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Strategical Alternative in Broadening the Profile for Thailand's Sustainable Agriculture

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ABSTRACT

One of the major rationales to bring about a viable economic development and environmental protection under the broader long-term based rural development concern through agriculture of our country is via sustainable strategy. Much of the support for a strategical alternative system of farming practices has given strength and viability in the way we treat our environment and changes in the way we view our economy. This is based on a felt need for a reorientation , a need to put a human ecological face on sustainable development underpinning today's future-oriented participatory strategies. These changes and other necessary conditions in creating a positive intellectual integrated approach and cardinal measures of successful development come with a long-term policy framework conducive to promotion of adaptive research, and innovative extension educational-application forces to support the needed changes in new agriculture paradigms sufficiently consistent with established agroecological knowledge. The effect of these various factors has been substantially contributed to moving and providing the best available appropriate technologies and information for increasing productivity and efficiency in making agriculture structure desirable with activities to reduce natural environment disturbances for a broader and better environmental quality protection of the society.

Key words: sustainable development strategy, alternative farming practices, agricultural chemicals, environmental quality.

INTRODUCTION

The picture that emerges is clear to all those who deal with human ecological problems and broader views of environmental quality issues of our country. Much has been stressed on the condition and process in which rural interests are important or predominant . This is dominant to move toward lifelong growth and learning of sustainable development strategy. On one hand, the role of alternative low-input required under a broader based long-term rural development concern through agriculture in our

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society is understood . There is a growing awareness among nonfarm people that there is a large gap between reality and aspirations regarding the total use of our resources in the economy. It is becoming increasingly clear that our total national income and products might be higher if people and resources now producing some farm products were producing goods and services more highly valued by consumers.

Most past and current farm programs have manipulated market price levels and processing of farm produce so that the individual farm incomes are dependent largely upon relative output. The pressures for action are particularly in certain areas setting forth the following public expectations: (1) to bring farm incomes more in line with incomes in other occupations; (2) to make more efficient use of resources in the economy, thereby increasing total national product; (3) to reduce year-to-year variations in farm income; (4) to motivate farmers to participate in the benefits of economic growth; and (5) to make the best possible use of our limited agricultural resources, especially for a better community well-being, environmental quality, and a desirable agricultural structure. Theses pressures are greatest for innovative farm policy and decision making with effective plans, and programs to support a more sustainable agriculture development focused on strengthening the productive capabilities, appropriate attitudes, and implementing skills, as well as enhancing the resilience of individuals, communities and organizations "as instruments for human resources development" to deal with rapidly changing economic and socio-cultural circumstances. Such a policy goal reflects an emerging set of alternative farming practices as a logical and necessary component of a sustainable system of agricultural production with an underlying set of beliefs " guides that people use in striving for significance as norms that individuals follow to approximate the person they wish to be" and values "the rankings people give to various beliefs, people can have the same beliefs but different values', plus alternative visions of the future common goodness " as an intellectual social expectation and cultural norm in seeing humans as part of nature and believing that the best way to improve nature is to improve human behavior" of individuals and groups of people in agriculture. Of greater importance is the growing acceptance of the quality of soil resources, availability of water resources, integrity of biological and ecological systems apart from productivity, profitability, and quality of life that is economically viable, and socio-culturally just and humane among others in being basic essential factors for the long-run sustainability- meaning not consuming more than will grow back, not using up one's basic resources.

The Pressures for Public Action

Alternative Measures

The existence of a serious malallocation of resources in producing farm products has increasingly become a common concern facing Thailand's agriculture and environment quality problems. Therefore, on the basis of this evidence, demands have been arisen, among both farm and nonfarm people, that public action via the government must be taken to bring the existing situation closer to the desired situation. Stronger regulations on agricultural chemicals and

safety food systems, besides making agriculture more productive and efficient with more environmentally sound in such a way so as to optimizing the impact of the programs and maximize their human resources development multiplier effects, and revitalizing rural areas that will bring reality closer to aspirations are among alternative measures.

Plan of Action

In the "Policies and guidelines for the fourth National Research and Development B.E.2535-2539 (National Research Council,1991) the plan of action was formulated with a time-oriented, and integrated human resources development at all levels and among all sectors of society directed toward solving the following current major problems:

First, there has been low productivity in certain economic crops, especially, rice, corn, cassava, soybeans, mung beans, and peanuts due to the lack of soil management practices, and fertilization. **Second**, the problem of low productivity has been due to a serious malallocation of farm land without appropriate integrated resource management for crops. Crops vary in tolerance to salts. Fruits on saline soils often have inferior texture, flavor and keeping quality. Corn, soybeans, and peanuts , for example ,must be produced where, along with productive soils, they have a long growing season with ample moisture and a long, warm growing day. The soil, including its fertility and topography, is of prime importance in determining the yield and the range of crops which can be grown in a locality; soil will affect the costs per unit and hence the economy of production. Increasingly, it is becoming clear that our total national income and product might be higher if some people and farm land resources now producing rice on saline soils were producing other more highly valued produce by consumers. Whether or not crops can be grown on alkaline soils depends on the type of salts, soil physical condition, fertility, climate,amount of water, subsoil drainage, method of irrigation, depth of ground water and kind of crop. Proper choice of crops to be grown is needed to prevent or improve alkaline conditions. Shallow-rooted crops should be grown where water tables are close to the surface. Appropriate integrated resource management for sustained crop production including cultural practices as well as selection of crops in preventing alkalinity is required. Soil tests to check deficiencies are needed. The cultivation of crop on the same field without the application of improved technical knowledge results in a decrease in yields per unit area. Decrease in crop yields, correlated with the increase in cultivated area, indicates that poorer land is being brought under cultivation. This becomes even more serious because of the increasing number of farm populations with the population growth of the country. **Third** , the condition of land tenure is another major concern. Less than 20 rai of land in average per farm family is available as owner operators while a great number of farmers are being tenants. The lease is a contract in either oral or written form and outlines the understanding between tenant and landlord with an arrangement whereby the farm owner specifies that the tenant shall have rights to occupy and use the farm for a stated length of time in respect importantly to (1) how production and income will be shared, (2) the resources and expenses

which each is to furnish, (3) improving the farm through addition of certain things such as buildings, fences, drainage, terraces, etc., and (4) special provisions in the crop and livestock program, farming practices to be used, and compensation for damage to the farm or determination of the lease. Rental rates vary depending on the productivity of the land. The majority of tenant farmers operate their units with a lease extending year by year. This does not mean that all tenants with a one year lease expect to move from the farm at the end of the year. Some farms have a different tenant each year because they are small, worn out or lack productivity. Insecurity of tenure causes many undesirable farming practices in Thailand. Modern farming cannot be conducted on a short term or annual plan. The tenant is not likely to invest his money where tenure being insecure but he is placed on annual crops which can be planted and harvested within the term of the lease. Also the landlord is not apt to invest in facilities if he is not sure that he will have a tenant who will use the facilities. The small size of farms associated with the shortage of investment capital, has been bound the Thai farmers to a prevailing traditional methods of conventional pesticide-intensive systems with low farm income insufficient for improving family living. **Fourth** , one major problem is centered around the fact that shortage of viable rural institutional infrastructure for rural farm populations to defend their interest and to gain representation in enterprise development and for improving related scientific and technological skills. Even the development of cooperatives, whose original purposes to be significantly focused on helping the poor and the under-privileged, appear to be more the preserve of better-off individuals. This makes it difficult for bargaining power of farmers in buying factors of production and selling farm produce. And **fifth**, the shortage of water resources for agriculture plus the wide variation of climatic conditions brings to the fore another important problem. This problem is centered around the fact that severe drought, floods, uncontrollable outbreaks of plant pests and diseases, soil erosion, deforestation , sedimentation in streams, rivers, and other water bodies, as well as economic calamity in food production systems affecting agricultural production of the country. In addition, choice of the course of action involves delicate socio-cultural-and economic issues for which public support and commitment are necessary. These include the drag of culture and tradition; the limited suitable farm credit ; and insufficient attractive career prospects of off-farm technical development plus shortcomings of viable rural institutional infrastructure to defend interests of the rapid growth of rural populations which has resulted in shrinked farm sizes and more mounts to be fed. These combined factors become the serious problems of resource allocation rooted both in our value system and in political power structure in agriculture and the role of agriculture in our society.

Poverty of Farmer Operators

Obviously, one weak point in agriculture of the country is that the farmers have not engaged much in the active trading and marketing of their produce. The farmer has been at the mercy of the middlemen. As long as the agricultural industry does not encourage the farmer to organize efficient marketing

organizations and access to suitable support services and credit facilities, the middleman will remain an economic necessity. Intimately connected with the marketing problem is the problem of standardization, transportation, storage facilities, risk bearing, financing, selling, buying, and market intelligence as a job of collecting, interpreting, and disseminating the large variety of information and technology necessary for serving the needs of clients to the smoothly functioning of the marketing process.

The linked problems that become a common concern call for new approach and cardinal measures setting forth an intelligent designed system with effective strategies, policies, plans and programs in dealing with intensive farming management practices to meet the desired developmental changes. That is, especially, to assure that available water resources for agriculture (mainly rain and small irrigation, large dams, streams, rivers, and communal deep well) must be managed so that crop needs are satisfied, and excessive water for agriculture has to be removed through drainage or otherwise kept from inundating fields. Soil resources must not be degraded in quality through loss of soil structure- compaction,or through the buildup of salts, or toxic elements; nor can top soil depth be significantly reduced through erosion, thereby reducing water-holding capacity. The system must be economically viable, returning to producers an acceptable profit. The biological and ecological integrity of the system must be preserved through effective integrated management of plant and animal genetic resources, crop protection, nutrient cycles, and animal health security. The development of resistance to pesticides must be avoided. Social expectations and cultural norms must be satisfied, as well as the food and fibre meet needs of the population. This is the need to understand the complexity of biological systems and the importance of connectedness. We need to understand about watersheds and ecosystems, about the roles of a wide range of species and how they interact properly, and about long-term sustainability. Farmers and agricultural scientists as well as extension gents in particular are among those raising questions the growing dependence of modern farming on high inputs---non-renewable resources, the depletion of our resource base,especially, through soil erosion, and heavy reliance on chemicals-- chemical fertilizers and pesticides- synthetic insecticides and fungicides. Their widespread use with negative values to practice that detract from sustainability raises questions about human and animal health, food quality and safety, environmental quality, and the continued demise of the family farm.

Alternative Strategies

Beliefs and Values Underlying Agriculture

The underlying drive for productive approaches to promote changes in appropriate farming practices and sustainable resource management systems that arise from complex set of beliefs , values and events regarding our society, in combination produces ideas regarding agriculture that provide the basis of much of the content and style of our whole society.

Long-Term Sustainable Development

What follows is an attempt to direct toward the long-term sustainable development of our food

productivity, food safety, resource protection, quality of life and environmental quality based on philosophies as well as cardinal measures and course of action. That is to help support the scientific and educational needs of a sustainable agricultural system in bringing about the nation's or region's long-term ecological-environmental-socio-cultural and economic soundness viability staying power.

Admittedly, a sustainable agricultural development system involves substituting resources produced on-farm for purchased synthetic fertilizers and agricultural chemicals including insecticides, fungicides, and herbicides among many other mechanisms to bring about effective and efficient short- and long-term use of natural resources and people. One way as a voice for alternative agriculture in the country that farmers might be considered sustainable is if they deliberately substitute certain on-farm resources for at least some purchased synthetic fertilizers and agricultural chemicals, especially, through integrated pest management in plant protection; crop rotations, intercropping, and relay cropping to enhance soil fertility, control weeds, and maximize use of space and time; nitrogen collected from the air and made available to crops through nitrogen fixing legumes; minerals released from soil reserves and recycled; water available to crops from enhanced soil moisture retention ; varieties selected for resistance or tolerance of insects and diseases ; bunds and terraces to control soil erosion; modified planting dates; biological control techniques; management and labor provided by farm family; and livestock waste, crop residues, and green manures to enhance soil fertility among others. Those who substitute natural resources for all synthetic chemicals are commonly called organic. Those who use typical amounts of synthetic chemicals are called mainstream.

Significantly, sustainability involves many different dimensions with several elements that go beyond the use or non-use of synthetic chemicals. The distribution of farmers producing a particular commodity involves a continuum, with farmers' production practices ranging collectively from very sustainable to very unsustainable. No one can know with confidence which production practices adopted today will be sustainable over the long run. A major concern of some farm people and policy makers is that farmers who follow sustainable practices may have lower yields and profits than those who follow mainstream practices.

Public Action

Policy and decision makers, planners, implementors,and consumers are important in determining what producers do and how they do it. These groups may be interested in knowing which factors influence farmers to adopt sustainable practices, so they can promote wider adoption of the practices more effectively.

The Changing Nature of Agroclimate and Land Use

Natural Conditions and Agriculture

Thailand, situated between 5 to 21 degrees north latitude and 97 to 106 east longitude, is entirely within the Tropic and in the area of monsoon Asia.

The climate is mostly wet and dry seasons. The total average annual rainfall ranging from 1,000 to 2,000 millimeters is subject to wide variations from year to year and from place to place throughout the country. This type of climate is well adapted to agriculture. According to the 1991 "Land Utilization" statistics of the country (MOAC,1993), of 320,696,888 rai, or 51,311,500 hectares having a total population of 60 million in 76 provinces, with about 60 per cent of working populations being farm labor force, and average population density of 1.1 per son per hectare. Of the total land, farm holding land is accounted for 41.50 per cent, the rest becomes forest land accounted for 26.64 per cent, and unclassified land accounted for 31.86 per cent. Out of the farm holding land, paddy land is accounted for 52.09 per cent. The rest becomes land under field crops accounted for 25.19 per cent, fruit trees and tree crops accounted for 15.10 per cent, homestead area for 2.66 per cent, livestock farm area for 0.53 per cent, land under vegetables and flowers for 0.64 per cent, idle land for 2.72 per cent, and others 1.07 per cent.

Agroforestry

Agroforestry has long been known and continues to be practiced by Thai farm people. Traditional agroforestry systems in the country, according to FAO, (Resource Management for Upland Areas in Southeast Asia: An Information Kit 1995), appear to be characterized by a simultaneous combination of trees and crops, low-input techniques and indigenous knowledge, are found to be harmonized with local culture and traditions. Newly developed agroforestry system models, with a systematic combination of trees, crops, and livestock and usually driven by market forces, emerged in areas where cultivated land is limited, beginning during the mid-1950s. These systems introduced in Prae province, where teak plantations being intercropped with upland rice have since evolved, however, into improved systems, with crops, fruit trees and rubber trees grown in various combinations with timber trees.

A Paradigm Shift

The country's agriculture is primarily composed of small-scale and technologically backward peasant operations. Small size of farm associated with the shortage of investment capital, has bound the Thai farmers to a traditional method. Capital inputs in forms of improved farm practices, and appropriate farm machinery are still limited. Generation and utilization of multiple cropping system techniques with low-input agricultural practices appear to have much in common including a set of beliefs and values in the alternative agriculture, organic agriculture, regenerate agriculture, eco-agriculture, and agroecology among others in the production activity as an alternative to conventional cropping systems with the dominance of a rice monoculture. Such the emergence has been characterized as a paradigm shift that uses pesticides or manufactured nitrogen fertilizer at or below the recommended rates of extension service. This has added another major impetus to agricultural growth from a self-sufficing occupation into a more business organized on a scientific and commercial basis. Elements that have focused on sustainable

agriculture include the advantages of reduced reliance on purchased inputs; substitution of farm produced inputs for synthetic materials especially pesticides and fertilizers; appropriate technology; reduced consumption of variuos nonrenewable resources; greater farm efficiency; and more direct sales to processors and consumers.

Royal Agricultural Projects

Initiatives of the Sustainable Development

On 5 th May 1950, at the time of the Coronation ceremony, His Majesty the King Bhumibol Adulyadej, the King of Kings, took a significant oath with the following text, that is: "We will reign with righteousness for the benefit and happiness of the Siamese people." In fulfillment of this oath, His Majesty the King has continuously and actively initiating projects and activities with the broad objective of promoting the welfare of his people and their economic prosperity. Since a large majority of the people in the Kingdom are still engaged in agriculture sector with aspirations deeply rooted in our history stemming from a complex set of beliefs and values, plus the role of agriculture in it, this sector has naturally received his priority attention, according to FAO (1987). Approximately 2,000 projects spread over different parts and pertain to irrigation, agriculture, livestock, fisheries, forestry, and rural development throughout the Kingdom have been initiated under the auspicious of His Majesty the King based on the following main components: (1) Research and experimental projects essentially located at the Royal Palace; (2) Based on the conclusions and lessons drawn from the experimental projects, implementation of field projects in various villages and rural areas; and (3) Royal Development Study Centers aimed at integrated study, demonstration and training in different agro-ecological regions of the country. As highlighted by Dr. Sumet Tantivejkul (1996), Secretary-General of Royal Development Project Board His Majesty the King understands that it is vital to address the problems associated with growth oriented development policy and inappropriate agricultural techniques, and has strived to seek ways to respond to this predicament through a holistic approach to agricultural development. He also understands that his development programs provide a preliminary **panacea** 'or **elixir**' for farmers who urgently need aid and direction, at a time when the development measures initiated by the government are not yet in place.

Major Principles

The scope of the Royal Development Projects ranging from agricultural development, water resources development to environmental preservation has their rational as to enable farmers to become self-sufficient, and reduce their dependence on a single crop; as this is usually the cause of their woes. This involves utilizing agricultural techniques that will lead to sustainable development with the following major principles: (1) Optimizing the use of nature such as making use of watershed and utilizing nature previously unnoticed; (2) Economizing with particular emphasis on reducing production cost, but not at the expense of quality; (3) Conserving and restoring natural resources as a foundation for long-term

national development; and (4) Using sustainable development approaches in ways that are consistent with the local environment, geographical and social conditions.

His Majesty sees that one way he can introduce the above mentioned principles to the country's farmers; and convince them of the true benefits of these principles, is to establish Royal Development Study Centers across the country. Six Royal Development Study Centers have thus been set up to serve as a successful demonstration model. The purpose of these centers is to conduct research and experimentation on development methods and technology which can be disseminatedto the farmers and applied to each particular area, according to the actual conditions and nature of the problems concerned. They also provide a venue where people can go to see demonstrations of development techniques in various fields, and receive occupational training appropriate to local conditions. This includes training in handicrafts, cottage industry, and basic health care for women and children.

The New Theory

Significantly, these centers not only provide 'on-stop service' for farmers who wish to acquire knowledge of suitable agricultural development techniques, they also serve as an integrated learning center for the whole family... Since most farmers in Thailand own on average 10-15 rai (one rai= 0.16 hectares, or 0.395 acres) , His Majesty recently initiated a new concept in land management applicable to small scale farmers. This ingenious concept has been named "The New Theory". The justification of this concept is that it advocates proportional use of land to promote maximum benefit; and that it allows for a measure to provide supplementary water during the dry season. The theory has four main objectives as follows: (1) to enable farmers to achieve self-sufficiency; (2) to consolidate farmers to form cooperatives; (3) to guard farmers against dramatic price fluctuation, and to generate a more sound income base; and (4) to expand the scope of development to that of social as well as economic viability.

Information-Technology Macrosystems in Plant Protection

Planned Change

Since 1971, the Division of Plant Protection Service under the Department of Agricultural Extension Service(DOAE), Ministry of Agriculture and Cooperatives (MOAC) in line with the Hazard Substance Act of Department of Industrial Works (Hazard Substance Act B. E. 2535, 1992) has started a planned change with alternative strategies in plant protection service activities setting forth the following scope of responsibilities based on adaptive research-innovative extension-application forces as highlighted by Surarit (Sri-Arunotai 1996) : (1)Planning and manipulating plant protection extension program; (2) Adapting research results from research institutes both inside and outside country to be suitable for each local conditions; (3) Transferring plant protection technology to extension officers, farmers and other people; (4) Helping farmers control plant pests especially in case of severe outbreaks; (5) Giving

services on pest diagnosis and pesticide residue analysis in agricultural products and environment; (6) Testing bee multiplication methods and promoting beekeeping; and(7) Encouraging all regulations and Acts concerned to be in action.

Policy and Approach Attempted to Solve the Problem

Integrated Approach

An innovative policy framework with new approach for integrated pest management (IPM) system model- in the context of the associated environment and population dynamics of the pest species, utilizing all suitable techniques and methods in as compatible a manner as possible and maintaining the pest populations at levels below those causing economically unacceptable damage or loss has been developed for specific cardinal measures in plant protection service aimed at the following tasks: (1)Extensively promote farmers practice of integrated pest management; (2) Encourage safe use of pesticides and reduce their adverse effects to users, consumers and environment; (3) Promote and develop IPM technology for sub-district agricultural extension officials or other officials concerned so that they can transfer the technology to farmers'organizations, and farmers-occupational groups; (4) Enhance and support the development of fruits as well as vegetables protection and pest control for export purposes; (5) Encourage IPM technology for various intensive crop production program;(6) Extensive support and promote beekeeping aimed at increasing crop yields and bee products for national industry use and for export purposes; and (7) Develop management system on project planning implementation, technology transfer and report system.

Management Mechanism

From the long-range point of view, plant protection service has set up administrative organization (both central and regional) structures setting forth national and international cooperation programs designed in the areas so as to ensuring a continually updated supply of science-based information-technology with the means for institutionalized rapid social change and an informational servicing capability to work. Apparently, this system model brings into the picture the conceptual scheme for identifying and examining the essential features of an information macrosystem setting forth information-technology generation-flow-use strategy for planned change and for problem-solving forces through a theory-to-practice specification of activities and functions being central of the problem-solving focus dedicated to anticipating informational needs, maintaining potential agency and personal networks upon which to draw, and to actually working on community problems and generating locally felt needs for information and action in turn below:

A. Central Administration

1. Insect pest control sub-division is responsible for studying and adapting insect pest control methodology to be suitable for local conditions; drawing up insect pest control extension plans and providing the technical know-how to extension officers, farmers and other people to be able to control insect pests effectively focused on fruit fly control

with the following activities:(1) Bait spray a mixture of protein hydrolysate, chemical and water in proportion of 200 cc: 5 liters respectively: the suspension is sprayed immediately when an average of 10 fruit flies are found in a monitoring trap; (2) Sterile insect release program- a control measure has been cooperated with the Department of Agriculture (DOA) and National Office of Atomic Energy since 1985; (3) Bagging by paper bag or polyethylene bag- a control measure to protect fruit fly infestation during ripening stage of some fruits, such as guava, citrus, mango, etc.; (4) Fruit fly campaign- usually carried out during outbreak season.

2. Plant disease control subdivision is responsible for studying and adapting plant disease control methodology to be suitable for local conditions; drawing up plant disease control extension plans and providing the technical know-how to extension agents, farmers and other people to enable to control plant diseases effectively with the program launched in 1990 to eradicate the severity of virus infestation in papaya plantation in the Northeast region of the country in particular. Cross protection method using mild strains of virus is widely implemented and expected some success.

3. Weed control sub-division is focused on integrated weed control program in providing weed control techniques according to localities and expands the packages of technology to specific local farmers through research "KAP" and technology transfer efforts-- posters, slides, video and leaflets as multimedia communication for integrated weed control concepts.

4. Vertebrate and other animal pest control sub-division is setting forth the following activities in intensive rat control both pre and post harvest types.

5. Biological control sub-division is setting forth in studying and adapting conservation and augmentation methodology to be suitable for local conditions; drawing up biological control extension plans focused on the utilization of existing natural enemies and providing the technical know-how to extension agents, farmers, and other people in enabling them to control plant pests effectively. An introduction of nuclear polyhedrosis virus (NPV) started in 1980-1981 in controlling Spodoptera exigua in farmer's fields with a large trial of using NPV was conducted by DOA in collaboration with the DOAE and farmers themselves (as with many other modern farm technology generation and utilization activities being done).

6. Beekeeping sub-division is focused on beekeeping farms and other industrial insects promotion.

7. Sugarcane pest control sub-division has set up 7 sugarcane pest control centers located in various parts of the country.

8. Locust and special pest control sub-division is focused on providing the technical know-how to extension agents, farmers,and other people so as to enable them to control locusts effectively.

9. Production development and pest control of fruit and vegetable production for export as a sub-division to increase production and to encourage farmers to standardize fruit and vegetable production for both local consumption and export purposes in terms of post harvest management is based on 5 operation centers: Chiang Mai, Chacherngsao, Chantaburi, Songkla, and Bangkok.

10. Agro-pesticide monitoring and equipment development sub-division has major tasks in carrying out pesticide analysis, improvement of pesticide application techniques, service, and repair sprayers of the farmers aside from rendering services to farmers and other people for detecting pesticide residues either in regard to agricultural products or in the environment.

11. Planning and technical coordination sub-division is to serve as a technical and planning coordination center between the central and regional administration offices; compiling pest data to facilitate pest forecasting and warning to farmers; giving services on plant pest diagnosis.

12. Administration sub-division is responsible for various administrative tasks, including clerical work, financing, accounting, procuring supplies plus international coordination: Thai-German plant protection project (TG-PPP) in integrated pest management on selected fruit-trees; International Atomic Energy Agency (IAEA) in fruit-fly focused on sterile insect techniques in Thailand; Food and Agriculture Organization of the United Nations (FAO) in integrated pest control in rice. FRG-Israel Joint Fund for Agricultural Research (GIARA) in controlling chalkbrood disease of honeybee (*Apis mellifera*).

B. Regional Administration

Six regional plant protection service sub-divisions including Chiang Mai, Khon Kean, Cholburi, Chainat, Ratchaburi, and Songkhla with a total of 76 plant protection service sections throughout the country have their direct functions and responsibilities in the following tasks: (1) to carry out plant protection activities in each individual province; (2) to coordinate with concerned government agencies in the area of plant protection; (3) to disseminate technical knowledge on plant protection to extension agents, farmers, and other people; (4) to help farmers in controlling plant pests based on socio-economic, environment and security aspects; (5) to adapt research derived from various academic sources suitable for local conditions; (6) to help farmers in the survey and diagnosis of plant pests; (7) to conserve beneficials in the nature; and (8) to plan and follow up plant protection activities in coordination with District and Sub-district Agricultural Extension Officers in target areas.

Project Operation

The following projects are in operation: (1) Integrated Pest Control in rice has been implemented along with the surveillance 'a process that collects, analyses, and interprets relevant data for pest management decision making' and early warning system since 1981. All available appropriate control methods are combined to a pest management package in order to assure attainable yields by preventing crop losses by pest industry. On-going surveillance activities have been carried out and being supervised nation-wide by working group from the Plant Protection Service Division; (2) Integrated Pest Control for soybeans has been firstly implemented since 1985 by field technicians for plant protection service units in provinces of the North and Northeastern Thailand; (3) IPC in Selected Fruit Trees has been implemented since 1989 with four major fruit trees; mango, pummelo, tangerine, and durian determined for the

implementation in this orientation phase in 11 provinces under Thai-German Plant Protection Program;and (4) IPC in Vegetable Crops has become more important in the country based on the National Economic and Social Development Plan. All available control measures are being integrated to produce pesticide-free crops (Chinese cabbage; and morning glory, the convolulus family-- sweet potatoes) in particular.

CONCLUSIONS AND IMPLICATIONS

The growing recognition of sustainable development directed towards attaining a vigorous economic and healthier environment protection brings to the fore a more strategical alternative system of farming practices to solve problems of sustainability under a broader long-term rural development concern through agriculture. This requires a thorough appreciation and understanding of participatory development strategies based on a positive intellectual approach and cardinal measures with innovative policies, plans, and programs for changes in the way we treat our environment and changes in the way we view our economy. In this problem area, there appears to be based on changes for a better solution to the human ecological problem borne by a host of linked factors that reflect socio-cultural,economic, technological, geopolitical, environmental and educational concerns. These changes must be carefully managed to enable that those being affected are given strength and vitality to adjust and take advantage of every opportunity inherent in our vigorous economy and a healthy environment. This must maintain essential ecological process, biological diversity, and the life support systems for our environment in moving toward broader sustainability condition and continued change by both the agriculture industry and the consumer perspective. That is essentially to maintain soil integrity- productivity , and provide a sustainable source of income with the low-input management strategies and ability to develop and maintain an optimal level of enterprise diversification in appropriate integrated resource management for various categories that are ecologically, biologically, and socio-culturally, economically, technologically, geopolitically, environmentally, and educationally sound on a continuous basis while preserving the natural resource without degrading soil productivity or environmental quality base.

The structure and operation underpinning of the organizational context of the innovative information-technology macrosystems perspective of alternative farming practices to reduced-chemical systems in combination with intensive integrated pest management techniques are required. The high value is placed on a positive intellectual integrated approach and cardinal measures conducive to increasing the capacity of locals for making own superior management decisions to solve their own problems. Importantly, this is based on supportive development policy framework to promote information-technology generation and utilization functions. Essentially, these functions include: **innovation, validation, dissemination, information, legitimation, integration, plus an overall directing function at all points of practical concern of people via science-based adaptive**

research, effective extension educational, and application systems. As a planned change strategy and problem-solving approach , it is essential and desirable to take stock of the present and future trends with regard to demand and supply of human resources with a positive orientation towards appropriate and productive science and technology to fulfill an essential role in the building up of needed capabilities, attitudes and skills for information-technology development, testing, flow, and use as well as an overall directing innovation function to meet the demands of the continuously changing technological situation of the country.

The creation and promotion of a suitable environment for nurturing technological human resources constitute a prerequisite for scientific and technological development responsive to the requirements. What is of major important is that a continuing supply of updated and locally validated information-technology to meet the increasing need for specialty information-technology of people in our changing society as a necessary condition is conducive to developments of the variety and timeliness of new information-technology within the established agroecological knowledge. However it is more realistic to assume that low-input requirements of low-input agriculture practices under the institutional support structure for supplying inputs other than information on behalf of information users in sustainable agriculture movement must collectively mobilize and link all essential functions to reduced agricultural chemicals. That is to reduce environmental damage also to cut production expenses with oriented safety food systems, making alternative agriculture more productive and efficient plus strengthening the productive capabilities, appropriate attitudes, and implementing skills in making more environmentally sound, enhancing the resilience of individuals, communities, and organizations of farm people to deal with rapidly changing economic and social circumstances, conserving resources, protecting the natural environment quality , and revitalizing rural areas under the established symbiotic relationships between the structure of agriculture, 'family farming system', and quality of rural life in particular.

Operationally, it is necessary that all levels and all sectors of the society must be involved in the process and condition of fitting new ideas, information-technology or innovations (new ideas and practices) into user social systems. Certainly within agriculture, ability to relate a variety of resources and conditions of facilitating the resource system to facilitate appropriate cultural practices and biological relationships in reducing the use of synthetically compounded fertilizers, most pesticides to control pests, as well as growth regulators, and livestock feed additives for the agriculture industry in harmony with sustainable development plus a favorable environment to provide increased quantities and qualities of farm products without a substantial increase in the real resources used has been a major factor in the development strategy and program as a significant end.

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