# RESEARCH NEEDS FOR MANAGING POTENTIAL WEED PROBLEMS IN THE MALAYSIAN AGRICULTURE INDUSTRY

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*Summary.* Weed science research in Malaysia is relatively young and is often dominated by site-specific empirical studies which almost always compare the effects of different control measures or herbicide application techniques. As a result several issues confronting weed science have emerged over the last decade, including increased weed resistance, emergence of new weed problems, growing public concern on indiscriminate pesticide use and its effect on environment and human health, and increased regulatory restraints on herbicide development. The greatest challenge to weed science research, therefore, is to develop a control technology that will integrate the ecological, physiological, demographical and morphological responses as crops and weed interact with their environment and with each other. This paper outlines thrust areas for research, priorities and development approaches required as well as specific studies for weed science.

## INTRODUCTION

The problems confronting the agriculture industry in Malaysia with respect to weeds and the current management practices available for oil palm, rubber, cocoa, orchards, field crops and rice have been reviewed elsewhere (1).

Plantation crops have dominated the agricultural scene in Malaysia over the last few decades, and by 1990 the area under rubber, oil palm, cocoa and rice had reached 1.86, 1.78, 0.36 and 0.64 million hectares respectively. In terms of export earnings, the three main crops, rubber, oil palm and cocoa constitute about 21.1% of the country's total earning amounting to 11.67 billion ringgits. For the country to maintain its competitive edge in the international market it has to be an efficient producer, which can only be achieved by obtaining high yields of crops and through reduction in the cost of production. One of the important production inputs is the management of weeds and the significance of this is reflected in the high expenditure of herbicides compared with other pesticides. Oil palm, rubber and cocoa are the three main crops that used large quantities of herbicides, approximately 80% of the total herbicides in 1990. Despite the significant progress in various control measures, it is estimated that weeds still cause losses in excess of 10% of the country's agricultural production per year.

A major void in the design and conduct of experiments to reveal the environmental impacts of new technology is the lack of understanding of the diversity of ecosystems under which crops are grown and of specific crop ecosystems in relation to their weeds. More basic information is needed on the prevalence and importance of native beneficial organisms and how they relate to each other and their pest hosts. Knowledge about the interactions within pest complexes and between host and pest populations is needed. Satisfying these basic ecological information needs would provide a much stronger foundation upon which to develop research programmes that would yield acceptable data on environmental impacts.

## THRUST AREAS FOR RESEARCH IN WEED SCIENCE

For the coming decade and beyond, researchers have come to recognize that they must develop a more thorough understanding of the basic biology of weeds. Studies on biochemistry, ecology, population dynamics and allelopathy are needed. Competition threshold calculations are required for specific weeds and crops. A better comprehension of the life cycles and growth stages of weeds, particularly of perennial and biennial species must be understood. In addition, more attention is required on plant and seed dormancy and their impacts on the efficacy of weed control tactics. A more thorough understanding of plant metabolism is needed to study translocation of herbicides and growth regulators and to evaluate the resistant and reactive sites of herbicides. The residual properties of herbicides in soil and water require attention and their degradative and metabolitic products need to be identified. An important technological area requiring additional research emphasis is the adverse effects on non-target environmental components of volatility, drift and misuse of herbicides.

These are some of the thrust areas where research is needed to strengthen, diversify or develop new weed control technology, and on which research institutions, universities and the R & D department in the plantation sector should focus.

## PRIORITIES AND DEVELOPMENT APPROACH REQUIRED

At least five major activities have been identified at the national level where emphasis is to be given by researchers engaged in weed science and related areas. These are to:

(i) develop relevant control technology based on the ecophysiology and demography of weeds, including biological control of noxious weeds;
(ii) continue biological studies of selected weed species including seed dormancy, germination and life cycle (growth and development) in order to elucidate their persistence in soil and the controlling factors for their germination and competitiveness;
(iii) elucidate the degree of weed colonization and of weed shift in selected agricultural systems as influenced by cultivation practices, continued use over years of similar control measures and other factors;
(iv) study the mode of action of novel herbicides, safening and other adjuvants; and
(v) improve and refine herbicide application technology.

Innovative approaches in weed control, e.g. using herbicide-resistant crops via biotechnology is also on the agenda for evaluation but this would be the preserve of chemical and biotechnology firms rather than research institutions, universities or the plantation sector.

## PROGRAMME AREAS IN WEED SCIENCE

Specific research programmes for weed science have been drawn up by bringing into focus the thrust areas and priorities outlined above. Both basic and applied studies will be tailored to the needs and requirements of realizing the full potential for weed management in the major crops in the agricultural industry. Some of the research programmes identified are listed below.

1. Biological control of major weeds in waterways. Particular emphasis is given to salvinia and water hyacinth. That for salvinia is completed where the impact of *Cyrtobagous salviniae* on its control have been quite significant in three of the areas evaluated. That for waterhyacinth looks promising with the introduced biological agent *Neochetina bruchi.*

2. The control of the noxious weed *Mikania micrantha* in oil palm, rubber and cocoa/coconut plantations is being studied through biological means with the use of the natural enemy *Liothrips mikaniae.* Two years of study have given mixed results on the efficacy of the introduced biological agent but more work in this area is being pursued.

3. The study on the biology, spread and control measures of four important weed species that are beginning to encroach into rubber, oil palm and cocoa and cane growing areas. These are *Asystasia* spp., *Mimosa pigra, Pennisetum polystachion* and *Rottboellia cochinchinensis.* For *M. pigra,* work on biological control has started in collaboration with CSIRO.

4. Phytotoxicity studies of some promising broad spectrum herbicides for use in cocoa. The studies will involve bioassays for residual activities of herbicides in soils and phytotoxicity to cocoa seedlings.

5. For weed management in fruit orchards, refinement of control measures both cultural and chemical are given emphasis which will include phytotoxicity tests for several new herbicides.

6. Development of cost effective systems for weed management in some of the important field crops including maize, cassava and sugarcane. Screening of more suitable chemicals will continue.

7. Maintenance of vegetation cover under different inputs and management systems for plantation crops and fruit trees.

8. Monitoring of herbicide residues in rice ecosystems, vegetables, fruits and in soils and groundwater.

9. Ecology of plant communities in tin-tailing areas. Little is known of the population dynamics of the natural vegetation and those of pioneer plant species that colonize large tracts of land. Baseline information is sought as to how best the natural vegetation can be manipulated for the success of reclamation and for growing of crops subsequently.

10. Programmes on herbicide application technology, safety and handling of chemicals are also being defined especially for orchards, field crops and vegetables.

These research activities have been designed and planned in such a way that the development of weed control technology must emphasize studies on biology and ecology, biological control, and low-cost herbicide development. Consideration will be given to safety aspects in herbicide application technology and integrated management for weed control. The primary concern must be that all such activities be geared towards preserving environmental quality while trying to achieve a more sustainable agriculture development for the country in years to come.

## CONCLUSION

In Malaysia, losses due to weeds in the plantation are moderately high (1). At present, herbicides are used to control weeds but the cost of chemical control is rapidly escalating. The present trend is towards the use of cost effective herbicides which have low toxicity to a particular ecosystem and the environment at large. Those herbicides which contribute to minimal pollution to soil, water and harvested products will be strongly recommended. There is an urgent need to cut back on the number of spraying rounds and rely more on selective spot-spraying for particular noxious weeds. In this way a beneficial ground cover can be finally obtained especially in the plantations.

An integrated management system involving the use of cultural methods, herbicides, grazing sheep and biological agents (insects) is highly recommended to reduce problems associated with weed infestations in plantations. Good cultural practices such as the use of minimal and proper timing of tillage, legume covers, intercropping and manuring will be encouraged (4, 5). The use of vigorous and high yielding clones or cultivars and advanced planting materials are to be stressed as this will reduce the period of immaturity and thereby reducing the number of spraying rounds for weed control in rubber and oil palm (6). In rice, emphasis is now given on proper water management and improvement of crop establishment in direct seeding to reduce weed problems (3).

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