemical use and applying fertilizer. The natural farming concept concentrates on preserving the natural ecology, by planning and controlling the equilibrium between different life cycles of crops, animals and weeds.

Practice of pure natural farming is still relatively rare in Thailand, but cases can be found of natural rice farming in northeast Thailand, far from commercial plantations with their intensive chemical use. This distance is needed, to minimize the spill-over effect in terms of the spread of pests and disease from areas given chemical treatments.

Agroforestry

Sustainable agriculture in an agroforestry system is a combination of farm production and forestry. Cash crops and livestock are raised within forested areas. Such a system conserves forests, as well as biodiversity and the natural ecology. The aim of agroforestry is not only to produce food and earn income for farmers, but to enhance forest resources. Agroforestry sustains the economic benefits of forest, such as soil fertility and nutrients from trees, topsoil protection, windbreaks, watersheds and recreational value. It is thus a good example of a compromise between agricultural and environmental needs, as well as a solution to the widespread problem of deforestation to provide land for agricultural purposes.

The practice of agroforestry can be observed everywhere in Thailand where the natural conditions are appropriate, but especially in marginal areas such as the mountainous Northern region.

New Theory farming

This special farming pattern for small-scale farmers in Thailand was initiated by His Majesty the King of Thailand. New Theory farming is the application of integrated farming systems to poor farmers on small land holdings with scarce water resources, as in the Northeast region. Its main aim is to bring food security and self-sufficiency to poor farmers who live in areas where water is scarce. The most important concept of New Theory farming is effective allocation of land to serve the different needs of farm households, including paddy fields for rice, a farm pond for water and fish, and cash crops and trees for farm income, plus a residential area. The area allocated to each kind of land use can be flexible, according to local resources, but is

usually 30:30:30:10. New Theory farming is expected to provide food security and a decent quality of life at a farm level. It is also considered an important step under the royal philosophy of economic self-sufficiency.

New Theory agriculture is now being promoted and extended throughout the country, especially in the Northeast region where poverty and water shortages are still serious problems.

It should be noted that there is the potential for many other kinds of farming system suitable for small-scale farmers, depending on local resources and environmental conditions, as well as the culture and values of farmers in each area. Table 1 and Table 2 show the characteristics of the five main farming systems recommended for small-scale farmers in Thailand, and their implications in terms of resources and the environment.

FINANCIAL RETURNS FROM SUSTAINABLE AGRICULTURAL SYSTEMS

Sustainable agricultural systems can be considered from several different points of view.

From the production aspect, sustainable agriculture is a good source of food security for farm households, as well as rural communities and the country as a whole.

From the resource and environmental aspect, it is an effective approach to preserve resources (soil, water and climate) and conserve biodiversity, at the same time maintaining a sound equilibrium between farm production and the ecology.

From the social aspect, all types of sustainable agricultural systems emphasize the quality of life, including food sufficiency and environmental values, in order to make farm households a desirable place to live. This in turn sustains the long-term survival of rural communities.

Nevertheless, many people express serious doubts about the profitability of sustainable agriculture, in terms of the costs and returns from each farming system.

It is rather difficult to draw a conclusion as to whether sustainable agriculture is economically viable. The profitability of farming may depend on which factors are taken into account, notably market and shadow prices, static and dynamic time dimensions and positive and negative externalities. However, for agricultural systems to be sustainable implies that farm investment and other input costs will yield a flow of monetary (market) and non-monetary (non-market) benefits in the long term.

Since non-monetary values, particularly the

environmental benefits, are very difficult to quantify, the most fundamental question from the economic aspect is whether the monetary benefits of sustainable agriculture are greater than the costs involved.

Table 3 shows the results of recent research in four regions of Thailand about the incremental net present benefit (NPB) or net present value (NPV) from five major sustainable agricultural systems compared with commercial farming. In general, the incremental net present benefits, estimated from the difference between incremental benefit and increment cost during the lifetime of the farming system (such as the life span of fruit trees on the farm, 10-15 years) show satisfactory results.

This confirms that these systems of sustainable agriculture are feasible in economic terms. Moreover, the externalities derived from sustainable agriculture, particularly the environmental benefits, are not taken into account in these figures. These are difficult to estimate in terms of their monetary value, but are likely to be significant, and potentially increase the net benefits from sustainable agriculture.

The environmental benefits from sustainable agriculture will tend to accumulate over time, so that they increase the net benefits to society in the long term. In contrast, if commercial farming is practiced without good management, the environmental costs will accumulate instead. Accordingly, any justification to promote sustainable agriculture should be based on a long-term perspective, rather than a short-term one.

It is therefore very important to allow both farmers and society an adjustment period when adopting a sustainable agricultural system, before calculating its net social benefit. The potential environmental benefits and costs from agricultural production are shown in Table 4.

POLICY IMPLICATIONS FOR SMALL-SCALE FARMERS

It is obvious that small-scale farmers, through sustainable agricultural systems, can play an important role in maintaining their agricultural production while preserving environmental quality at a local level. Farmers, in selecting their farming system, affect positively or negatively the status of the environment on their farms and in surrounding areas. It has already been shown that appropriate farming systems are not only profitable to farmers, but produce significant environmental benefits for society.

Major issues regarding policy recommendations for sustainable agriculture can be

Table 1. Characteristics of major sustainable agricultural systems in Thailand...

| Type of system | Major characteristics | Priority areas in Thailand |
|---------------------------|--|--|
| Integrated farming system | Economy of scope | Small farms with plentiful water (Central region) |
| Organic farming | Food safety | Areas close to niche markets (suburbs of Bangkok and other major cities) |
| Natural farming | Pest and disease control without chemicals | Remote farms far from pesticide use (Northeast region) |
| Agroforestry | Production and forest ecology | Mountainous and marginal lands (Northern and Southern regions) |
| New Theory farming | Food security | Small farms with water shortage (Northeast region) |

Table 2. Environmental impact of major sustainable agricultural systems in Thailand

| Type of system | Implication for resources and environment |
|---------------------------|--|
| Integrated farming system | <ul style="list-style-type: none"> - Waste and garbage reduction - Recycling of inputs among farm activities - Effective use of limited land |
| Organic farming | <ul style="list-style-type: none"> - Revival of soil fertility - Health impact on producers and consumers - Quality control of products and production process |
| Nature farming | <ul style="list-style-type: none"> - Natural ecological balance - Eradication of chemical residues - Complete nutrient cycle within farm |
| Agroforestry | <ul style="list-style-type: none"> - Use of soil nutrients from forest - Preservation of forestland and biodiversity - Watershed and recreational values - Solution to deforestation problem |
| New Theory farming | <ul style="list-style-type: none"> - Diversification of production and resources - Effective land and water use - Self-sufficiency and reduction of social impact |

classified into three categories: the important considerations, farmer-centered policies and public policies.

Important considerations

In case of Thailand, agricultural development policies will have to take into account at least four considerations in relation to the economic conditions of small-scale farmers and their resources. These four considerations are:

Production base

This includes an appropriate farming system, farm management, input use and the economic feasibility of the selected farming system in the real world.

Resource base

This includes natural resources and the environment, as well as the biodiversity of each location, that will affect the selection of the farming system.

Human base

This must include the spiritual outlook of farmers themselves, including their philosophy, their values, their culture, and their traditional knowledge of agriculture.

Social base

This includes the groupings, organization and social values of farmers, so that they can exchange information about how to achieve a stable and self-

sufficient society.

Farmer-centered policies for sustainable agriculture

It can be seen that the factors leading to the success of development policy in sustainable agriculture for Thai small-scale farmers are as follows:

Spiritual values of individual farmers

Farmers practicing sustainable agriculture should begin with a full understanding of what it means, and a willingness to change their way of farming, as well as their way of life, so they take a more sustainable direction. Farmers should consider themselves and their activities as part of the whole ecological system. Whatever farming system is adopted by farmers, it will definitely affect the quality of the environment in one way or another. Sustainable agriculture to maintain environmental quality thus begins in the minds of farmers, before we can go into the technical, economic and social aspects.

Organization and networking

Although each farmer may have made up his mind to adopt sustainable agriculture, this is not merely a matter of extending farm management techniques to farmers. Rather, sustainable agriculture needs a process of learning and understanding by farmers, with the support of other farmers. Exchanging experience and knowledge within farmers' groups, and then further information exchange by networking with other groups, are a great source of support for small-scale farmers, who

Table 3. Incremental net present benefit from sustainable agricultural systems in Thailand: Case studies of farms in four regions of Thailand
(Unit: US\$/ha/year)

| Farming system | Central | North | Northeast | South |
|---------------------------|---------|-------|-----------|--------|
| Integrated farming system | 20.32 | 48.34 | 35.47 | 18.46 |
| Organic farming | 14.76 | 38.98 | 15.03 | n.a. |
| Natural farming | n.a. | n.a. | 5.68 | 25.93 |
| Agroforestry | 0.53 | 9.28 | 16.91 | 505.34 |
| New Theory farming | 0.8 | 42.16 | 21.80 | 15.14 |

Note: n.a. = non-available data, 1 hectare = 6.25 rai, 1US\$ = 45 Baht
Source: Jitsanguan T. *et al.* 2000

Table 4. Potential environmental benefits and costs from agricultural production systems

| Environmental benefits | Environmental costs |
|-------------------------------|--------------------------------|
| Topsoil protection | Topsoil loss |
| Increase in soil nutrients | Soil degradation |
| Conservation of biodiversity | Surface/ground water pollution |
| Atmosphere/recreational value | Wastes and toxic substances |
| Watershed value | Forest loss |
| Positive health effects | Negative health effects |
| Eco-tourism value | Increase in pests and diseases |
| Harmony among farmers | Conflict between farmers |

on their own have limited access to information. Networking for small-scale farmers practicing sustainable agriculture can go even beyond the community or nation, to an international level.

Participation of external agencies

Not only small-scale farmers will be directly involving in sustainable agriculture and environmental conservation. Government organizations (GOs) and non-government organizations (NGOs) can also join as partners. However, farmers must be the center of policy implementation.

GOs act as facilitators and give technical support to farmers, while NGOs act as coordinators between farmers and GOs. A participatory approach to development, involving these three main groups, is the key to achieving a more effective and environmentally friendly policy in Thailand's agricultural development.

Short-term subsidies

Although the ultimate goal of sustainable agriculture is food security and the self-sufficiency of each farmer, adjusting to the process of sustainable production may take some time. At the beginning, subsidies from GOs and NGOs may be needed, including:

- Data and information;
- Research and development;
- Training;
- Construction of rural infrastructure; *and*
- Farm inputs and credit.

Leading farmers in the community

A good short-cut to extending sustainable

agriculture effectively is to identify leading farmers in each village. At least one successful farmer should be found in each community, and used as an example for other farmers. Leading farmers can help other farmers to understand both the production process and the environmental benefits, so they can feel confident about making the decision to take up sustainable agriculture.

Public policies

In addition to various farmer-centered policies, there are still a number of public policies needed to accelerate the growth rate of sustainable agriculture and to enhance environmental quality. These include the following:

Resource management

Policies are needed which focus on micro and macro levels of sustainable resource utilization, including:

- Policies to develop surface water, to provide a secure water supply at a farm level;
- Policies to promote the conservation of soil and groundwater;
- Clarification of property rights over forestland and farmland;
- Land use planning for watershed and upstream-downstream areas; *and*
- Production zoning for specific farming systems.

Economic incentives

Policies should support the sustainable agriculture sector, as the provider of various environmental benefits to society, including:

- Credit subsidies to farmers practicing sustainable agriculture;
- Tax reductions for inputs used in sustainable agriculture; *and*
- A community revolving fund to spur the growth of a sustainable agriculture network.

Research and development

These policies should emphasize the new, major role of GOs in assisting farmers to adopt sustainable agriculture, including:

- Integrated agricultural planning at a community level;
- Community capacity building for sustainable agriculture;
- Economic valuation of the environmental benefits from sustainable agriculture;
- Training in sustainable agriculture, both for college degrees and short courses;
- Participatory action research in sustainable agriculture;
- Adjust Gross Domestic Product (GDP) to take into account the environmental benefits and costs; *and*
- Research into the multifunctionality of agriculture.

CONCLUSION

Agriculture has always been the primary economic sector in Thailand, and is likely to remain so, because the country's environment is so well suited to agriculture. However, at present, the many roles played by agriculture are being seen in terms of the cash income they earn, so that the benefits of agriculture are under-estimated. The conservation of resources and the environment is a good example of a non-market benefit from agriculture that has often been ignored.

As Thailand undergoes an economic recession caused by the recent financial crisis, agriculture acts as a social safety net for the country, providing food security and employment. Thai farmers, especially the small-scale farmers who are among the poorest group, are recommended to adopt farming systems under what is called "sustainable agriculture". There is evidence that sustainable agriculture is economically viable, in terms of providing financial benefits to farmers.

Thailand has adopted the "self-sufficient economy" as a basic part of its development plan. Sustainable agriculture is well suited to this

philosophy, since environmental quality is definitely a key ingredient in the quality of life. Not only the benefits to the natural environment, but also to the social environment, of sustainable agriculture should be taken into account.

It might take some time for the people and agencies in Thai society to realize the significance of the environmental benefits from sustainable agriculture. Agricultural development policy, as the framework of resource and environmental management, as well as research and development, therefore, should promote sustainable agriculture as an alternative for farmers, especially those on small farms. Economic incentives as well as other subsidies should also be given, to help spur the growth of sustainable agriculture. Success in promoting sustainable agriculture will bring about, not only the sustainability of Thai farmers, but at the same time the sustainability of the country's resources and environment, as well as Thai society in general.

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