MILLENNIUM DEVELOPMENT GOALS AND NEW PARADIGMS FOR PLANT PROTECTION

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INTRODUCTION

In tropical Asia today, pest management is still strongly influenced by the agrochemical era of the 1960s and 1970s (Rossiter 1975). The herbivore model is still dominating research agendas and the prevention of damage and yield loss are still the only goals of plant protection interventions. Green Revolution rice intensification programs in the Philippines and Indonesia had prophylactic insecticide applications "packaged" as necessary requirements (Alix 1978, Adjid 1983) and farmers were encouraged to use insecticides at regular intervals through intensive promotions, subsidy and loan schemes (Conway and Barbier 1990). Indeed farmers who use pesticides are often deemed more "modern" than those who do not (Kenmore et al 1987). Today, prophylactic pesticide applications are the norm in most cases as farmers view pesticides as "medicines" necessary to achieve high yields. On-farm research in many Asian countries showed that a large proportion of the insecticide and fungicide applications used by rice farmers are unnecessary, had questionable efficacies and often do not result in any economic return (Heong and Escalada 1997b). In fact many of the insecticide sprays, especially in the early season, could have detrimental effects on ecological balance causing secondary pest problems, like the brown plant hopper (Way and Heong 1994, Heong and Schoenly 1998). In addition, the pesticides used can cause health problems to farmers (Rola and Pingali 1993). As evidences of environmental and health effects become more apparent, new paradigms in plant protection are emerging as scientific thinking changes, shifting towards more ecological and sociological aspects of plant protection (Heong 1996). The role of naturally occurring biological control had not received sufficient attention and most herbivores in crops had been treated as unwanted pests. A shift to the contention that pesticides are not needed rather than they are, and that "pests" should now be critically re-assessed and proven guilty before pesticide use is contemplated (Way and Heong 1994), can help focus new research efforts on ecological and sociological issues which form the foundations of good plant protection practices.

Environmental and health concerns related to pesticide use prompted development agencies to adopt integrated pest management (IPM) to be the principle plant protection strategy. IPM, which combines biological control, host plant resistance and farm practices with minimal use of pesticides, is an environmentally friendly approach to plant protection. For instance the World Bank in 1998 institutionalize the Operational Policy (OP4.09) as the official pest management policy. The Bank will only finance pesticides as a last resort, prohibits the use of WHO category I pesticides and only allow WHO II pesticides when conditions to use them safely are available. In the Rio Convention 1992, IPM was adopted as the best option for the future, with well defined targets and dates. However, by the 2002 World Summit on Sustainable Development (Rio +10) in Johannesburg, most of these targets had not been reached. Many national agricultural programs may have formally adopted IPM but in most cases, pesticide policies remain weak and poorly implemented. Farmers' pest management decisions have improved in some cases, but for most relatively little, which led Morse and Buhler (1997) to suggest that the people at the center of IPM are not farmers, but IPM scientists and implementers, raising the question: whose agenda is IPM serving? IPM seems to reflect the "ideal" way to manage pest problems designed by non-farmers.

At the start of the new millennium, the UN General Assembly adopted the Millennium Declaration in September 2000 to pave a way for development agencies to address issues of poverty eradication and sustainable development again through a set of targets and dates. The Millennium Development Goals (MDGs) are shown in Table 1. In this paper I shall discuss the MDGs where plant protection may be relevant and paradigms shifts that might facilitate research and development of plant protection sciences towards these goals.

THE MILLENNIUM DEVELOPMENT GOALS AND ROLES OF PLANT PROTECTION

The two MDGs where plant protection activities will be expected to play significant roles are Goal 1: Eradicate extreme poverty and hunger and Goal 7: Ensure environmental sustainability. Poor people, especially those living in marginal environments and in areas with low agricultural productivity, depends on locally grown food to support their livelihoods. These marginal areas may also be ecologically unstable and tend to be susceptible to sudden pest and disease outbreaks. Although these outbreak events are often sporadic and might affect relatively few people, the families affected might go into extreme poverty and hunger because their crops are destroyed. Most farmers living in these marginal lands are often too poor to buy pesticides and their options might be crop diversification and strategies that minimize pest outbreaks.

DEALING WITH PEST OUTBREAKS - MASS SPRAYING MAY NOT BE APPROPRIATE

The "fire brigade" approach to implement sponsored mass pesticide spraying (often using aerial applications) or distributing pesticides to farmers for them to spray had been commonly used in the 1970s (Traintafillou 2001). Today, this approach is considered an extremely poor option because it does more harm to the environment and lacks sustainability (Conway 1997). Often the outbreaks occur in small patches and mass spraying regimes, not only have low efficacy to pests instead have vast effects on non- target organisms. Usually by the time mass sprayings are organized after outbreaks are detected, pest populations might be on the decline and the sprays become more detrimental to the naturally occurring biological control. Free pesticide distributions are also poor strategic options because in many cases, farmers might not even have sprayers or know how to use them. In addition, such organized actions tend to increase farmers' dependency on pesticide handouts making them vulnerable to pesticide abuse. For instance in Laos, although rice farmers' pesticide use is still low a study showed that they have similar attitudes and behavioral responses to pests as farmers in Vietnam and Philippines and can potentially become victims of misuse (Heong et al. 2002). Current low usage in Laos as well as Myanmar is due mainly to farmers' lack of access to pesticides and cash to buy them.

DEVELOPING SUSTAINABLE STRATEGIES - IMPORTANCE OF UNDERSTANDING ECOLOGY AND BIODIVERSITY

To develop sustainable strategies to minimize pest outbreaks would require better ecological understanding of biodiversity and natural enemy conservation, both at the local and landscape levels. The goal is to manipulate agroecosystems so that they hold pests below economic levels and to avoid disruption of the natural conttol

[1] Malaysian Plant Protection Society.

[2] Operational Policy 4.09. Pest Management. World Bank, Washington, DC. 1998

Table 1: The Millennium Development Goals and Targets

Goal 1 - Eradicate Extreme Poverty and Hunger
Targets: Halve, between 1990 and 2015, the proportion of people whose income is less than $1 a day; Halve, between 1990 and 2015, the proportion of people who suffer from hunger.

Goal 2 - Achieve Universal Primary Education
Targets: Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling.

Goal 3 - Promote Gender Equality and Empower Women
Targets: Eliminate gender disparity in primary and secondary education preferably by 2005 and in all levels of education no later than 2015.

Goal 4 - Reduce Child Mortality
Targets: Reduce, by two-thirds, between 1990 and 2015, the under-five mortality rate.

Goal 5 - Improve Maternal Health
Targets: Reduce by three-quarters, between 1990 and 2015, the maternal mortality ratio.

Goal 6 - Combat HIV/AIDS, Malaria and Other Diseases
Targets: Have halted by 2015 and begun to reverse the spread of HIV/AIDS; Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases.

Goal 7 - Ensure Environmental Sustainability
Targets: Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources; Halve, by 2015, the proportion of people without sustainable access to safe drinking water; Halve achieved, by 2020, a significant improvement in the lives of at least 100 million slum dwellers.

Goal 8 - Develop a Global Partnership for Development
Targets: Develop further an open, rule-based, predictable, nondiscriminatory trading and financial system (includes a commitment to good governance, development and poverty reduction - both nationally and internationally); Address the special needs of the least developed countries (including tariff- and quota-free access for exports, enhanced program of debts relief for and cancellation of official bilateral debt, and more generous ODA for countries committed to poverty reduction; Address the special needs of landlocked countries and small island developing states (through the Program of Action for the Sustainable Development of Small Island Developing States and 22nd General Assembly provisions); deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term; In cooperation with developing countries, develop and implement strategies for decent and productive work for youth; In cooperation with pharmaceutical companies, provide access to affordable essential drugs in developing countries; In cooperation with the private sector, make available the benefits of new technologies, especially information and communication technologies.

mechanisms. Unfortunately such research often lack support in many agricultural research institutes, universities and funding agencies. One reason is because such research produces only intermediate goals and thus lack "impact" that donors seek. Another is because such research quite often is long term and with project circles of 3 to 5 years, one can hardly design meaningful research. Thirdly, is because ecological research lacks the present day's appeals as in biotechnology and modeling. Most crop pest management research focuses on the flora, fauna and ecological processes within the crop habitats. In most cases, special attention is paid to herbivores and often concerned only with single herbivore species or groups. While this kind of research has made important contributions to understanding of individual pest dynamics, it has also biased many plant protection judgments. Pest management strategies thus tended to become pest-centered rather than ecosystem-orientated. Smith and van den Bosch (1967) stressed the importance of the ecosystem approach in development integrated pest management strategies, but rarely do research and implementation pay attention to interactions between habitats and their diversity.

In their review of the role of biodiversity in the management of pests in rice ecosystems, Way and Heong (1994) pointed out the unique natural stability in tropical rice ecosystems. Each habitat can be recognized ecologically as a patch, with most of its insects moving and concentrating on the patches for development. Within a climatically stable environment, we can envisage a within crop community of parasitoids and generalists predators complementing each other's action on different stages of pest herbivores at different times (Murdoch 1990). Switching of predation to detritivores, casual species and other predators including their own species (Heong et al 1990) may be a vital attribute of regulation. Bunds in rice fields may be important refugia for early arriving predators incapable of long distance movement, such as spiders, crickets, beetles and ants. Grassy habitats dominated by *Bracharia mutica*, for instance are homes of two important gryllid egg predators, *Anaxipha longipennis* and *Metioche vittalicollis* (Yu 1995). Many of these arthropod rich non-crop habitats may be vital to minimizing outbreaks but have received insufficient research attention.

REDUCING UNNECESSARY USE OF PESTICIDES - NEED FOR NEW COMMUNICATION TOOLS AND STRATEGIES

Peasant farmers' pesticide decisions are often based on their perceptions and in many cases applied unnecessarily at the wrong targets at the wrong time and using the wrong chemicals. A study in the Philippines showed that about 80% of rice farmers' insecticide sprays were deemed unnecessary (Heong et al., 1995) and this trend is common among Asian rice farmers (Heong and Escalada, 1997b). Farmers who grow both rice and vegetables had higher pesticide misuse in vegetables than in rice (Heong et al 1997) and for fruit borer control in eggplants, unnecessary spraying is common (Talekar pers comm. 2003). Such pesticide misuses are often due to farmers' biased responses to perceived prospects of incurring loss - a loss aversion behavior. According to Prospect Theory (Tversky and Kahnemann 1992) "losses loom larger than gains" is basic to human's choices thus entrenching farmers' aversion to loss attitudes and favoring pesticide use. Rice farmers generally overestimate potential losses by more than 10-fold (Heong and Escalada, 1999). Since most farmers use "heuristics" or decision rules when making spray decisions, strategies to modify their current heuristics will improve decisions and thus reduce pesticide use. We can do this through training, like the farmer field school (FFS) approach (Matteson, 2000) or through non face-to-face methods like the use of media (Heong et al 1998). Both approaches have been shown to reduce farmers' unnecessary pesticide usage. The FFS approach is intensive and requires higher financial resources to implement, while the use of media through an entertainment-education (EE) strategy, is less costly. In Vietnam, the media approach helped reduced rice farmers' insecticide use by 53% and had spread to the whole of the Mekong

[3] "Normal science" means research based upon one or more past scientific achievements, achievements that some particular scientific community acknowledges for a time as supplying the foundations of its practice (Khun 1970).

Delta reaching 2 million farmers in just three years after the launch (Huan at al 1999). The media approach used in Sing Buri province, Thailand reduced farmers' insecticide use by 22% and a similar program, launched in Hanoi recently is expected to reduce insecticide use by 30%. This approach is now being used to reduce insecticide use among eggplant growers in South Asia (Talekar, pers com 2003).

BROADENING PLANT PROTECTION SCIENCES - NEED FOR ACROSS DISCIPLINE INTEGRATION

Traditionally, plant protection is composed mainly of biological sciences, such as entomology, zoology, plant pathology, nematology and weed science. In each of these fields, experts are usually highly specialized, some to the extent of being an expert on a particular insect or pathogen. Control methods designed by experts thus tend to focus on managing populations or infestations of single species, either through developing host plant resistance in the crop, using biological control agents, cultural techniques and chemicals. An integrated control would usually means a combination of two or more of these techniques. Often pest management methods developed are "stand alones" with little reference or relevance to other farming practices and social needs. Biological understanding of the pest organisms is essential for developing sustainable strategies. However, biological elements alone may not be sufficient for developing plant protection strategies that are economical, practical, socially acceptable, sustainable and can readily adopted.

Science is a permanent revolution, those who remain in the realms of "normal science" are sometimes "prisoners" caught in prevailing paradigms (Popper 1970) or locked-in to particular paths (Perkins 1982). Peasant farmers' plant protection practices have changed little in the last four decades and to meet the challenges of improving their decision making and practices, a venture to seek across discipline integration seem necessary. The history of science shows that integration across disciplines is a critical ingredient of scientific progress (Cohen 1985).

An emerging field that can provide rich opportunities for research application in plant protection is decision sciences (Kleindorfer et al. 1993, Gigerenzer et al. 1999) that are concerned with understanding and improving decision-making. Literature on agricultural decision-making (example Raiffa 1970, Halter and Dean 1971, Anderson et al. 1977) had focused on the perspective aspects. More recently evidence has shown that these prescriptive models are unable to account for how people actually make decisions (Slovic et al 1977, Simon 1978). Anomalies have become norms because decision-making is behavioral in nature (Rabin and Thaler 2001) and psychology can contribute to research in understanding the factors of farmers' choices and judgments. Festinger's (1957) theory of cognitive dissonance had been successfully applied to motivate changes in farmers' beliefs and practices in early season insecticide spraying (Heong and Escalada 1997a). Kahneman and Tversky's (1973) heuristics concept also provides a framework for us to examine biases in current decisions and explore for ways for intervention. To obtain a broader picture of farmers' decision situations, the pest belief model and Ajzen's (1988) Theory of Reasoned Action (TRA) provide the theory and constructs to quantify farmers' decisions. More recently Ajzen (1991) introduced the Theory of Planned Behavior (TpB) that provides further predictability and explanations to decision making.

Face-to-face training and participatory programs have been successfully employed to change farmers' perceptions and practices in plant protection (examples Matteson 2000) but these approaches are often slow and expensive (Quizon et al 2001). With the millions of peasant farmers still to reach, the current low extension-farmer ratios and declining investments (both domestic and international) in agricultural research and development, it is difficult to expect face-to-face training alone to reach and benefit the millions of farmers in the near future. Yet a large amount of research results remains "locked-in" within research systems, publications and reports unavailable for use by farmers. There is rich opportunity for plant protection R and D to focus on "distilling" the volumes of existing information into usable entities that can be communicated. More merit needs to be given to such efforts instead of just focusing on getting more original works that might remain unused. Here integration with communication sciences can yield useful results as discussed earlier (Heong et al 1998). There are lots of opportunities for developing scaling up and out strategies (Snapp and Heong 2003) through communication sciences so as to reach and benefit millions efficiently.

FACILITATING INTERDISCIPLINARY PARTNERSHIPS - QUALITY AND SUSTAINABLE PARTNERSHIPS

MDG # 8 is to develop a ĝlobal partnership for development and it focuses on the means of achieving the first seven goals. In the spirit of this goal, various stakeholders need to work together to address shared objectives and fostering ownerships at the macro (national), meso (district) and the local levels. This can be achieved through participatory research and planning processes designed and managed to ensure equitable participation with good governance (Norton et al. 1999, Martin and Sutherland 2003, Snapp and Heong 2003). Establishing quality partnerships between a wider range of stakeholders will be necessary to accelerate the communication of plant protection information to end users. The stakeholders might include people in research, extension, central and local government bureaucracies, NGOs, village groups and farmer groups. An important goal is to develop jointly shared objectives through establishing a common understanding of the problem, needs and interventions.

CONCLUDING REMARKS

Plant protection history dates back to the beginnings of agriculture. Even in the BC years, various forms of pesticides have been used for plant protection, like botanicals, sulphur, mercury and arsenic compounds. Cultural methods such as manipulating growing dates have been recorded in the 1500 BC and manipulating natural enemies in biological control date back more than 1000 years, like the use of predatory ants in China. Genetic resistance is also one of the oldest methods used (Panda and Khush 1995). A fundamental change in agriculture during the late 19th century led to rapid growth from subsistence way of life to mechanization and commercialization. Since pests were seen as limiting factors to agricultural efficiency, the importance of their control increased which had major impact on attitudes to plant protection. The standard of acceptable levels of pest damages reduced and the need to reduce yield loss became a prime consideration. This provided the ideal opportunities for chemical pesticides that were reliable at relatively low costs and the golden age of pesticide research began (Casida and Quistad 1998) and farmers entered the "pesticide treadmill" and became virtually impossible to try other alternatives (Clunies-Ross and Hildyard 1992). Many farmers developed faith in and addiction to the chemical technology that continue to dominate plant protection today.

Rachel Carson's publication in 1962 of "Silent Springs" brought about public awareness of plant protection practices. The growing concerns in environment and health, combined with the advocates of integrated pest control, provided funding and attention to the development of alternatives and environmentally friendly approaches. In Asia, the IPM philosophy began penetrating into the academe, research, extension and policy domains from the 1980s, but farmers' practices had changed relatively little. With dauntingly high populations of farmers IPM has still to reach, there is need to re visit current strategies and develop new approaches. The development of plant protection solutions has concentrated in the biological and physical sciences. Perhaps in the new millennium, there is need to develop integration with sociological sciences where plant protection education incorporates salient principles of the two sets of sciences. The contention that pesticides are last resort should be strongly emphasized to adopt the paradigm that pesticides are not needed and should only be contemplated when the target pest is "proven guilty" and there is not other option. "Use Pesticides Last" should be the new slogan. Maximizing naturally occurring biological control should remain the basic element and efforts to increase and conserve their functions should be strongly emphasized. Natural biological control is like the human body's immune system that protects us from diseases. A strong immune system means good health and similarly strong natural biological control means good plant protection. In order for us to develop innovative methods to strengthen the immune systems in crops, fundamental knowledge of ecology is necessary. Plant protection sciences in the new millennium will need to be based on ecological principles, particularly population ecology of pest species and landscape ecology to provide the basis for sustainable pest management designs and practices.

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MAPPS EXCELLENCE AWARD 2003

MAPPS EXCELLENCE AWARD 2003

In line with the vision to be the premier society that promotes and advances the science and practice of plant protection, the Society launched the MAPPS Excellence Award for Plant Protection in the Tropics in 2002 to recognise individuals who have made outstanding contributions to plant protection in the tropics. The Award carries a cash prize of RM10,000 and a certificate. In addition, the recipient will be given the honour to present a guest lecture at a special function to commemorate the presentation of the Award. The Award is open to Malaysians pursuing an area of study pertinent to tropical plant protection, and who:

✓ have made a major contribution to scientific knowledge,
✓ have made an important invention/innovation, or
✓ have solved a major technological problem

Candidates for the Award are nominated by members of MAPPS, and nominations are evaluated by a Selection Panel appointed by the Board of Trustees of the Education Trust Fund. The selection criteria include:

- ❑ Contribution to plant protection knowledge
- ❑ Economic impact of the candidate's contribution
- ❑ Social impact of the candidate's contribution
- ❑ Publications
- ❑ Academic achievements
- ❑ Professional recognition
- ❑ Contributions to MAPPS and science related professional societies

THE AWARD SELECTION PANEL

- ❑ Mr Teoh Cheng Hai
  (Chairman, Education Trust Fund)
- ❑ Tuan Syed Abd. Rahman
  (President, Malaysian Plant Protection Society)
- ❑ Y Bhg Tan Sri Dr Augustine S.H. Ong
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- ❑ Mr M.R. Chandran
  (Chief Executive, Malaysian Palm Oil Association)
- ❑ Prof Dr George Varghese
  (ETF Board Member)
- ❑ Dr Loke Wai Hong
  (Director, CAB International South East Asia Regional Centre)
- ❑ Dr Lim Jung Lee
  (Chairman, Malaysian Crop Care & Public Health Association)

For the inaugural award, the selection panel chose Dr. Heong Kong Luen, currently an entomologist with IRRI. Excerpts of Heong's achievements and the full text of his guest lecture are as follows:-

ABOUT THE RECIPIENT

Dr Heong is a global Malaysian who hails from Bentong, Pahang where he was born on 2nd June 1948. He obtained his B.Sc degree with honours from the University of Malaya in 1973 and his M.Sc and PhD degrees from the University of London Imperial College in 1978 and 1986, respectively. Currently, Dr Heong is the Deputy Divisional Head of Entomology and Plant Pathology at IRRI. His years of ground breaking work in insect ecology have earned him an international reputation as reflected by the various awards conferred on him: the appointment as visiting professor in 7 universities in India, PR China, Philippines and Thailand and as external examiner for 5 universities in Australia, Malaysia and Sri Lanka. Dr Heong has also made significant contributions to MAPPS; he served as the President in 1987 and was Editor of the MAPPS Journal of Plant Protection in the Tropics for a substantial number of years.

Dr Heong Kong Luen is an insect ecologist who has diversified his interests and expertise into a variety of fields including sociology, psychology, communication and marketing. He has integrated many of these disciplines into innovative ways of communicating his research findings to various stakeholders. He has published more than 120 peer-reviewed papers in scientific journals. In November 2000 he was conferred the advance degree of Doctor of Science by the University of London. Dr Heong and his research team at International Rice Research Institute (IRRI) were awarded the St Andrews Prize for Environment in 2002. The team's work was also recognised by the Vietnamese government. Dr Heong was conferred the 'Golden Rice Award' and the 'Medal for Agricultural Development in Vietnam'. An NGO, Green Organization, presented the team the 'International Green Apple Environment Award'. Early this year, Dr Heong received the prestigious Charles Black Award for outstanding achievements in contributing to the advancement of science in the policy arena.

In his research at IRRI, Dr Heong investigated the ecological consequences of application of pesticides in the rice ecosystem, using a variety of ecological tools. He concluded that insecticides do more harm than good because they disrupt the normal dynamics of ecological balance and favour the development of more damaging secondary pests. In the early 1990s such findings were rather revolutionary and were difficult for many stakeholders, including scientists to accept. His unique ability to simplify science in tandem with the use of cartoons, drama and satire to demonstrate the changes in the predator-prey dynamics after pesticide applications has helped to change the mindsets of many, including decision makers in the pesticide industry.

To put his findings into practice, Dr Heong developed a participatory process to communicate with more than 200 million farmers in Asia. This process involves all stakeholders, including scientists, extension workers, local government officials and NGOs. The primary objective of the process which has been effectively implemented in countries in the Mekong Delta is to enhance 'buy-ins' and local ownership from stakeholders and to leverage local support, besides serving as the platform for designing tenable and practical solutions to local problems.