

# FEASIBILITY OF AN AREA-WIDE PEST MANAGEMENT PROGRAM OF KEY INSECT PESTS IN THAILAND\*

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## ABSTRACT

Based on the area-wide approach (AWA) of pest management, several insect pests and pest complexes could be identified for such a program in Thailand. In addition to rice, the major economic crop of the country, there are several insect pests and pest complexes associated with field crops, vegetable crops, plantation crops and fruit trees including some invasive alien species, insects, weeds and snails, which are also amenable. However, the feasibility is to be determined on the suitability of the target pests, implementing agencies responsible, availability of specific area-wide pest management technologies, interest and socioeconomic condition of the farmers involved. This paper presents the general scenario on the feasibility of an area-wide pest management program of key insect pests on selected economic crops in Thailand.

**Key Words:** area-wide pest management, feasibility, Thailand

## Introduction

No matter how the country is attempting to industrialize itself with all available and possible efforts, Thailand's economy is strictly agriculture-based and will remain dominantly an agricultural country. In being more than self-sufficient in food, Thailand produces a number of agricultural commodities flooding its domestic markets causing a wide range of price fluctuation with surplus for export to the world markets in almost all continents. Agricultural production systems in Thailand are also highly diversified ranging from subsistent farming through traditional farming practices adopting technology packages of seed of high yielding varieties and agrochemicals consisting of fertilizers and pesticides which are typical of the so-called "*green revolution*" to the recently

acclaimed “*organic farming*” in coexistence with an adoption of biotech or genetically modified (GMI) crops of the so-called “*gene revolution*”. With no exception to any agricultural production system and no matter how marginal, intensive or extensive, or highly technical these systems could be, they can never escape or are free from being attacked by the age-old, customary and classical agricultural pests consisting mainly of insect pests, diseases and weeds.

To alleviate pest problems in agriculture, several pest management tactics and strategies have been invented, employed and integrated into the “*integrated pest management – IPM*” system resulting in successes and failures, economic loss and gain as well as desirable and undesirable impacts to the environment. An area-wide pest management program is among one of the said pest management strategies which could be incorporated into the on-going or existing IPM systems designed for any specific pest in which the area-wide approach (AWA) for the suppression and control is practical and applicable.

As defined by Lindquist (2000), an area-wide insect control program is “a long-term planned campaign against a pest insect population in a relatively large predefined area with the objective of reducing the insect population to a non-economic status.” Other non-insect agricultural pests such as weeds, plant diseases, nematodes, rats, birds, etc. are also susceptible to the area-wide concept. It is applied against an important insect pest over a relatively large area involving many individual producers of the same or similar crops. The “area” is a combination of geography and the range of hosts of the target insect pest, and the term “area” in “area-wide” refers to the area where the target insect population survives. The “area” which could be included for consideration also is the “area” defined as “an official defined country, part of a country or all or parts of several countries” by FAO (2002) based on the World Trade Organization (WTO) Agreement on the Application of Sanitary and Phytosanitary Measures in IPPC/FAO International Standards for Phytosanitary Measures (ISPM) No. 5 – Glossary of Phytosanitary Terms. In most cases, an area-wide pest management will be the responsibility of a separate or specific organization. Its program normally uses specialized methods of pest control that are not effective or are not used on a farm by farm or individual farm basis. Some of these specialized techniques are the use of sterile insect technique (SIT), male annihilation, natural enemies (parasites or parasitoids and predators), trap crops, host plant resistance, mating inhibitors, pesticides, and physical, chemical, biological and legal or regulatory control methods. Awareness has to be raised such that all of these specialized or specific control methods employed in the area-wide pest

management program must be environmentally sound and acceptable over the entire area.

The objective of this country paper is to provide a scenario of the current status on the feasibility of an area-wide pest management program of key insect pests and insect pest complexes on various economic crops in Thailand.

### **Selected Key or Target Insect Pests in Thailand**

The basis for identifying and selecting key or target insect pests to determine if they are feasible and amenable to an area-wide approach (AWA) could be on the basis of economic crops and/or the unique extent and nature of damage inflicted by specific insect pests over an area. Table 1 shows possible target insect pests or pest complexes which could be considered for an area-wide pest management programs in Thailand.

**Table 1. Some key or target insect pests amenable to an area-wide pest management programs.**

<b>Crops</b>	<b>Insect pest species</b>
<b>Rice</b>	Rice stem borer complex consisting of <i>Chilo polychrysus</i> , <i>Chilo suppressalis</i> , <i>Scirpophaga incertulas</i> and <i>Sesamia inferens</i> Leafhopper complex and brown planthopper consisting of <i>Nephotetix nigropictus</i> , <i>N. virescens</i> , <i>Nilaparvata lugens</i> , etc.
<b>Field crops:</b>	
Corn	Asiatic corn stalk borer, <i>Ostrinia furnacalis</i> Bombay locust, <i>Patanga succincta</i>
Cotton	Cotton bollworm, <i>Helicoverpa armigera</i> Cotton leafhopper, <i>Amrasca biguttul</i> Cotton whitefly, <i>Bemisia tabaci</i> (Asia) (De Barro <u>et al.</u> 2005)
<b>Vegetable crops:</b>	

Crucifers	Diamondback moth, <i>Plutella xylostella</i>
Cucurbits	Melon fly, <i>Bactrocera cucurbitae</i>
<b>Plantation crops:</b>	
Banana	Banana skipper, <i>Pelopidas thrax</i>
Coconut and oil palm	Coconut rhinoceros beetle, <i>Oryctes rhinoceros</i> Coconut weevil, <i>Rhychophorus ferrugineus</i>
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Sugarcane	Sugarcane stalk borer complex consisting of <i>Chilo infuscatellus</i> , <i>C. sacchariphagus</i> , <i>C. tumidicostallis</i> , <i>Scirpophaga excerptalis</i> and <i>Sesamia inferens</i> Sugarcane whitefly complex consisting of <i>Aleurolobus barodensis</i> and <i>Neomaskellia bergii</i>
<b>Fruit trees:</b>	
All fruit crops susceptible to fruit fly infestation	Oriental fruit fly, <i>Bactrocera dorsalis</i>

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**Invasive Alien Species Conducive to AWA**

Some alien invasive species (IAS) of long introduction and of recent entry into the country (Napompeth 1990a, 1990b, 2004), insect pests, aquatic and terrestrial weeds and snails are also feasible and amenable to an area-wide management program. The more important such IAS is given in Table 2.

**Table 2. Some invasive alien species (IAS) conducive to an area-wide management program in Thailand.**

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<b>Invasive Alien Species</b>	<b>Probable Origin and Year of Introduction/Invasion</b>
<b>Insects:</b>	
<i>Aleurodicus dispersus</i> (Homoptera: Aleyrodidae) Spiraling whitefly	Central America; 1980s

<i>Brontispa longissima</i> (Coleoptera: Hispididae) Coconut leafminer, hispid	Indonesia via Vietnam; 2002
<i>Gynaikothrips ficorum</i> (Thysanoptera: Phlaeothripidae) Cuban laurel thrips	Cuba; 1960s
<i>Heteropsylla cubana</i> (Homoptera: psyllidae) Leucaena psyllid	<i>L. trifolii</i> (Diptera: Agromyzidae) Central America; September 1986
<i>Liriomyza huidobrensis</i> <i>L. sativae</i> <i>L. strigata</i> <i>L. trifolii</i> (Diptera: Agromyzidae)	Europe, 1980s
<i>Pectinophora gossypiella</i> (Lepidoptera: Gelechiidae) Cotton pink bollworm	Australia; not known
<i>Plutella xylostella</i> (Lepidoptera: Yponomeutidae) Diamondback moth	Southeastern Europe? South Africa? not known
<b>Weeds:</b> <i>Ageratina adenophorum</i> (Asteraceae) Crofton weed, Pamakani	Central America via China; not known
<i>Alternanthera philoxeroides</i> (Amaranthaceae) Alligator weed	Central and South America; not known
<i>Chromolaena odorata</i> (Asteraceae) Siam weed	Central America via Singapore; 1940s
<i>Eichhornia crassipes</i> (Pontederiaceae) Water hyacinth	Central and South America via Indonesia; 1901
<i>Mimosa pigra</i> (Mimosaceae) Giant sensitive plant	Central and South America via Australia and Indonesia; 1950s

<i>Salvinia molesta</i> (Salviniaceae) Giant water fern	South America via Malaysia; 2000
<b>Snails:</b>	
<i>Achatina fulica</i> Achatinidae Giant African snail	Africa via Malaysia; 1937
<i>Pomacea canaliculata</i> Viviparidae Golden apple snail	Argentina via Taiwan; 1980s

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### **Competent Plant Protection-related Organizations in Thailand**

Plant protection-related organizations in Thailand could be grouped into four categories, namely, universities and academic institutions, research organizations, government agencies, and private organizations such as professional associations or societies including pesticide dealers associations and farmers associations. To a large extent they all are basic components in the formulation of any area-wide pest management program.

These plant protection-related organizations and their possible roles and specific competence in the formulation of an area-wide pest management program are summarized in Table 3.

**Table 3. Plant protection-related organizations and their possible role in an area-wide pest management program in Thailand**

<b>Organizations</b>	<b>Role and function</b>
<b>Universities and Academic Institutions:</b>	
Department of Entomology Kasetsart University (KU) Bangkok and Nakhon Pathom	Teaching, research and extension in entomology and plant protection
Department of Entomology Chiang Mai University (CMU) Chiang Mai	-do-
Department of Plant Protection Mae Jo University (MU)	-do-

Chiang Mai	
Department of Entomology	-do-
Khon Kaen University (KKU)	
Khon Kaen	
Department of Pest Management	Teaching, research and extension
Prince of Songkla University (PSU)	in pest management
Hat Yai, Songkhla	
<b>Research Organizations:</b>	
National Biological Control Research	Research and development,
Center (NBCRC)	extension and implementation in
Kasetsart University and its regional	biological control of insect pests
centers	and weeds and insects of medical
at Kasetsart University, Mae Jo University,	and public health importance
Naresuan University, Khon Kaen	
University, Ubon Ratchathani University	
and Prince of	
Songkla University	
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<b>Government Agencies:</b>	
Institute of Plant Protection	Research in entomology and plant
Department of Agriculture (DOA),	protection; competent authority of
Bangkok	Plant Quarantine Act and IPPC's
	National Plant Protection
	Organization (NPPO)
Plant Protection Division Department of	Implementation of plant protection
Agricultural Extension (DOAE),	activities nationwide
Bangkok	
Office of Atom for Peace (OAP) (Fo	Research in radiation entomology
Ministry of Science and Technology	and SIT facilities
Bangkok	
<b>Private Organizations:</b>	
Pesticide dealers associations	Plant protection issues of various
Farmers associations and cooperatives	aspects ranging from plant
Professional societies	protection recommendations, plant
Etc.	protection
	training and pesticide supplies, etc.
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## Area-wide Pest Management Technology

To meet an objective and to achieve a substantial success in an area-wide approach to insect pest control there is a necessity that the required specific technology be met in order to implement, maintain and sustain the programs at least during the life of the project or until a satisfactory degree of control has been cost-effectively achieved.

Lindquist (2000) cautioned that specific technology for use in area-wide control or management program is limited and depends to a large extent on advanced technology, such as satellite imagery, weather forecasting, very early detection of resistance, very sensitive trapping/detection methods, genetic manipulations to improve parasites and insects used in SIT programs, etc. which are opposed to what the individual producer uses for a conventional insect control. In the area-wide control it must also integrate conventional and special technologies into a program that attacks the pest population within the target area.

In Thailand, SIT facilities are available and the program made possible by the Office of Atom for Peace (OAP) (formerly Office of Atomic Energy for Peace – OAEP). The National Biological Control Research Center (NBCRC) at Kasetsart University and its regional center located at all key agro-geographical areas of the country in addition to Bangkok, in Nakhon Pathom, Chiang Mai, Phitsanulok, Khon Kaen, Ubon Ratchathani and Hat Yai, Songkhla are responsible and mandated to implement any biological control of insect pests and weeds of economic importance. Department of Agricultural Extension (DOAE) with its plant protection Division and regional as well as district and provincial plant protection offices are mandatory to help assist farmers to combat insect and other plant pests. However, in case of DOAE most insect control or management is conventional and could be mobilized in collaboration with other existing technology providers to implement an area-wide insect pest management program. An example of which was the SIT program against the oriental fly, *Bactrocera dorsalis* (Diptera: Tephritidae) covering an area of 38 sq. km. in Pak Chong District of Nakhon Ratchasima organized by OAP and DOAE (Kaewchoung et al. 2000).

Use of natural enemies including insect parasites or parasitoids and insect predators as well as some insect pathogens in an area-wide pest management program is made possible and practicable by NBCRC, Kasetsart University and its regional centers as well as its collaborative networking with other government agencies such as DOA and DOAE for agricultural insect pests in general; Department of Livestock Development (DOLD) for livestock

pests; Royal Irrigation Department (RID) and Department of Fisheries(DOF) on aquatic weeds; and Department of Medical Science (DOMS) and Department of Disease Control (DODC), Ministry of Public Health (MOPH) for insects of medical and public health importance.

R&D on other specific technologies which could be employed in the implementation of an area-wide pest management program is not unique to any particular research or plant protection organization or agency and is still highly limited. Use of host plant resistance is specific to the target crops and may or may not be available and relatively stable. The use of insecticides and other agrochemicals is relatively easy and common while the use of semiochemicals such as pheromones, attractants and repellents is not easily available. Development of transgenic or genetically modified (GM) crops is also limited and largely depends on private and commercial transnational companies and is still beyond the reach of the relatively small and poor farmers, in addition to currently being controversial and is opposed by the non- government pressure groups.

## **Conclusion**

In most insect pest management programs, the conventional strategies and tactics available are mainly suitable for individual farmers, small to large farmers, whether they will be used as a single component or as an integrated pest management strategy. Any or all such strategies could be integrated into an area-wide pest management system but with a different approach and operational procedure. For certain and many target insect pests, specific technologies are also required but whether they are readily available for long-term use or not could determine the success of the program.

As far as Thailand is concerned, there are several target insect pests which are conducive to an area-wide pest management approach. Each target insect pests or pest complex is characteristic in itself and an area-wide pest management program for each of them must be specifically designed taking into consideration the availability of resources required, human, capacity, technology and implementation authority. In addition the government policy, interest of the farmers and long-term input, effort and commitment are essential. Above all the socioeconomic conditions of the farmers involved will also be the key to the success of the programs be it conventional pest management programs or area-wide pest management program.

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