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Institutional Constraints to IPM

Papers presented at the
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(IPPC)
The Hague, July 2 - 7, 1995

H. Waibel • J.C. Zadoks
(eds.)

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Institutional Constraints to IPM

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Editorial Foreword

The potential strength and contributions of the IPM model are often not realised. Policy makers, donor representatives, researchers and the users of IPM are not always satisfied with the actual achievements in terms of demonstrable and quantifiable results. Whereas in the past, the main concern has been the design and composition of the technical components of IPM, there is an increasing recognition that IPM is a social process strongly influenced by institutions. Institutions in this context are structures and rules of the main actors in the field of pest management. It is recognised that these are not always conducive to a more rapid adoption of IPM. IPM, despite its apparent advantages, is difficult to put into practice because it requires a change in thinking. In addition, promotion of IPM is largely incompatible with the reward structure in agricultural research and technology development systems.

The session on institutional constraints to IPM at the XIIIth International Plant Protection Congress addressed these questions through contributions from various angles of the "IPM Club". It was the specific objective of this session to report success stories and examples of bottlenecks of IPM programs, from developing as well as from industrialised countries.

Two papers (VIJFTIGSCHILD and REUS) deal with the situation of the Netherlands, a country which has become most concrete in implementing IPM according to quantitative targets in terms of the reduction of pesticide use. It becomes clear from these case studies that the policy instruments and the success indicators used can be a constraint in IPM implementation if these are not defined in a context of a cause and effect relation.

Specialisation in research is a severe obstacle to IPM technology development as pointed out by DENT. The presently used specialist terminology of the different disciplines and the appraisal and reward system largely ignore the requirements of interdisciplinary research management.

As pointed out in the paper by FLEISCHER the role of donor agencies with their established administrative procedures and self-interests sometimes add to the confusion about what the implementing governments can expect from IPM.

A holistic and farmer-driven IPM model may not reach its full potential if it conflicts with agricultural policy objectives such as intensification and food security. The case study by UNTUNG (Indonesia) - a country where IPM has gained wide-spread support and recognition - impressively demonstrates these relationships.

The need to redefine the role of plant protection services away from the classical fire brigade mentality towards a concept of agro-eco-systems management is emphasised. An example of a possible reorganisation for a traditional plant protection service in an African country is exemplified for Tanzania in the contribution by KASKE.

The ultimate importance of political support and commitment which goes significantly beyond the usual rhetoric of public administrators is made clear in the report by CASTILLO about the implementation of IPM in the Philippines.

The papers presented at this IPPC session are a stimulating mixture of case studies which allow important conclusions to be drawn. These are believed to be useful for those seriously interested in the implementation of the "real IPM":

> A crop protection system which is based on rational and unbiased information leading to a balance of non-chemical and chemical components moving pesticide use levels away from their present political optimum to a social optimum defined in the context of welfare economics.

Hermann Waibel
Jan C. Zadoks

March 1996

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The Relationship Between Pesticide Use and Environmental Burden for Arable Farms in the Netherlands

Rob A.N. Vijftigschild[1]

Introduction

This meeting is about institutional constraints on IPM. Mostly IPM can be divided into chemical and non-chemical pest control measures like use of resistant varieties and use of natural enemies. This presentation focuses on the chemical measures.

In Dutch pesticide policy quantitative targets are important. Monitoring is important to check whether the targets have been reached. The total amount of active ingredient is **the** indicator. Here we search for a more qualitative indicator which relates to the use of pesticides and the effects on the environment[2]. The lack of this indicator might be a constraint on IPM.

The title of this presentation speaks for itself. Only the term environmental burden needs some explanation. Here the environmental burden is meant, as calculated by the so-called environmental yardstick. This yardstick has been developed by the Dutch Centre of Agriculture and Environment (CLM).

First I will introduce the subject matter of this paper. Then I will present some aspects of the chosen methodology. After this I will present a selection of results and finally I shall draw some conclusions.

So we shall investigate the relationship between environmental burden and pesticide use per hectare on farm and on crop level and we shall focus on arable farming. The following questions are important. Can we find a relationship? Is this relationship less than proportional, proportional or more than proportional? If we find no relationship, an additional indicator is necessary. If we find a relationship which is less than

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2 There is a paper behind this presentation. This paper is a cooperation of three persons: A.J. Oskam, an economist, H. Janssen, an agronomist, and R.A.N. Vijftigschild, a plant pathologist and above all interested in pesticide policy. This paper is also input of a more economic workshop on pesticides in August 1995 in Wageningen, funded by the European Commission.

proportional a more qualitative indicator than the total amount of active ingredient is necessary. If we find a proportional or more than proportional relationship an additional indicator is not necessary. If an additional indicator for the environmental burden is necessary, then the usefulness of the volume policy as the main instrument of environmental policy with respect to pesticides can be questioned.

Two tools are important in this research:

- the Farm-Accountancy Data Network of LEI-DLO, and
- the Environmental Yardstick of CLM.

First I ask your attention for some characteristics of the farm accountancy data network. For decades LEI-DLO has been collecting data of agricultural enterprises. Since the mid sixties, the emphasis has changed towards representing Dutch agriculture as a whole. This change in course was initiated by the European Community guidelines. The data network contains data about approximately 60,000 European farms. LEI-DLO provides the Dutch contribution by recording data from about 1500 agricultural and horticultural enterprises. The data network is based on a stratified sample from the Dutch Bureau of Statistics Annual Census which contains data about all Dutch farms. The strata are constructed by using economic farm size, age of the farmer, farm type and region as distinguishing characteristics. Each year, about 20 % of the farmers are replaced by similar enterprises, in order to maintain representativeness. The data network can be used for other purposes. Monitoring use of pesticides on farm and crop level allows to evaluate change in pesticide use over the years.

Secondly I want to explain the environmental yardstick. This yardstick was developed as a management tool for farmers. The tool functions mainly at disease or crop level. The yardstick is based on a quantitative approach. So far it has covered three aspects:

- risks for water organisms;
- risks for soil organisms;
- risk of leaching into ground water.

The yardstick gives every pesticide so-called Environmental Impact Points (EIPs). The relationship is calculated between the Predicted

Environmental Concentration (PEC) and the concentration which is regarded as acceptable, the reference point. It uses models which are used in the registration procedure of the Dutch government. At this moment concentrations of 0.1 * the Lethal Concentration for water and soil organisms and 0.1 microgram per litre of groundwater are acceptable. The yardstick, just as the models used in the registration procedure, based on a standard dosage of 1 kg active ingredient per hectare. The actual dosage in kg a.i. ha^{-1} will be multiplied by the EIPs for 1 kg. Every year, starting in 1994, the yardsticks are updated. The yardsticks are updated according to new toxicological and chemical knowledge which becomes available from registration, and new acceptable concentrations simply follow the official registration policy.

Before applying the yardstick we have to make some assumptions, which may be rough from an ecotoxicological point of view. First we assume a drift percentage of 1 % of the use, which is important for calculating the risks for water organisms. Secondly we assume a fraction of organic compounds in the soil between 3 % and 6 % for all farms. Thirdly we assume that all pesticides are applied in the spring. The last two assumptions are important for calculating the risk of leaching into groundwater.

Methodology

Once again I give you the definition of environmental burden. This time in a more formal way:

$$EB_{i,k} = \sum_{j=1}^{J}\sum_{c=1}^{C} EIP_{j,c,k} \, X \, QH_{i,j,c} \quad (1)$$

where:

$EB_{i,k}$ = Environmental burden per hectare of farm *i* with respect to aspect *k* (in EIPs*ha^{-1})

$EIP_{j,c,k}$ = Environmental impact measure of 1 kg pesticide *j* and crop *c* with respect to aspect *k* (in EIPs*kg^{-1})

$QH_{c,i,j}$ = Quantity of pesticide *j* applied by farm *i* on an average hectare land of crop *c* (in kg a.i.*ha^{-1}).

The environmental burden is a function of the use and of the environmental impact points of pesticide *j*.

After this definition we go to the general model, applied at farm level and crop level:

$$EB_k = \alpha_k QH^{\beta_k} \quad k = 1,..,K \tag{2}$$

where:

α_k and $ß_k$ are parameters (k is the indicator of in total K environmental aspects; here $K = 3$)

QH is the average use of pesticides per hectare.

In presenting the results two aspects are of importance if we want to check whether a relationship is proportional or not.

1 The marginal environmental burden of an average quantity of active ingredient (the so called marginal effect) can be derived from equation (2):

$$\frac{\partial EB_k}{\partial QH} = \alpha_k \beta_k QH^{\beta_k - 1} \quad k = 1,..,K \tag{3}$$

and

2 The average effect: $a = EB_a/QH_a$, where:

EB_a and QH_a are the averages over all farms/crops and all years

If the marginal effect equals the average effect, we have a proportional relationship. If the marginal effect is bigger than the average effect, we have a more than proportional relationship. If the marginal effect is smaller than the average effect, we have a less than proportional relationship. I will give some examples in the results.

Results

Table 1 shows average levels of pesticide use and toxicity per farm. These results are important in calculating the average effect.

Table 1: Average levels of pesticide use and toxicity, derived from farm level data of 158 specialised arable farms.
All data are (calculated) per hectare

Variable	Year				Average
	90/91	91/92	92/93	93/94	
Pesticides(kg a.i.)	22.4	20.4	17.6	15.0	18.7
Water toxicity (EIPs)	202.0	72.0	69.0	70.0	103.0
Soil toxicity (EIPs)	209.0	147.0	110.0	111.0	143.0
Leaching ’toxicity’ (EIPs)	73.0	67.0	64.0	50.0	63.0
Water toxicity (EIPs per kg a.i.)	9.0	3.6	3.9	4.7	5.5
Soil toxicity (EIPs per kg a.i.)	9.3	7.4	6.2	7.4	8.6
Leaching ’toxicity’ (EIPs per kg a.i.)	3.3	3.3	3.6	3.3	3.4

What can be seen in this table:

- in the observation period the average Dutch arable farm reduced the quantity of pesticides applied per ha;
- this reduction in quantity goes together with a reduction of the environmental burden;
- from the 91/92 season there are no indications that the applied pesticides became less toxic on average;
- the yardsticks are quite different in average level.

In the past four seasons the average farm has reduced the amount of pesticide applied and the toxicity. Reduction of use AND toxicity seem to go together according to the Long Term Crop Protection Plan. An additional indicator seems unnecessary.

Table 2 shows average levels of pesticide use **and** toxicity for the most important crops. These results are also important to calculate the average effect.

Table 2: Average levels for crops on 158 specialised arable farms during the period 1990/91-1993/94.
All data, except area share, are per hectare.

Crop	Area (%)	Pesticide use (kg a.i.)	Water toxicity (kg a.i.)	Soil toxicity (kg a.i.)	Leaching ’toxicity’ (kg a.i.)
Wheat	20.2	6.1	27	29	56
Other cereals	6.4	2.5	11	3	18
Grass seeds	5.5	3.3	4	5	99
Seed potatoes	8.4	41.4	218	212	87
Ware potatoes	11.3	25.0	173	107	26
Starch potatoes	8.7	104.0	412	334	54
Sugar beet	18.6	8.1	10	291	12

What can we see in this table:

- use and environmental burden are high in potatoes and low in other cereals. There are large differences in use and toxicity;
- the risk of leaching is relatively high in grass seeds;
- the risk for soil organisms is relatively high in sugar beet.

The high figures of environmental burden might be due to a few pesticides. We have not checked this yet.

Now we leave the average and look at results at individual farm level. I will show you the results of our regression analysis, the specific form of the general model in tables, but before that I will show some graphic examples.

Figure 1 shows the relationship between water toxicity and pesticide use at farm level. On the X-axis you see the average quantity of 18.7 kg a.i. per ha, which we have already seen in table 1. The figure shows the marginal effect (also in table 3) and the average effect (also in table 1) of the average quantity. If we calculate them, we know they are slightly different. Though the above average levels of use are not in the figure the difference cannot, however, be seen in figure 1. This is an example of a proportional relationship. Notice that the degree of determination is low.

Figure 1: The relationship between the environmental burden (water toxicity) and pesticide use per hectare at individual farm level

Figure 2 shows the relationship between soil toxicity and pesticide use at farm level. On the X-axis we see again the average quantity of 18.7 kg a.i. per ha. The figure shows the marginal effect (also in table 3) and the average effect (also in table 1). If we compare them, and this can be seen in figure 2, the marginal effect is smaller than the average effect. This is an example of a less than proportional relationship. Notice that the degree of determination is again low.

Figure 2: The relationship between the environmental burden (soil toxicity) and pesticide use per hectare at individual farm level

Figure 3 shows the relationship between water toxicity and pesticide use at crop level, for wheat. On the X-axis you should see the average quantity of 6.1 kg a.i. per ha in wheat of all farms in all years, as we have already seen in table 2. The figure shows the marginal effect (also in table 4) and the average effect (also in table 2). If we compare them, and this can be seen in figure 3, the marginal effect exceeds the average effect. This is an example of a more than proportional relationship. Notice that the degree of determination is higher.

Figure 3: The relationship between the environmental burden (water toxicity) and pesticide use per hectare for wheat at individual farm level

After these graphics I will show some results of regression analysis in tables. Table 3 shows parameters of the model at farm level.

Table 3: Results of the farm level analysis.
(Estimated standard errors of parameters between parentheses)

Parameters	**Water toxicity**[1)]	**Soil toxicity**[2)]	**Leaching 'toxicity'**
→	7.2 (5.9)	65.6 (9.3)	43.3 (4.9)
ß	0.92 (0.20)	0.30 (0.04)	0.15 (0.04)
R^2	0.038	0.052	0.021
Marginal effect	5.24	2.53	0.54
Average effect	5.54	7.70	3.39

1) See figure 1
2) See figure 2

The table shows:

- one proportional and two less than proportional relationships;
- in case of leaching reduction of volume from the average quantity has a very small effect on the environmental burden. We see a small marginal effect;
- the degree of determination is very low in all three models. At farm level the quantity of active ingredient gives only a rough indication of the toxicity.

Table 4 shows parameters of the model at crop level. As in table 2, I will only show results for the most important crops.

Table 4: Average and estimated marginal environmental effects of the average quantity of pesticides used in different crops

Crop	Water toxicity			Soil toxicity			Leaching 'toxicity'		
	Aver.	Marg.	R^2	Aver.	Marg.	R^2	Aver.	Marg.	R^2
Wheat[1)]	4.4	6.0	0.36	4.8	6.7	0.12	9.2	7.2	0.10
Other cereals	4.5	5.2	0.35	1.4	1.3	0.37	7.0	3.2	0.02
Grass seeds	1.2	1.0	0.03	1.6	0.9	0.01	30.2	28.0	0.69
Seed potatoes	5.3	3.8	0.03	5.1	3.9	0.34	2.1	0.7	0.06
Ware potatoes	6.9	1.7	0.08	4.3	3.5	0.55	1.1	0.9	0.16
Starch-potatoes	4.0	2.3	0.01	3.2	3.3	0.88	0.5	0.4	0.25
Sugar beet	1.3	0.6	0.10	36.2	7.7	0.01	1.5	1.0	0.11

1)= See figure 3 for water toxicity

The table shows:

- a higher degree of determination than at farm level. It is highest for soil toxicity in starch potatoes;
- with some exceptions, the marginal effects of the average quantity are smaller than the average effects. Therefore in most crops we find a less than proportional relationship;
- in some crops we find a low marginal effect for the average quantity. So a reduction of the volume in these crops has little effect on the environmental burden.

Conclusions

Often the three measures of environmental burden show quite different results.

In all models at farm level the degree of explanation (R^2) is low. Therefore, the quantity of active ingredient at farm level gives only a very rough indication of the toxicity. At this level an additional indicator is necessary to measure the environmental impact.

At crop level the degree of explanation is higher. The R^2's are often much higher for crops with a relative large use of pesticides. However, there is no strict rule.

Quite often the marginal effects are lower than the averages. This implies that additional pesticides lead to a less than proportional increase of the toxicity level. In other words: reduction of use leads to a less than proportional decrease in the environmental burden. However, the results are not uniform.

In the observed seasons the results at average level seem promising for the volume policy. However, the analysis at farm level suggests that the success might have been sheer luck. We come to the overall view that the present-day volume policy does not succeed in reducing the environmental burden proportionally or more than proportionally. Therefore it is advisable to develop the Environmental Burden as an additional indicator to the total of active ingredients.

For this meeting, we conclude that the lack of a more qualitative indicator is an important constraint for IPM in The Netherlands.

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Reduction of Hazardous Pesticide Use: Stick or Carrot?

J.A.W.A. Reus[3]

Introduction

The central question in this paper is how a reduction in the use of hazardous pesticides can be achieved. Which instrument should be used? Should we force farmers to adopt more environment friendly crop protection techniques by using rules and regulations, metaphorically speaking: a stick? Or should we persuade them by using a carrot and apply more stimulating instruments?

This paper will concentrate on the more motivating instruments and I will mention a few experiences we have gained at the Centre for Agriculture and Environment (CLM). CLM is a research organisation that closely co-operates with farmers and environment groups to find solutions for environmental problems at farm level. We also advice policy makers on how to perform agricultural policies aimed at a reduction of the environmental impact of agricultural production.

Problem

What is the problem we are talking about? Pesticide use in some crops and regions in Europe and especially in the Netherlands is quite intensive. In the Netherlands we use about 12 kg of active ingredient per hectare on average. In bulb growing areas, pesticide use can amount to more than 80 kg/ha.

This intensive use of pesticides can cause problems in some regions, like:

- contamination of groundwater, surface water and rainwater;
- long-term health effects (there are indications of reduced fertility);
- development of resistance within pests.

3 Centre for Agriculture and Environment, P.O. Box 10015, 3505 AA Utrecht, The Netherlands.

Therefore present crop protection policies aim at:

- reduction of pesticide use and emission;
- promotion of integrated farming systems and IPM-methods, like mechanical weeding, biological control and selective pesticide use.

What are the constraints for the adoption and implementation of IPM-methods? In the first place there are technical constraints, like:

- physical constraints (e.g. soil, climate): not every method can be applied in each situation;
- availability of technology.

Apart of technical constraints the implementation of IPM is also influenced by other factors, like:

- motivation: one farmer may have a more positive attitude towards the environment than another;
- knowledge: IPM is often a more knowledge-intensive and complex system than pure chemical control, which hampers a fast adoption;
- economics and risks: farmers often consider IPM to involve more risks.

Moreover measures which benefit the environment are not compensated by a higher price on the market.

Today's more 'classical' policy instruments consist of the following instruments:

- banning of hazardous pesticides;
- regulation of pesticide application, only in specific crops or with specific equipment;
- research;
- extension.

These instruments are usually not enough to achieve desirable results. There are several reasons for this:

- rules and regulations (using a stick) do not motivate farmers;

- regulations can be effective, but are often difficult to control. There is a risk that farmers put more energy into attempts to get around regulations than in adopting new crop protection techniques. Regulations will therefore be only effective in situations where control is easy to carry out. In crop protection and pesticide use these situations are rather scarce;
- present policies offer no economic incentives for farmers.

The Work of CLM

There is therefore a need for additional instruments and measures which stimulate farmers to adopt IPM. In the Netherlands CLM has gained some experience with these kind of instruments. I give you some examples.

The strategy CLM follows consists of several steps:

1. to quantify the environmental impact of pesticides at farm level. This will show farmers what the problems are related to the use of pesticides and will motivate them to reduce the environmental impact;
2. to develop IPM at farm level together with farmers. This will enhance their motivation and knowledge;
3. to give financial incentives to forerunners. This may reduce some of the economical constraints.

Ad 1.

In order to quantify the environmental impact of pesticides CLM has developed an environmental yardstick for pesticides. Pesticides get so-called environmental impact points for:

- contamination of groundwater;
- contamination of surface water (risks to water organisms);
- contamination of soil (risks to soil organisms).

When calculating the environmental impact points farmers can take into account:

- dosage;
- method of application (important to calculate the emission to surface water);
- soil type (important to calculate the emission to groundwater).

The yardstick is being implemented in the Netherlands since 1993 in all field crops. For greenhouse crops CLM will develop a similar instrument this year.

The results of this approach are that farmers:

- become aware of the environmental burden of pesticides;
- can choose the least harmful pesticide for their specific situation;
- can compare results with colleagues or with previous years in order to measure the progress they make;
- are more motivated to take measures to reduce the environmental impact.

Ad 2.

CLM works together with so-called study groups of farmers to develop IPM at farm level together with farmers.

In these study groups farmers can:

- compare pesticide use;
- discuss potential of various measures to reduce the environmental burden;
- exchange experiences;
- get support in the process of decision making, e.g. by the extension service.

The results are that farmers:

- are more motivated to apply IPM methods;
- learn from colleagues and get more knowledge on IPM;
- dare to take more risks;
- stimulate each other (social control).

Ad 3

Financial incentives can be given to forerunners in several ways, e.g.:

- incentive payments to farmers who take extra measures or risks. CLM has carried out a project in groundwater protection areas where farmers received an incentive payment if they voluntarily reduced the use of hazardous pesticides. This had a tremendous impact. Farmers reduced the risk to groundwater with more than 95 %. Another possibility is the introduction of a green label which creates a market advantage for farmers who apply IPM. CLM has developed criteria and standards for such a label in close co-operation with producers, retailers, consumer and environment organisations. This year it will be introduced and hopefully the first products can be found in the supermarkets by the end of this year.

The results of giving financial incentives are that farmers are more motivated to take measures and dare to take more risks, because they get a premium for reducing the environmental impact of their production system.

These were some examples of additional instruments to reduce the use of hazardous pesticides. In most cases one single instrument is not sufficient. For each situation it is necessary to apply the most appropriate mix of policy instruments and measures. Our experience is that instruments which stimulate and motivate farmers (using the carrot) can speed up the adoption of IPM-methods and are necessary in addition to using rules and regulations (sticks).

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Research Specialisation: A Constraint to Integration

David R. Dent [4]

There is an increasing demand by funding agencies at national and international levels for collaborative multidisciplinary research programmes, where the idea is to make much more effective use of limited resources (DENT, 1992). This bodes well for IPM because IPM is dependent on developing integrated solutions to problems from multidisciplinary inputs (DENT, 1995). However, the goal of interdisciplinary research is in practice constrained by the disciplinary and specialist nature of research. IPM may involve scientists from the disciplines of entomology, plant pathology, weed science and nematology. Scientists from these disciplines specialise further in subjects such as monitoring and forecasting, chemical control, hostplant resistance and biological and cultural control. Within this framework even further levels of specialisation occur as scientists address particular pest problems. Pesticide scientists, for instance, specialise in particular classes of chemicals, pesticide resistance, spray deposition studies, pesticide efficacy, effects on beneficials etc.

The consequence of this emphasis on research specialisation is the development of disciplines with their own modes of enquiry, specific key terms and vocabulary, standards of proof, basic concepts and observational categories and techniques (PETRIE, 1976; DENT, 1991; 1992; 1994; 1995). By way of example consider ’terminology’ and the problems it can cause. The same terms may have **different** meanings between disciplines, or there may be different terms between disciplines for the same phenomenon, process or procedure. Terms may be specific to a discipline and have no meaning outside the discipline and acronyms or abbreviations may be used. When plant pathologists talk of ’damping-off’, ’Beaumont, Smith or latent periods’, there are not many entomologists who know precisely what is meant!

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4 Insect Investigations Ltd, School of Pure & Applied Biology, University of Wales, Cardiff, PO Box 915, Cardiff, CF1 3TL.

The subject of genetic manipulation has conjured up a whole new range of specialist terms. For instance, what is a RFLP (Restriction Fragment Length Polymorphism), or a transposable element and is microprojectile bombardment really referring to a biological phenomenon? Every discipline has its own specialist vocabulary but its use can act to constrain our ability to carry out interdisciplinary research.

Specialist terms are necessary to promote communication and understanding **within** a discipline but the same process causes compartmentalisation, reduces communication and inhibits collaboration **between** disciplines. Such factors caused by specialisation limit the likelihood of successful interdisciplinary collaborative IPM programmes and hence the development of integrated solutions to pest management problems. If you can't communicate how can you collaborate? The paradox of IPM research is that IPM requires highly specialised inputs from its constituent disciplines but integrating these inputs is extremely difficulty because of the inherent nature of specialisation.

There is a need to address some of the institutional influences which constrain integration in pest management research programmes. The following discussion considers (i) appraisal and reward systems, (ii) organisational structures, (iii) training in interdisciplinary research and management.

Appraisal and Reward Systems

Existing scientific qualifications and reward systems seek to promote specialist endeavour in preference to more generalist approaches - the discipline specialist rather than the interdisciplinary generalist. This is seen primarily in reward systems: Scientists advance in their career according to their scientific ability measured largely through their publication record. The more papers you publish the better - but the effect is more subtle than this - it is not only the number of papers published but your perceived contribution to their content and preparation. A large number of single author papers are regarded as more important than a large numbers of papers where you are one of 3 or 4 other contributors - especially if you are not the senior author of the paper. Such perceived differences in the value of single author vs. multi-author publications do little for the cause of publication of interdisciplinary research results.

Scientists working in multidisciplinary teams are more likely to publish their own results as a single or co-author in a specialist journal than publish an integrated solution as a team in a multi-author paper. But what can be done to change this?

There are a number of possibilities including the following:

- funding agencies can insist that criteria for success include publications in an interdisciplinary format;
- specialist journals could publish interdisciplinary papers;
- journals could establish mechanisms of accreditation that can distinguish between contribution to writing a paper and its scientific content;
- a new type of scientific paper could be considered for the publication of IPM results, one which emphasises integration of results rather than the individual specialist inputs.

The new journal - *IPM Reviews* seeks to achieve this latter point by providing the option of inclusion of published results from specialist journals in a review format in combination with previously unpublished results which integrate the different specialist inputs. Such 'Programme Reviews' will meet the need for scientists to publish in specialist journals but create a whole new level of publication in a review format which emphasises interdisciplinary work. In addition, funding agencies or governments who emphasise the need for multidisciplinary research programmes should place a greater value on the publication of results in an interdisciplinary form and reward scientists who can show that they not only work as independent specialists but also as members of an interdisciplinary team.

Organisational Structures

Different organisations have different structures some of which are more conducive than others to the needs of interdisciplinary research in IPM. University departments with their emphasis on disciplinary expertise such as Entomology Departments or Plant Pathology Departments fare poorly as organisations that function to facilitate interdisciplinary research (ROSSINI *et al.*, 1978; TAIT, 1987; DENT, 1991; 1992; 1995). Large organisations tend to have inflexible internal structures and hence are also less amenable to interdisciplinary team work. Flexible open structures which allow project groups to be established to deal with specific interdisciplinary problems are the most appropriate. Research has shown that small groups with a core of 6-8 key people deal best with developing integrated solutions to multidisciplinary problems (ROSSINI *et al.*, 1978) - but only if managed properly!

Interdisciplinary Research and Management

The management of interdisciplinary research represents one of the most challenging of human resource management activities and yet we expect scientists to just somehow acquire the skills and techniques. There is also an implicit assumption that a good scientist will make a good manager. Studies carried out by Rossini *et al.* (1978) considered the best way to manage scientists in interdisciplinary teams. One of the key findings of their work was that integrated solutions to problems are best served by a multidisciplinary team developing a conceptual model of their project, a shared paradigm in which they agree on the inputs and the outputs and the way in which they are to be integrated. In pest management we tend to define our research in great detail - that is our inputs, but pay too little attention to the outputs of research which may be skills provided by training, products, techniques, information or just recommendations for further research. Little effort also goes into considering their interaction.

Research managers need to promote communication within their team. How can you communicate and collaborate effectively if you do not share common terminology, concepts, modes of enquiry etc. We each need to learn a little of each others discipline to collaborate effectively and structures need to be established which promote this (DENT, 1995).

Efforts should be made in the early stages of a programme to promote communication between disciplines through setting up glossaries of key terms and compendia of basic concepts (DENT, 1992; 1994; 1995). Meeting as often as possible during these initial stages also helps (BARKER, 1994; CLARKE, 1994).

The techniques of programme planning and monitoring, of setting targets and milestones, are increasingly becoming a pre-requisite of funding agencies for project applications (DENT, 1992). However, they are seen by scientists as necessary evils rather than as an integral part of programme development and management. But if the work of specialist scientists are to be brought together to develop integrated programmes in IPM then such approaches are essential.

Management is a necessary skill to bring together the work of specialist groups to provide the integrated solutions to pest management problems, yet how many scientists are trained in the skills of management? Very few indeed! Despite the fact that management of multidisciplinary collaborative programmes is one of the most difficult of tasks.

If specialism is not to act as a constraint to integration then research management training is crucial. This needs to be combined with changes in appraisal and reward systems to make collaboration more attractive to specialists and then we need appropriate organisational structures to make it all possible!

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Policies of Multi- and Bilateral Donors - Do they Really Help IPM?

Gerd Fleischer[5]

Introduction

It is frequently hoped that the indiscriminate use of pesticide which has such harmful effects on human health and the natural environment can be overcome by the introduction of integrated pest management (IPM). Multi- and bilateral donor and aid agencies play an important role in the promotion of IPM in agricultural and horticultural production in developing countries. However, adoption of IPM has not yet reached a level that significantly reduces the widespread over-use of chemical pesticides.

In this paper, the scope for donor intervention into pesticide use and policy in developing countries is first outlined. It is followed by analysing the current activities of major agencies. Institutional limitations to the wider diffusion of IPM and shortcomings of the present approach are then discussed. The results presented in this paper are based on a survey conducted in 1993, among eleven multi- and bilateral donor and co-ordination agencies in preparation for the Global IPM Conference in Bangkok.[6] Conclusions drawn in this paper are based on the evaluation of guidelines and a survey among responsible desk officers. As a further step, research should evaluate the experiences gained in the implementation of the guidelines.

Rationale for Pesticide-Related Policies of Donor Agencies

The rationale for explicitly formulating pesticide policies within international donor agencies was influenced by several factors. Ever increasing pesticide use in most of the developing countries led to concern about the sustainability of agricultural production. Resistance of pests towards pesticides is one indicator of degradation of productive

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6 Details are provided in Fleischer (1993).

capacity (ARCHIBALD, 1988; WAIBEL and SETBOONSARNG, 1993). Empirical evidence concerning mis- and over-use of chemicals, that have led to human health hazards and significant environmental problems, raised awareness of the harmful effects of this kind of production input. The donors' reaction to the growing problems was accelerated by the increasing demands for intervention by the general public in the industrialised world.

Frequently, donor action in order to control and reduce indiscriminate pesticide use was demanded because donations of pesticides formed a considerable part of the national pesticide supplies in some Asian and African countries (DINHAM, 1993; SZMEDRA, 1994). Governments of developing countries began to demand technical assistance in research and extension of IPM practices as well as in regulatory affairs.

Instruments for Pesticide Policies and their Use among Donor Agencies

Donor agencies may interfere directly and indirectly with pesticide distribution and use. **Administrative provisions** for pesticide procurement for agricultural development and plant protection projects and to national plant protection services directly influence the type and amount of chemicals used. These provisions have been adopted by most of the international donors as their internal procurement procedures. Whereas some agencies have black lists of chemicals that must not be provided to developing countries, others assign the decision on the supply to a responsible desk officer.

Special pesticide procurement guidelines were first issued by the World Bank in 1985 (*Guidelines for the selection and use of pesticides in bank-financed projects and their procurement when financed by the bank),* followed by the Asian Development Bank (ADB) in 1987. Bilateral donor agencies adopted internal regulations for pesticide supply in their projects and programmes in the beginning of the nineties. USAID (United States Agency for International Development) finalised its *pest management guidelines* in 1991, German KfW (Kreditanstalt für Wiederaufbau) issued a black list of substances not to be financed in 1992, and GTZ (Deutsche

Gesellschaft für Technische Zusammenarbeit) elaborated on internal procedures for pesticide procurements also in 1992.

Some donor agencies, such as the British Overseas Development Association (ODA), USAID and the European Union (EU) consider the pesticide use and procurement problem within the broader framework of environmental impact analysis. Special guidelines for the implementation of IPM projects were issued by the World Bank, the GTZ, the Asian Development Bank and recently by the Organisation for Economic Co-operation and Development (OECD).

Provisions for compliance can be achieved by introducing global conventions and voluntary agreements that aim at regulating the distribution, marketing and use of chemical products. In sharp contrast to administrative regulations, adherence to compliance provisions by the parties involved is voluntary.

The General Assembly of the UN was the first to present a *Consolidated list of products whose consumption and/or sale have been banned, withdrawn, severely restricted or not approved by governments,* in 1982. This declaration served as a means of information exchange. In 1984 OECD issued its *Recommendation concerning exchange related to the export of banned or severely restricted chemicals,* which was addressed to its member countries. A global voluntary agreement between governments in developing and industrialised countries, as well as between industry and importers was introduced by the Food and Agriculture Organisation (FAO) in 1985. The *Code of Conduct on the Distribution and Use of Pesticides* put major responsibilities on industry and retailers as well as on national governments in order to avoid misleading labelling and advertising.

The Prior Informed Consent (PIC) principle - adopted by FAO and UNEP in 1989 - is meant to be an instrument of information exchange in pesticide trade between exporting and importing countries. Information on the hazardous potential of pesticides is frequently lacking in developing countries. Imports of pesticides mentioned in the PIC list should be explicitly allowed by the authorities in developing countries prior to their first shipment. The PIC list currently comprises of 12 pesticides. However, the scope of PIC is limited since it demands administrative capacities in developing countries and doesn't provide for effective control. Even when made legally binding by an international convention, which is envisaged in the near future, this unsatisfactory situation is unlikely to change.

Economic provisions can be used to decrease indiscriminate pesticide use by adjusting the price paid by the user. The removal of price distortions, the introduction of an environmental levy on chemical pesticides and the establishment of liability requirements are comparatively new methods of controlling pesticide use. Since such policy instruments are market-based and offer considerable flexibility to the individual user, they are receiving increasing attention as particularly efficient solutions (OPSCHOOR et al., 1994). However, apart from the removal of direct subsidies to pesticides in donor-financed projects and programmes, those instruments cannot be directly implemented by donor agencies. Advice to national governments plays a key role in formulating this kind of pesticide policy. In the course of negotiating and implementing the structural adjustment programmes in the second half of the eighties, subsidies on chemical pesticides paid by national governments were already successfully removed. However, a large variety of indirect subsidies still exist in many countries as revealed by a World Bank report (FARAH, 1993).

Indirect intervention into pesticide use in developing countries is achieved via technical and financial assistance by donors. Technical assistance is provided to national governments in the field of institution building - mostly with plant protection services -, establishment of regulatory capacities and research and development of IPM in selected crops. Increasing importance is given to the monitoring and mitigation of negative side-effects, such as residue laboratories and waste disposal management. Financial assistance is mostly related to the support of IPM projects, either as an adherent component of agricultural commodity programmes or as a separate entity.

The degree of implementation of different instruments and activities within the donor agencies is ranked in table 1. It shows that administrative provisions to tighten procurement procedures are fairly well developed. Research and development of IPM is another major focus of activity. However, the overall dimension of the pesticide problem has not yet received significant attention. IPM projects are seldomly part of broader national programmes which include training activities. Policy advice also presently only plays a small role.

Table 1: Implementation of pesticide policy instruments

Policy measure	Degree of implementation	
	Financing institutions 1)	Technical co-operation agencies 2)
Administrative provisions for pesticide procurement	++	+++
Environmental impact analysis in agricultural sector projects	++	+++
Advice on national pesticide policy	+	+
Research & Development, extension on IPM in selected crops	+	+++
Nation-wide pest management programmes that include IPM training	+	+
Support of institution building for pesticide legislation and regulatory affairs	0	+
Technical assistance on mitigative measures (laboratories, waste disposal)	0	+

(+++) = very high, (++) = high, (+) = low, (0) = no implementation

1) i.e. World Bank, Asian Development Bank, African Development Bank, European Union, International Fund for Agricultural Development, Kreditanstalt für Wiederaufbau (Germany)
2) i.e. USAID, ODA, GTZ, FAO

How is IPM Diffusion Influenced by Donor Policies?

Support of IPM research and development plays a key role in donor strategies for counterbalancing increasing pesticide use trends in developing countries. However, the current strategy is lacking some important elements. IPM is generally crop-specific and is carried out in isolated projects. The latter are not linked to agricultural policies, e.g. import and trade policies, provision of direct and indirect subsidies, and pesticides as compulsory part of credit schemes. It is likely that IPM will be of only limited success as long as general agricultural policy is not suited to its adoption by the majority of farmers.

In most of the larger agricultural development programmes, IPM is often simply a mitigative measure, a counterbalance to the expected adverse effects of increased pesticide use. IPM projects lack clear quantitative targets for the reduction and/or prevention of pesticide inputs.

Shortcomings of the Current Approach

Although pesticide procurement guidelines regulating aid donations and pesticide procurement in donor-sponsored projects are in place in most agencies, a ban of the most dangerous pesticides in donor supply programmes has not yet been introduced. There is also a general lack of needs assessment of proposed pesticide use. Economic studies and cost-benefit analyses of the current level of pesticide use are rarely conducted. Donors generally have little information about the benefits and costs of proposed pesticide use, in relation to both the individual and the society as a whole. Procurement guidelines may help to select chemicals with a comparatively low hazardous potential, however. There are no economic incentives provided to reduce the overall use and dependency on pesticides.

Agricultural sector development strategies have a decisive influence on the intensity of crop production and thereby on pesticide use. Nearly every agricultural project has an impact on its use. A conclusive strategy of integrating agricultural development and natural resource management is still lacking in the donor community.

Although environmental impact analyses are conducted regularly, the action that follows such examination is often of a fairly limited range. When negative side-effects of pesticide use occur, donor agencies rely generally on mitigative measures such as food residue monitoring and pesticide quality laboratories. Alternatives, such as effective measures of reducing pesticide use or influencing the institutional and political framework that favours overuse are rarely considered in project planning.

Currently, IPM in developing countries is not adequately promoted by donor agencies. A range of IPM projects have been conducted, but they tended to suffer from an excessively technical orientation. It should be clearly recognised that non-technical factors, e.g. government price policy, institutional arrangements in research, extension and education and socio-economic constraints of the farming household play an important role in the plant protection system.

In order to fit IPM projects' field activities better into the institutional environment, donor support on all institutional levels should be provided. Success at field level will be limited unless basic adjustments at a national level have been made.

All donors have a commitment to promote and implement IPM. However, a common understanding of which measures have a part in IPM programmes is still missing. Donor agencies lack co-ordination of their plant protection and pesticide policies. At the same time, support for IPM projects and a great deal of pesticide related assistance is given by different donors, thus confusing the strategy and the management of national plant protection services.

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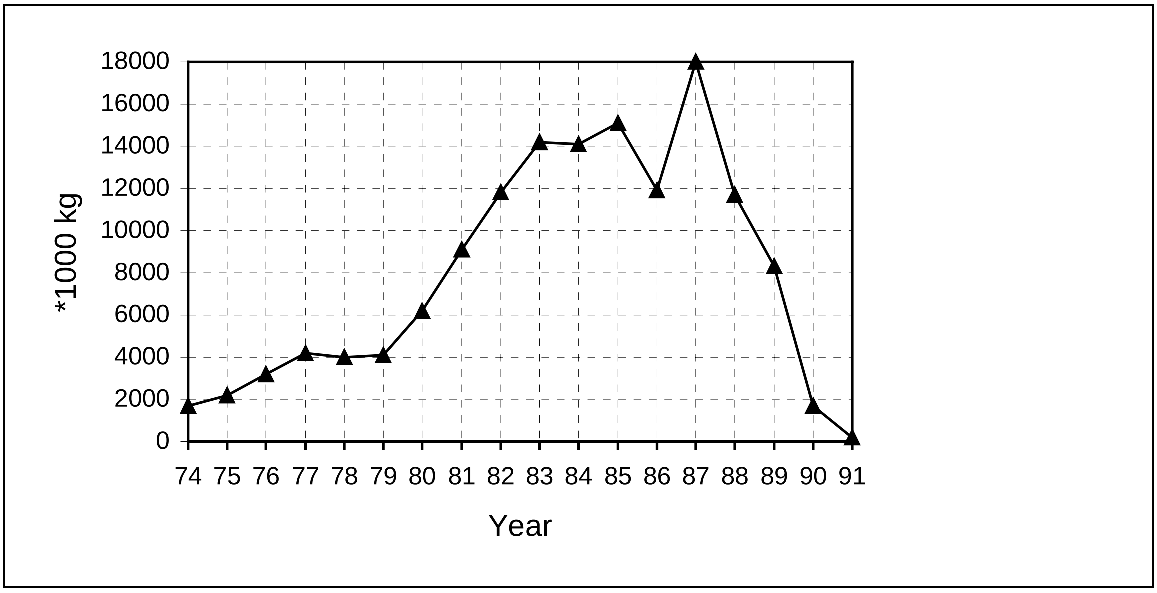
Institutional Constraints on IPM Implementation in Indonesia

K. Untung[7]

Introduction

Pesticides have been known and used in the Indonesian agricultural industry and public health sector since 1950. The use of pesticides for agricultural pest control has rapidly increased since the government launched intensification programmes for domestic food supply. Mass guidance programmes introduced pesticides together with high yielding varieties, irrigation and fertilisers. Prior to 1970 one hundred tons of pesticides were used for food production, especially rice. In the 1970s the government subsidised pesticides to food crop farmers at the average of 2.000 tons a year. This increased to about 18,000 tons in 1987 (figure 1) until the subsidy was abolished in the following year. The government subsidy at times covered 80 % of price of pesticides, at a cost of US $ 100 - 150 million per year.

Figure 1: Pesticide subsidy for food crops, 1974 - 1990

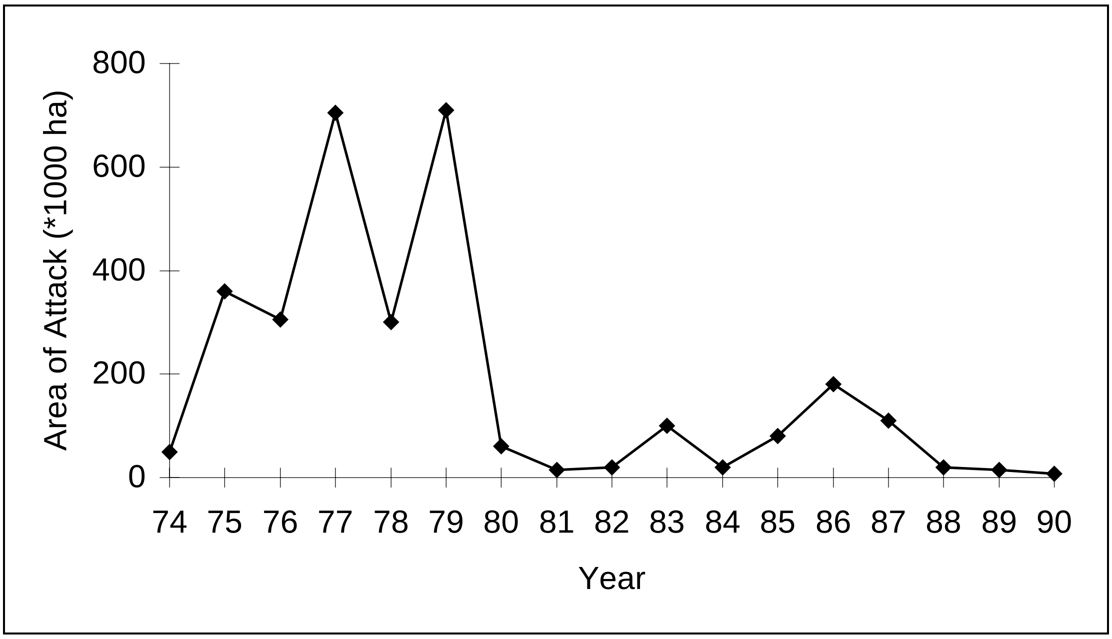


Source: Directorate General of Food Crops

7 State Ministry for the Environment, Jln. Merdeka Barat, Jakarta 10110, Indonesia Faculty of Agriculture, Gadjah Mada University, Sekip Unit I P.O.Box 1, Yogyakarta 55001, Indonesia.

Despite the increased use of pesticides by farmers, outbreaks of the brown plant hopper (BPH) and its new pesticide resistant biotypes were so severe, that it slowed down the governmental self sufficiency programmes. Since 1970 the total damage inflicted by the BPH has increased significantly (figure 2). The resurgence of the species and the resulting problems caused the government to change its pest control policy into one of IPM implementation.

Figure 2: Area attacked by brown plant hopper - Indonesia, 1974 - 1990



The Presidential Instruction No. 3/1983 gave impetus to the IPM programme in Indonesia by outlining the government's commitment maintaining rice self-sufficiency through human resources development, environmental management and public health legislation (to protect from the effects of pesticides) and increased efficiency. This was achieved through the implementation of IPM principles which began with the banning of 57 pesticide products previously used in rice production. In 1984 the government allowed the pesticides industry to trade in a free market structure.

IPM is a national programme that emphasises human resources development and minimum government intervention. In 1989 in the IPM

National Programme began a human resources development programme, which targets specific groups i.e. farmers, field and extension workers, related government officials, informal community leaders as well as the general public.

By 1992, 300,000 rice farmers in 20 provinces and 10,000 highland vegetables farmers have had their IPM training through IPM Field School system which utilises the participatory approach in making farmers the decision makers of IPM activities. During the training period of a full planting season farmers learn to make proper pest management decisions, based on analysis of information they gather through weekly monitoring. They then put these decisions into practice.

The result of IPM training is promising, but to sustain the success of IPM concepts for the national agricultural development programme, several basic constraints must be overcome. This paper briefly discusses some policy, research and development, and technical constraints which have hindered IPM implementation in Indonesia.

Results of the IPM Training Programme on Farm Level

IPM was introduced in the six largest rice producing provinces, and was then expanded to 14 other provinces in 1991. Initially IPM was aimed at rice fields only, but in 1992 it was then extended to include soybeans and certain vegetables namely: cabbage, potato, shallot, and yardlong bean.

The objectives of IPM training are: higher productivity, increased farmers' income, guarded pest population (i.e. to keep pests below economic threshold levels), limited use of chemical pesticides, and an improved environment and better public health.

The following aims are central to the IPM Field Schools' philosophy:

- grow healthy crops;
- conserve and utilise natural enemies;
- carry out weekly field observation;
- develop farmers as IPM experts.

Farmer training applies adult participatory education methodology, using a field as an educational tool. Farmers in groups of 25, learn through experience how to observe the ecosystem on a weekly basis in order to maintain pest population at its equilibrium level.

In the field, IPM involves not only pest control but also other aspects of farming such as balanced and efficient fertilising, efficient use of water, crop rotation and soil conservation. It also makes use of the farmers own experiences in terms of reduction or total elimination of pesticide use as well as other external inputs.

After participating in a one-season IPM Field School, rice farmers could reduce pesticide use to 56.2 % (table 1). Similar data for 1992-1993 seasons showed an even better figure.

Table 1: Average number of pesticides* application by rice farmers after IPM implementation during 1990 - 1991 crop season

Province	Before IPM	After IPM	Percent Reduction
North Sumatra	5.17	1.72	66.7
West Java	2.39	1.04	56.5
Central Java	2.23	1.37	38.6
East Java	2.31	1.17	49.3
South Sulawesi	2.33	0.48	75.1
Average	2.58	1.13	56.2

* including insecticides, rodenticides, fungicides and herbicides

The results of IPM trained vegetable farmers are even more impressive. Compared to the conventional system, the IPM system on cabbage could reduce insecticide use by 94.95 %, increase yield by 7.6 % and increase net return by US $ 831.44/ha (table 2). Implementation of IPM technology by farmers on potatoes reduced insecticide usage by 89.20 % and fungicide usage by 81 %, increased yield to 3.8 ton/ha, and increased net return to US $ 1,710.64/ ha (table 3). Similar results were also achieved by IPM implementation on tomatoes, shallots and yardlong beans.

Table 2: Implementation of IPM technology on cabbage in 1993
(Means of 105 FFS in eight provinces)

Item	IPM System	Conventional System	Difference
Pesticide use:			
- Insecticide	2.60 l(kg)/ha	13.50 l(kg)/ha	80.74 %
- Fungicide	0.50 l(kg)/ha	9.90 l(kg)/ha	94.95 %
Number of applications			
- Insecticide	1.20 times	10.30 times	88.35 %
- Fungicide	2.90 times	11.60 times	75.00 %
Yield			
Yield	46.70 t/ha	43.40 t/ha	7.6 %
Partial Economic Analysis (US $ 1.00 ≅ Rp. 2,172.00)			
- value	3320.26	2758.75	
- cost	2032.92	5598.76	
- net return	1287.29	455.85	
- R/C	1.6	1.2	

Source: LEHRI, 1994

Table 3: The implementation of IPM technology on potatoes in 1993
(Means of 105 FFS in eight provinces)

Item	IPM System	Conventional System	Difference
Pesticide use:			
- Insecticide	1.90 l(kg)/ha	17.60 l(kg)/ha	80.74 %
- Fungicide	4.90 l(kg)/ha	25.80 l(kg)/ha	94.95 %
Number of applications			
- Insecticide	1.20 times	10.30 times	71.84 %
- Fungicide	2.90 times	11.60 times	89.66 %
Yield			
Yield	19.10 t/ha	15.30 t/ha	24.84 %
Partial Economic Analysis (US $ 1.00 ≅ Rp. 2,172.00)			
- value	3233.89	2758.75	
- cost	2364.18	3543.28	
- net return	869.71	-901.93	
- R/C	1.37	0.75	

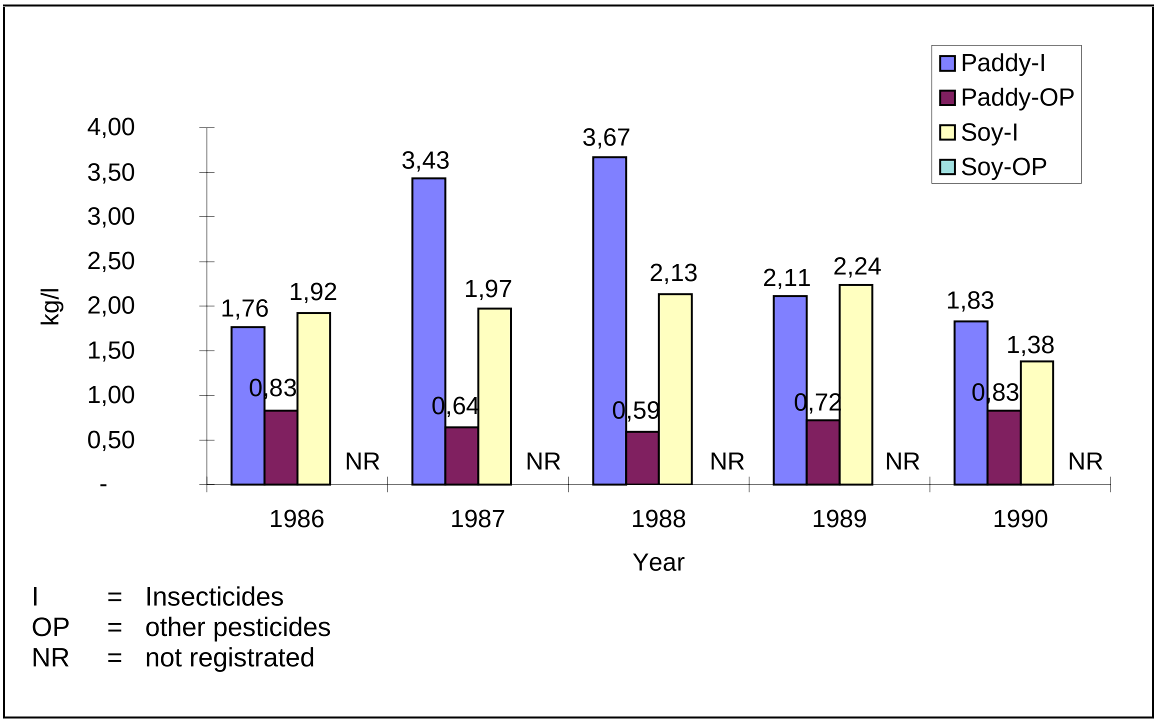
Source: LEHRI, 1994

The IPM National Programme is presently being extended until 1998 so that a further target of training 800,000 farmers and 16,000 agricultural extension workers can be achieved. Hopefully the trained farmers would then train the other 15 million farmers in IPM.

Result of IPM Implementation at Macro Level

Since the IPM trained farmers are only a very small proportion of the total number of Indonesian farmers (300.000 farmers vs. 16 million farming households), the effect of the IPM implementation on farmers behaviour in using pesticide is not yet clear. Most Indonesian farmers are unaffected by the IPM training programme. They are still practising the conventional approach to pest control, especially under pest outbreak conditions. This is especially observed for farmers on the northern coast of West Java during the rice white stemborer outbreak in 1992.

Figure 3: Quantity of pesticides used per hectare by farmers for wetland paddy and soybean (kg/l) 1986 - 1990

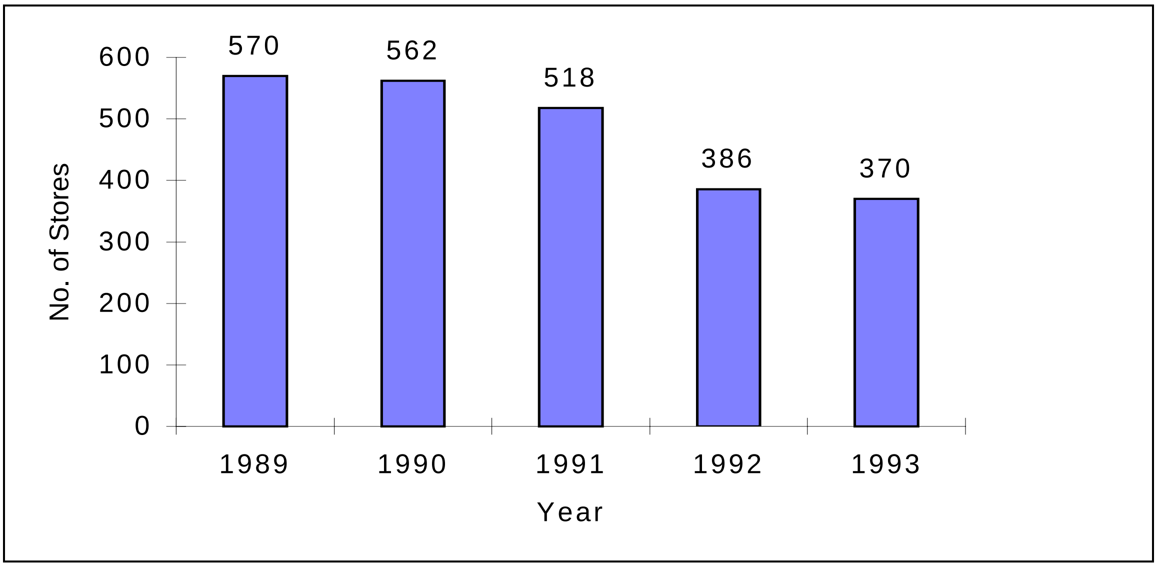


Source : Central Bureau of Statistics, 1993

Recent statistics show that average pesticide usage by rice and soybean farmers was reduced (figure 3). Partially, this can be seen in the effect of government expenditure. The quantities of pesticides subsidised between 1984 - 1991 declined to a low amount. The government could save around 100 million US dollars every year.

A socio-economic survey by Andalas University (MUCHTAR, 1994) on the effect of IPM training on the distribution of pesticides in villages showed that the number of pesticide retail stores in the province of West Sumatra has declined in the last five years (figure 4). The data show that agricultural demand for pesticides has decreased which indicates that the popularity of pesticides is declining.

Figure 4: Quantity of pesticide retail stores in West Sumatra province 1989-1993



Source: MUCHTAR, 1994

The next target of the IPM National Programme is to institutionalise IPM at the national level. The technology and organisation of IPM needs to be improved in order to pave the way for sustainable agricultural production.

Institutional Constraints

Indonesia has successfully developed and implemented IPM principles through the IPM Field School Training Programme for field workers and food crop farmers. Apart from the IPM field school system which covers only a limited number of farmers and a small acreage of rice fields, vast number of rice and food crop farmers are still practising the conventional methods of pest control which rely on pesticides. Pesticide producers and formulators are producing and distributing pesticides at increasing rates in the midst of governments efforts to promote and implement IPM (figure 5).

Figure 5: Constraints to IPM development and implementation in Indonesia

1. Different perceptions of IPM

Uncertainty due to different perceptions from different scientists, field workers and farmers. Indonesia's Crop Production and Protection Act No. 12/1992 is available but has no practical enforcement mechanism capable of making IPM a nation-wide reality.

2. IPM vs. rice intensification programmes

IPM programmes promote and base their action on a productive and balanced agro-ecosystem. Intensification programmes based their action on national food sufficiency and security.

3. Strongly sectorial bureaucratic system

Programmes are directed by administrative institutions rather than aimed at common objectives. Each - sections, departments, directorates, sub-sections sub-directorates, and what-nots may develop different and asynchronous guidelines for the same objective.

4. Lack of discipline oriented research

IPM research is still carried out the old-fashioned way. Integration of research by different disciplines is rare if not practically non-existent.

5. Need to empower farmers

Low skill, limited ability and little experience prevent farmers from managing their own fields, making them heavily depended on government officers (extension and field workers, etc.).

The question is how IPM principles and techniques could be effective and institutionalised in the future agricultural development in Indonesia. The following immediate constraints are the challenges of IPM implementation and institutionalisation.

1. Different Perceptions of IPM

After the announcement of the Presidential Instruction No. 3 in 1986 on IPM, various perceptions and understandings of IPM have been developed by decision makers, scientists, field workers and farmers. Different issues have been raised and discussed, ranging from the objectives and field coverage of IPM, the place of IPM in agro-management systems, the role of pesticides in IPM, to the organisation of IPM implementation at field level. Due to the differing perceptions and the resulting confusion, IPM institutionalisation and the national agriculture development programme are somewhat hampered.

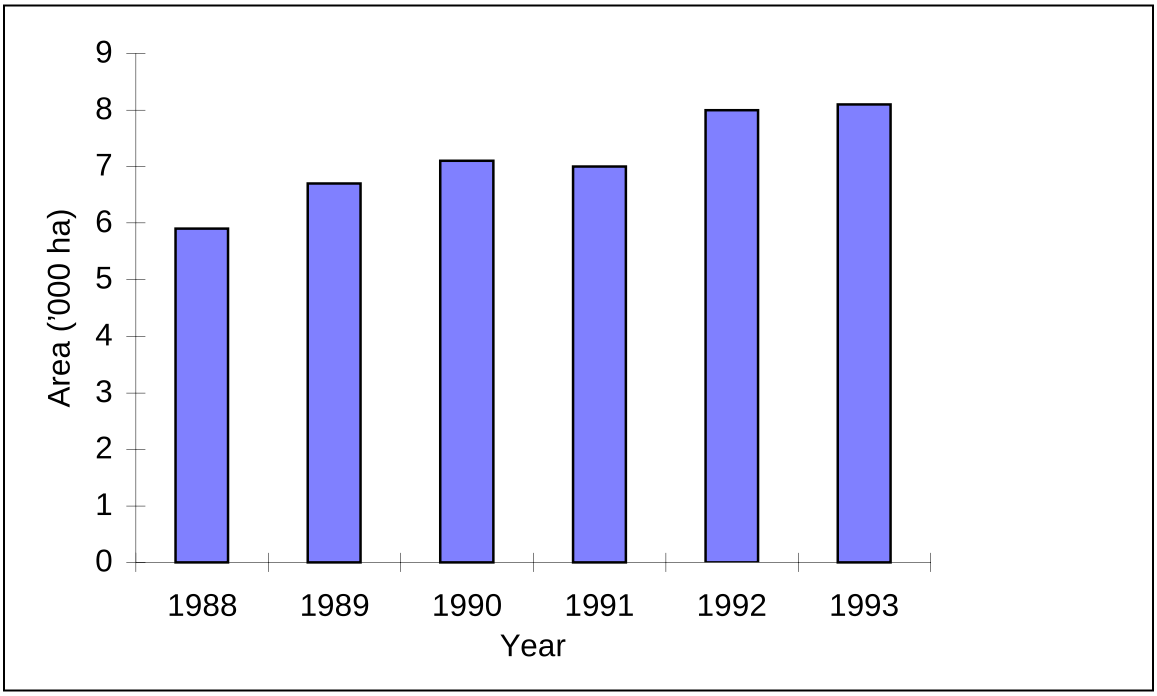
In actual fact the current definition of IPM in Indonesia has been formulated clearly in the explanation section of Act No. 12/1992 on Crop Cultivation Systems. This act defines the Integrated Pest Management System as "an effort to control pest populations or pest damage by utilising one or several control techniques in an integrated manner, in order to prevent the occurrence of economic loss and environmental damage". Furthermore this Act mentions that "in the IPM system, pesticide is used only as the last resort".

Unfortunately the Act has not yet been followed by ordinances and operating procedures for related sectors and regions, which means that the Act has not been successfully implemented.

2. IPM in Rice Production Intensification Programmes

Today, the national agricultural programme is still strongly dominated by the national intensification programme aimed at maintaining rice self-sufficiency (achieved since 1984), and achieving national food sufficiency and security. The government has introduced a new highly developed version of the intensification programme, called "Supra Insus". Supra Insus is the successor of earlier rice intensification programmes, BIMAS (Mass Guidance), IMMAS (Mass Intensification), and INSUS (Special Intensification). The acreage covered by rice production intensification programmes (consisting of INSUS and SUPRA INSUS area) has increased in the last 10 years (Fig. 6).

Figure 6: Area covered by SUPRA INSUS 1988 - 1993



Under the intensification programme farmers are given technical advice by field extension workers, who make specific recommendations concerning fertiliser application, high quality seeds selection, planning synchronised planting, organising farmer groups, credit arrangements, etc.

All farmers under the SUPRA INSUS programme have to implement what is known as the "Ten Technologies Package" of which IPM is one part. These "Ten Technologies" are (IRHAM, 1992):

1. cropping pattern;
2. certified rice seed;
3. balanced use of different types of fertilisers;
4. planting densities of at least 20,000 plants per hectare;
5. better harvesting and post harvest handling;
6. an improved method of land preparation;
7. the application of plant growth stimulants;
8. integrated pest and disease management;
9. better water management techniques;
10. rotation of rice varieties.

This ten technologies package of SUPRA INSUS limits the IPM impact to pest and disease control actions only, thereby excluding cropping patterns, seed selection, fertilisation, water management and other crop husbandries. The high dependency of SUPRA INSUS technology on other chemicals such as various types of fertilisers, including leaf liquid fertilisers and plant growth hormones, are not in line with the IPM objectives of cutting and eventually eliminating the use of chemical pesticides. Most of government's decision makers at the central and provincial levels are busy organising national intensification programmes in attaining the annual target of food crop production. They have little concern with reducing the use of agricultural inputs such as pesticides and fertilisers.

3. Strongly Sectorial Bureaucratic System

The main emphasis of the First Long-term National Development Programme in Indonesia is on the agricultural sector. Efforts have been made to achieve increased agricultural production. During this period the Department of Agriculture has developed into a huge and complicated organisation with a strong and rigid bureaucratic system. The boundaries between the functions and programmes of different departments, directorate generals, directorates, bureaus, sub-directorates, sections and other organisational levels are rigid, which makes it difficult to organise integrated programmes, or to encourage participation and partnerships with farmers, in the same way that IPM does both at policy as well as at field level.

According to the organisational arrangements of the Department of Agriculture, the implementation of IPM, as the best technological option for pest control, is the main responsibility of the Crop Protection Directorate under its respective Directorate General (Ditrctorate General of Food Crops and Horticulture and Directorate General of Estate Crops). The research and development of IPM implementation must be organisationally supported by the Agency of Research and Development; in the extension of IPM the Directorate of Crop Protection should be working together with the Agency of Extension and Education. Because IPM is not high in the priorities of other agencies, research and extension programmes of IPM at the field level have not been given appropriate attention.

4. Discipline Oriented Research

Integrated research activities on IPM covering several disciplines (agronomy, soil science, crop protection sciences, natural and biological sciences, biochemistry, mathematics, social and cultural sciences, economics, culture, etc.) were never conducted in Indonesia. The IPM research is still carried out by researchers of classical crop protection disciplines i.e., entomology, phytopathology, nematology, and weed science.

Involvement of other disciplines such as socio-economics in crop protection research has been rare. Interdisciplinary research programmes are not on the priority list of research managers and policy makers because they are costly, involving various institutions and sectors, and must be planned for the long term. Most researchers hardly ever expose, train, and support themselves in an integrated and interdisciplinary environment. System science as a tool for integrating related disciplines was not utilised for crop protection and IPM research and development.

5. IPM Farmers Empowerment

Although the role of farmer groups in the decision making process under the current SUPRA INSUS programme is encouraged, but due to the lack of farmer abilities and experiences in making appropriate decisions, most of food crop farmers are highly dependent upon the recommendations and decisions made by the field or extension workers. The dependency of farmers on their leaders and field workers should be reduced by training farmers in IPM Field School.

Farmers as individuals and as a group should have an opportunity to acquire the ability to make their own decisions in managing their own field, based on IPM principles. After the farmers have participated in the IPM Field School for one season they should by given a chance to apply their IPM experiences and skills in their own fields together with their neighbouring farmers. They still need full support and encouragement from their formal and informal leaders to continue the establishment of the IPM systems in their community.

If the community leaders do not give enough support to IPM and still concentrate on achieving production target through the BIMAS system, the conductive environment for IPM's promotion and socialisation cannot be developed. Under such unfavourable conditions, IPM farmers will return to the conventional methods which would mean that the IPM farmers training programme fails.

Conclusions

Indonesia has successfully trained 300,000 rice farmers, 10,000 vegetable farmers and 8,000 field workers through IPM Field School System. The programme is being extended to 1998 so that a target of training for 800,000 farmers and 16,000 extension workers might be achieved. Hopefully those trained people would then train 15 million other farmers in IPM.

The result of IPM policies and training is very important for the participating farmers. They enjoy being independent in making IPM decisions, being able to train fellow farmers, achieve better net revenues, and conserve the environment. The statistics show that, on average, rice and soybean farmers in Indonesia have used less pesticides during the last 5 years. The government benefited by saving the pesticide subsidies after 1987.

Some of the constraints on the implementation and institutionalisation of IPM on the policy level are the different perceptions of IPM, the role of IPM in the national rice intensification programme, a strong bureaucratic system, discipline oriented research programmes, and lack of IPM farmers empowerment. Strong political direction is required from the government to overcome all these constraints and to speed up the implementation of IPM for the benefit of sustainable development.

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Are Plant Protection Services a Constraint to IPM?

Rüdiger Kaske[8]

Introduction

Plant Protection Services have been introduced in many countries along with the growing sophistication of plant protection technologies, where pesticides played a major role. The need for legislation and regulation became apparent with the availability of toxic and persistent substances as plant protection products. Also, the increasing intensification and specialisation of agricultural systems on a global scale required more crop protection interventions. As a consequence a specialised organisational body also became necessary within governmental agricultural support services. With the emergence of the IPM concept the mono-factional and disciplinary approach to solving crop related problems became challenged. There is thus a growing need for the management of change within these organisations.

The Tasks of Plant Protection Services

Plant and post-harvest protection is one of the major issues within the government's ministerial organisations structure and is considered important for food production and food security.

Agricultural production and food security are supervised and often directed and influenced by "Ministries of Agriculture" with various departments taking responsibilities for plant production, including plant protection and animal husbandry.

Governmental plant protection institutions are entrusted with so-called "core functions" such as quarantine, implementation and control of plant protection acts and ordinances, pest surveillance and containment of pest outbreaks. The scope of the work encompasses various basic government trusts like:

- food security, especially for the urban population;
- export security and necessities.

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Plant protection policy guidelines determine the range which respective government institutions cover within country-specific agricultural policy and whether private and non-government activities can contribute to the agricultural production and plant protection.

Looking around world-wide one will find all forms of agricultural production management from totally privately managed to government dominated in varying parts and sections. However, a certain necessity to influence agricultural production through government institutions should not be denied to meet minimum requirements, e.g. food security.

A classical "Plant Protection Service" incorporates various disciplines within its various sections like entomology, phytopathology, virology, herbology etc.

Integrated Pest Management (IPM) programmes appeared gradually, several decades ago already. It became apparent that increasing use of fertilisers and pesticides created up to then unknown problems like pest resistance against chemical pesticides and specific environmental pollutions (soil, water). The problems of cotton production in Central America forms one of those early examples, followed by similar events in USA and Europe followed in turn by the respective IPM approaches.

IPM programmes try to optimise all means of traditional and modern crop production and crop protection under one consistent umbrella, including the use of external inputs like fertilisers and pesticides. This favours the holistic approach. The factors which favour pesticide use often act as a constraint to true IPM implementation.

Since more than three decades it became a common practice that countries with more advanced technologies give support to other countries. On the international level this support is called "Technical Co-operation (T.C.)". Programmes agreed upon are named "projects". Agricultural projects are an integrated part within Technical Co-operation. Projects favouring IPM approaches became increasingly important since the beginning of the seventies for all major international and national donor agencies and their respective partner countries. This applies also to the IPM projects within the T.C. programmes of the Federal Republic of Germany.

These projects were implemented together with plant protection services of the respective ministry of agriculture. Out of these joint experiences a certain catalogue of facts contribute to the question:

Are plant protection services a constraint to IPM?

To answer this question, it is helpful to investigate the organigramme of a traditional government plant protection service. Plant protection services are organised following the predominant research paradigm of the green revolution period, which is to tackle problems one by one. Therefore, specialist sections have been created with distinct disciplinary responsibilities. Especially for the core disciplines such as entomology, plant pathology and weed science this disciplinary approach can become a hindrance to IPM.

Figure 1: Organigramme of a traditional government plant protection service

In addition to the prevailing organisational set-up financial limitations may prohibit implementation of IPM. The strongly technically oriented organisational split-up makes co-operation between working groups difficult. Inconsistencies exist within the tasks of a plant protection service e.g. because of its role as distributor of subsidised pesticides and its responsibility for IPM strategy development. Difficulties may arise when efforts are made to combine agricultural research institutions with extension services e.g. because of conflicts about responsibilities. In general the confidence which farmers give to government programmes is more often than not limited.

Additional donor-influenced constraints to IPM can be time frames set within project agreements which are too short for the development and introduction of a sound IPM strategy.

A few recent examples of the outcome of restructuring programmes for plant protection services encourage the feeling, that these governmental services will find a useful role within their new supplementary tasks also to promote IPM as a governmental institution. This will include many other organisations. But most important, it is necessary that the farmers participate in decision making and find their own way of going ahead in the field of IPM plant protection. Thus securing all economic benefits for them with ecological benefits also for the country as a whole.

Possible Ways to Overcome Constraints

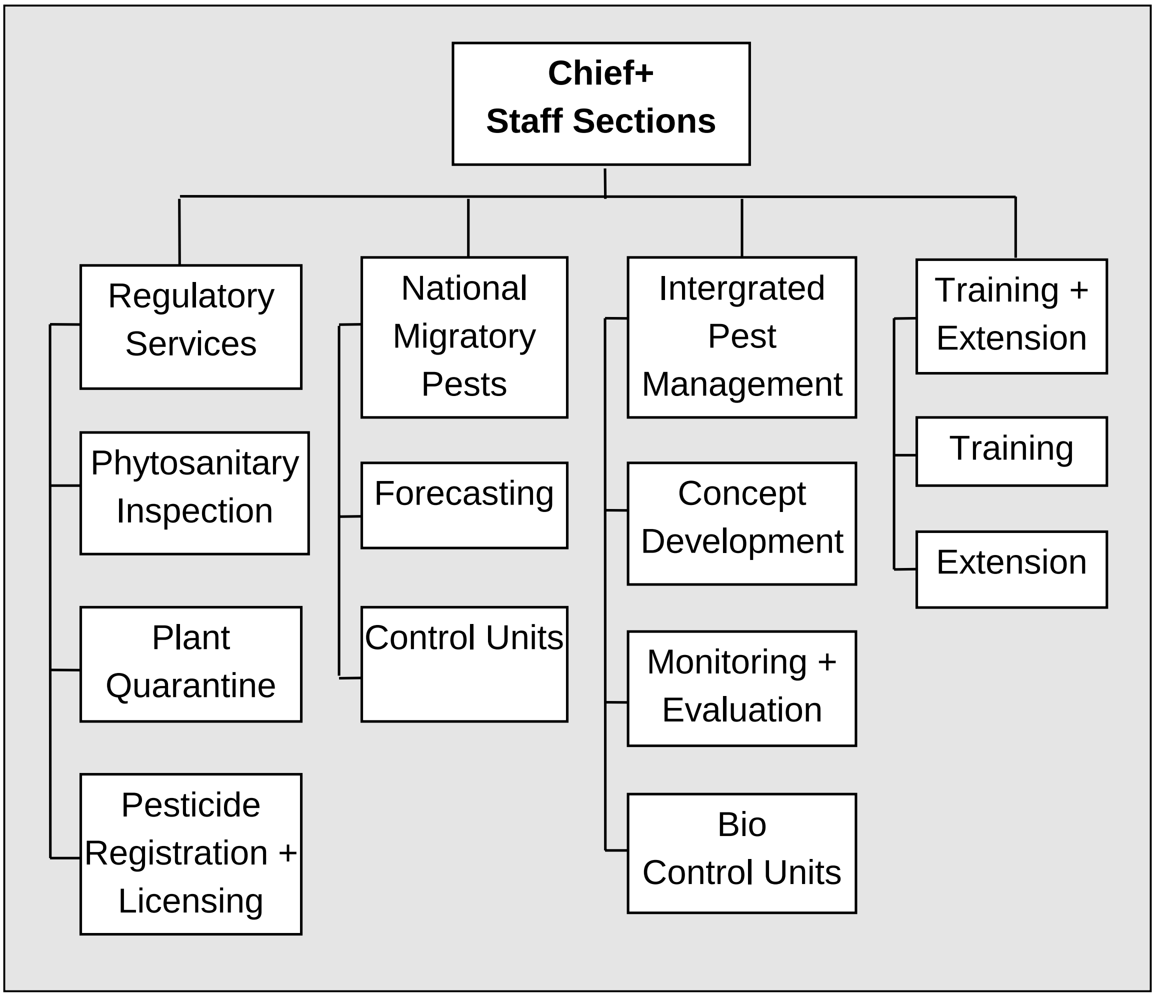
In general one has to distinguish between national priorities (e.g. food security) and private interests of farmers based on market opportunities.

Government decision makers must raise awareness for holistic approaches and adopt IPM as their IPM policy. The organisational structures within plant protection services have to be changed to incorporate an IPM co-ordination group. In some cases it may be necessary to organise an interagency IPM implementation unit. In any case it has to be carefully judged what Plant Protection Services are allowed to assume in implementing IPM. In general they have to formulate and propagate appropriate IPM research and extension programmes, so that acceptable IPM strategies can reach farmers. Therefore the existing training or education curricula have to be restructured.

Secondly, donor influenced improved planning procedures should include intensified baseline surveys, with a systematic involvement of farmers and other "target" groups, including NGO's in IPM project activities. Especially pesticides should not be subsidised any longer.

Table 2 might provide the necessary structure to overcome constraints to IPM by governmental plant protection services.

Table 2: Organigramme of a government plant protection service compatible with IPM



This organigramme and its IPM-strategy and relevance was worked out during the first half of 1995 for the government of Tanzania. The change in the organisational set up is expected to provide all necessary support to present and future IPM strategies. Note that organisational units are split up according to major tasks rather than disciplines and specialisations. It has yet to be worked out in which way interagency co-operation including agriculture, environment and health can be structured.

These strategic approaches are laid down in a draft of a masterplan and a preceding IPM policy paper which are now subject for government approval. Similar development can be observed in other countries across Africa (Kenya, Egypt), Asia (Jordan, ASEAN-group) and Latin-America (Costa Rica, Panama, El Salvador).

Conclusions

The current organisational set-up of plant protection organisations in many countries is tailored according to the traditional paradigm of pesticide based control and eradication of pests. The widespread diffusion of the IPM idea requires these institutions to change and follow a systems concept which is problem-oriented. The management of this change requires technical co-operation in plant protection to substantially widen its technical scope and adopt concepts provided by social and political sciences. The change from a firebrigade philosophy towards agro-ecosystems management within a framework of interagency collaboration has been started in some countries but needs more support if IPM thinking is to change into IPM practice more rapidly.

Integrated Pest Management:
Institutional Constraints and Opportunities in the Philippines

Marinela R. Castillo[9]

Introduction

When IPM farmer training was first initiated in the Philippines in 1978, crop protection policy still placed a strong emphasis on calendar applications of insecticides - an approach enthusiastically backed by the country's influential and highly profitable agro-chemical industry. Crop protection policy also relied on uni-directional, classroom-based training methods. In the Philippines, policy makers assumed that the scientific principles underlying crop management decisions were too complicated for farmers to understand. In this environment, the concepts of agro-ecosystem balance and natural control of insect pests did not take root easily, and it is not difficult to understand why Filipino farmers were not so much attracted to IPM.

In the 1980s, both IPM and the Philippines entered a period of significant change. By the middle of the decade, a broad-based popular movement had re-established democracy in our country. In IPM as well, a renewed emphasis on "people power", or in this case "farmer power", brought about a shift from command or prescription based systems to new methods of building farmer knowledge and farmers' decision making capacity. Beginning with a pilot project in the province of Antique, rice IPM in the Philippines moved to a "farmer field school" approach in which farmers learn IPM principles by practising agro-ecosystem analysis in their own fields. Through weekly meetings with facilitators over a full cropping season, farmers learn to make better cultivation decisions based on group observations and discussion of pest-predator balance, fertilisation, varietal selection, water management, and a range of other factors affecting their crops.

Building on the success of the pilot project, the IPM National Programme, known in the Philippines as *Kasakalikasan* ("Nature is Agricultural's

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Bounty"), was launched by Presidential Order in 1993. It should be noted that the strong and visible commitment of the national leadership to IPM has served to pave the way for building IPM constituencies at the local level, which is a feature of the national programme that will be dealt with later in this paper. The long-term goal of *Kasakalikasan* is to establish IPM as the standard approach to crop management in rice, corn and vegetable growing areas. Over its first five years the programme has set an interim target of training 145,000 farmers in rice IPM, 40,000 farmers in maize IPM and 15,000 vegetable farmers. Farmer training is being carried out by field workers originating from local government units, non-government organisations and farmer groups trained under season-long "training of trainers" programmes. *Kasakalikasan* also provides support for farmer-based action research and supporting studies involving researchers, IPM trainers and farmers.

The programme is now in the second year of its first five-year cycle. As of the end of June 1995, 913 full-season field schools have been completed in 27 provinces throughout the country. Some 17,247 farmers have graduated from these IPM field schools. About 1,055 IPM trainers are active in the programme, having completed training of trainer courses at the provincial level.

But perhaps the most interesting developments over the first two years of *Kasakalikasan* relate to the way in which the programme has responded to changes in institutional, social and economic conditions in Philippine agriculture. Experience in a range of countries has shown that the sustainability of farmer-based IPM programmes depends to a large extent on the capacity of these programmes to respond to challenges and opportunities arising from national and local patterns of change.

I would now like to address three areas in which IPM policy in the Philippines has adjusted *or must adjust* over the coming years if *Kasakalikasan* is to achieve its main goal of establishing IPM as standard practice, and providing farmers with the scientific tools they need to make better management decisions. These areas, taken in the order in which they will be addressed, consist of the following: (1) the decentralisation of agricultural extension from national to local government; (2) the re-orientation of pesticide registration criteria to take into account conservation of natural enemies; and (3) the need to increase the access of women farmers to IPM field schools and other activities. These three issues do not by any means exhaust the institutional factors affecting the performance of IPM in the Philippines. Nevertheless, they do provide useful examples of institutional concerns confronting the programme at the national, municipal and village levels, and the ways in which *Kasakalikasan* has attempted to respond to these challenges.

Decentralisation of Agricultural Services

The national Department of Agriculture is the lead implementing agency of *Kasakalikasan*. However, with the enactment of the Local Government Code in 1992, all financial and decision-making authority for agricultural extension was decentralised to local government units. Responsibility for allocation of funds, deployment of personnel, and management of former assets of the central Department, is now held by municipal and provincial governments. Nonetheless, it should be pointed out that as they adjust to decentralisation, many local governments have yet to build up administrative capacities for managing devolved resources.

The Local Government Code also provides for the allocation of a portion of national revenue collections to provinces, municipalities, and villages. These internal revenue allotments from the national government supplement local tax revenues as sources of funding for the programmes that local communities wish to undertake. *Kasakalikasan* has taken the government decentralisation embodied in the Local Government Code as an opportunity to build constituencies for IPM at the provincial, municipal, and village levels. Admittedly, some aspects of programme organisation have become more complex with the absence of central control over the distribution of extension budgets and personnel, coupled with the generally weak state of local government administrative systems at this stage. Despite these constraints, IPM has led the way in the Philippines in demonstrating that devolution in fact encourages the sustainability of programmes by engendering local political, financial, and technical support. Farmers' enthusiasm for IPM field schools elicits strong political support from local leaders who view IPM not only as a production-enhancing technology, but also as a popular, yet inexpensive service that they can provide to farmers. With the growing demand for IPM training, more and more provincial and municipal governments are allocating increasing shares of their budgets to IPM.

Local political support works to strengthen IPM in several ways. First, municipal leaders can tap into local sources of funding for IPM training and follow-up activities. This ensures consistent financing which is not subject to changes in availability of funds at the provincial or national levels. Moreover, when local resources are put to use, municipal politicians tend to become more directly involved in the implementation of the programme and hence more familiar with its methods and goals.

Second, the growth of local support for IPM encourages more consistent application of IPM principles. Since municipal governments are closer to their constituents, they respond more rapidly to demands from farmers for more IPM and less top-down, command-style extension programmes which take decisions away from farmers.

Finally, local governments have opportunities to be more creative and innovative with regard to IPM activities. Because conditions vary substantially from place to place, IPM activities cannot be planned effectively at the national level. For example, while farmers in one locality may be interested in moving from IPM rice to IPM vegetables, farmers in a neighbouring agro-ecological zone may prefer to build on their experience gained in farmer field schools with experiments addressing specific local pest and disease problems.

The local focus of *Kasakalikasan* is already paying dividends in many localities throughout the Philippines. In the Cordilleras of Luzon, for example, the Fertiliser and Pesticide Authority reports that vegetable farmers have reduced the number of pesticide applications from over twenty to only two per season with at least as much yield. In the municipality of Sto. Tomas in Davao del Norte, Mindanao, the volume of chemical products sold, primarily for rice, dropped by 38 percent in 1994, while the value fell by 25.9 percent.

Local control of the IPM programme is not without its problems. Owing to the three-year cycle of mayoral and council elections, the high level of turnover among municipal officials means that *Kasakalikasan* must continuously work to cultivate commitment among new office holders. In addition, the programme must counter the influence of aggressive pesticide sales tactics at the local level to ensure that politicians do not come under the way of unscrupulous dealers. Nevertheless, the experience of the Philippines provides evidence that IPM programmes committed to enhanced farmer initiative and responsiveness to local needs will flourish under decentralised administrative structures.

Pesticide Registration Criteria

Another area in which policy needs to respond in the coming years is pesticide registration. With the expansion of IPM training and growing awareness among farmers of the need to conserve natural enemies as an effective means of pest control, policy reform is needed to ensure that pesticides marketed in the Philippines are targeted to specific pests and do not destroy predator populations under field conditions. Although current registration requirements do consider the impact of pesticides on human health and the environment, the impact on natural enemy populations is not yet routinely considered.

There are indications, however, that pesticide policy is moving toward more consistency with the IPM training effort. The decisions to ban methyl parathion and azinphos ethyl, and to impose severe restrictions on the use of monocrotophos, did in fact consider the impact of these insecticides on natural enemy populations under field conditions. Although human health considerations and the existence of less toxic alternatives figured prominently in these decisions, data showing that predators of the pests targeted by these chemicals were destroyed under typical conditions of use was instrumental in demonstrating the inferiority of these products.

Women and IPM

Let me now move on to women and IPM. Women in the Philippines play a major role in farming, including farm labour and farm management. It is therefore not surprising that women farmers consistently express an interest in participating in IPM field schools in regions where *Kasakalikasan* is already active.

Kasakalikasan has responded by calling for "the incorporation of a mechanism to facilitate women farmers' access to IPM training (to reach a) 30 percent female participation rate by the end of the programme period, both as trainers and recipients of IPM."

It must be recognised from the outset that women's access to IPM training - or for that matter, agricultural services of any sort - raises fundamental structural issues relating not only to the organisation and implementation of training, but also to such matters as the local gender division of labour, resistance among men in sharing with women access to services and opportunities for participating in income-augmenting activities, and patriarchal decision-making structures.

Making IPM training more accessible to women, therefore, requires a *proactive* approach incorporating measures to increase female participation in the programme design. Several steps already implemented by or planned for *Kasakalikasan* include the following:

1. Incorporating gender sensitivity in IPM training and delivery based on recognition of the multiple roles of women

Stereotyped images of women represent a serious obstacle to female participation in IPM. For this reason, programme managers, trainers, and local officials should be given ample opportunity to examine their own perceptions (or misperceptions) concerning the role of women in agriculture and village life through gender awareness and sensitivity training. Exercises for use in IPM field schools to stimulate discussion about these images and their correspondence or lack thereof to local realities should also be developed, and their use should be encouraged. Such exercises could, for example, explore the division of labour and patterns of decision making within the household to illustrate the need for women to understand IPM principles as a means of becoming better farm managers.

2. Promoting through IPM training processes equal access to knowledge, resources, and opportunities

One of the most important avenues to increase women's participation in IPM activities is to recruit and train more women as IPM trainers, specialists, and programme managers. In particular, all-women IPM field schools facilitated by female trainers would guarantee access to IPM for rural women. These field schools would offer the same quality of training and address the same core topic in a more relaxed social context for female farmers. In addition, all-women field schools can adapt special topics to suit the needs and interests of local women. Experience from a range of locations suggests that graduates of all-women field schools are more likely to become farmer trainers themselves, often organising new all-women field schools for their neighbours and kin.

3. Including in IPM technology design and adoption concepts and practices to increase women’s production and income while reducing their work burden

Involving women farmers in research is the most direct means of ensuring that new technical solutions address actual problems faced by women in their fields. While most off-farm researchers may assume that technical problems at the field level are "gender-neutral", in actuality the strict gender division of labour which exists at the field level means that some technical problems are in fact of greater concern to women than men. For instance, the fact that women are responsible for transplanting rice seedlings in many areas means that men may not be directly affected by skin irritations and more serious illnesses resulting from the use of highly toxic pesticides in seedbeds.

To sum up, this paper has briefly reviewed three institutional issues relating to the implementation of the Philippine IPM National Programme or *Kasakalikasan*: the implications for IPM of the decentralisation of agricultural services to local governments, the need for pesticide registration criteria to take into account conservation of natural enemies, and the role of women in IPM training. These issues provide indicative examples of institutional factors affecting the development and durability of IPM in the Philippines. We have attempted to illustrate how the Philippine programme is responding to these challenges in programme design and execution.

The Pesticide Policy Project

The Pesticide Policy Project started in April 1994 as a project of the GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit), sponsored by the BMZ (Ministry of Economic Cooperation and Development) and carried out under supervision of Prof. Waibel, Institute of Horticultural Economics, University of Hannover. Within the project four country studies in Latin America, Africa and Asia are conducted which principally follow the guidelines elaborated in the course of the project.

The overall hypothesis of the project states that the current use of pesticides goes beyond a level which is acceptable from the society's point of view. This seems largely a result of ignoring economic considerations in pest management. The objective of this project therefore is to augment the use of economic instruments in pesticide policy. This is expected to lead to increased agricultural productivity and ecologically benign pest management.

Within the five year duration of the project a series of publications will be published inform about the latest findings of the project as well as related topics. The series is titled "Pesticide Policy Publication Series" and is available on request through:

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MUDIMU, G.D., S. CHIGUME and M. CHIKANDA (1995): Pesticide Use and Policies in Zimbabwe - Current Perspectives and Emerging Issues for Research. Pesticide Policy Publication Series No. 2, Hannover